

CP1

Actuarial Practice

**Combined Materials Pack
for exams in 2019**

The Actuarial Education Company
on behalf of the Institute and Faculty of Actuaries

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Subject CP1

2019 Study Guide

Introduction

This Study Guide has been created to help guide you through Subject CP1. It contains all the information that you will need before starting to study Subject CP1 for the 2019 exams and you may also find it useful to refer to throughout your Subject CP1 journey.

The guide is split into two parts:

- Part 1 contains general information about the Core Practices subjects
- Part 2 contains specific information about Subject CP1.

Please read this Study Guide carefully before reading the Course Notes, even if you have studied for some actuarial exams before.

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1.1 Before you start

When studying for the UK actuarial exams, you will need:

- a copy of the **Formulae and Tables for Examinations of the Faculty of Actuaries and the Institute of Actuaries, 2nd Edition (2002)** – these are often referred to as simply the *Yellow Tables* or the *Tables*
- a ‘permitted’ **scientific calculator** – you will find the list of permitted calculators on the profession’s website. Please check the list carefully, since it is reviewed each year.

These are both available from the Institute and Faculty of Actuaries’ eShop. Please visit www.actuaries.org.uk.

1.2 Core study material

This section explains the role of the Syllabus, Core Reading and supplementary ActEd text. It also gives guidance on how to use these materials most effectively in order to pass the exam.

Some of the information below is also contained in the introduction to the Core Reading produced by the Institute and Faculty of Actuaries.

Syllabus

The Syllabus for Subject CP1 has been produced by the Institute and Faculty of Actuaries. The relevant individual Syllabus Objectives are included at the start of each course chapter and a complete copy of the Syllabus is included in Section 2.2 of this Study Guide. We recommend that you use the Syllabus as an important part of your study.

Core Reading

The Core Reading has been produced by the Institute and Faculty of Actuaries. The purpose of the Core Reading is to ensure that tutors, students and examiners understand the requirements of the syllabus for the qualification examinations for Fellowship of the Institute and Faculty of Actuaries.

The Core Reading supports coverage of the Syllabus in helping to ensure that both depth and breadth are re-enforced. It is therefore important that students have a good understanding of the concepts covered by the Core Reading.

The examinations require students to demonstrate their understanding of the concepts given in the syllabus and described in the Core Reading; this will be based on the legislation, professional guidance *etc* that are in force when the Core Reading is published, *ie* on 31 May in the year preceding the examinations.

Therefore the exams in April and September 2019 will be based on the Syllabus and Core Reading as at 31 May 2018. We recommend that you always use the up-to-date Core Reading to prepare for the exams.

Examiners will have this Core Reading when setting the papers. In preparing for examinations, students are advised to work through past examination questions and may find additional tuition helpful. The Core Reading will be updated each year to reflect changes in the syllabus and current practice, and in the interest of clarity.

Accreditation

The Institute and Faculty of Actuaries would like to thank the numerous people who have helped in the development of the material contained in this Core Reading.

ActEd text

Core Reading deals with each syllabus objective and covers what is needed to pass the exam. However, the tuition material that has been written by ActEd enhances it by giving examples and further explanation of key points. Here is an excerpt from some ActEd Course Notes to show you how to identify Core Reading and the ActEd material. **Core Reading is shown in this bold font.**

Note that in the example given above, the index *will* fall if the actual share price goes below the theoretical ex-rights share price. Again, this is consistent with what would happen to an underlying portfolio.

After allowing for chain-linking, **the formula for the investment index then becomes:**

$$I(t) = \frac{\sum_i N_{i,t} P_{i,t}}{B(t)}$$

where **$N_{i,t}$ is the number of shares issued for the i th constituent at time t ;**

$B(t)$ is the base value, or divisor, at time t .

This is
ActEd
text

This is Core
Reading

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1.3 ActEd study support

This section gives a description of the products offered by ActEd.

Successful students tend to undertake three main study activities:

1. *Learning* – initial study and understanding of subject material
2. *Revision* – learning subject material and preparing to tackle exam-style questions
3. *Rehearsal* – answering exam-style questions, culminating in answering questions at exam speed without notes.

Different approaches suit different people. For example, you may like to learn material gradually over the months running up to the exams or you may do your revision in a shorter period just before the exams. Also, these three activities will almost certainly overlap.

We offer a flexible range of products to suit you and let you control your own learning and exam preparation. The following table shows the products that we produce. Note that not all products are available for all subjects.

LEARNING	LEARNING & REVISION	REVISION	REVISION & REHEARSAL	REHEARSAL
Course Notes	X Assignments Combined Materials Pack (CMP) X Assignment Marking Tutorials Online Classroom	Flashcards	Revision Notes ASET	Mock Exam Mock Exam Marking

The products and services are described in more detail below.

‘Learning’ products

Course Notes

The Course Notes will help you develop the basic knowledge and understanding of principles needed to pass the exam. They incorporate the complete Core Reading and include full explanation of all the syllabus objectives, with worked examples and questions (including some past exam questions) to test your understanding.

Each chapter includes:

- the relevant syllabus objectives
- a chapter summary
- practice questions with full solutions.

‘Learning & revision’ products

X Assignments

The Series X Assignments consist of six written assessments. The first five assignments test two parts of the course each. They can be used to both develop and test your understanding of the material. The last assignment provides extra practice on case studies and tests topics across the course.

Combined Materials Pack (CMP)

The Combined Materials Pack (CMP) comprises the Course Notes and the Series X Assignments.

The CMP is available in **eBook** format for viewing on a range of electronic devices. eBooks can be ordered separately or as an addition to paper products. Visit www.ActEd.co.uk for full details about the eBooks that are available, compatibility with different devices, software requirements and printing restrictions.

X Assignment Marking

We are happy to mark your attempts at the X assignments. Marking is not included with the Assignments or the CMP and you need to order it separately. You should submit your script as a PDF attached to an email. Your script will be marked electronically and you will be able to download your marked script via a secure link on the internet.

Don’t underestimate the benefits of doing and submitting assignments:

- Question practice during this phase of your study gives an early focus on the end goal of answering exam-style questions.
- You’re incentivised to keep up with your study plan and get a regular, realistic assessment of your progress.
- Objective, personalised feedback from a high quality marker will highlight areas on which to work and help with exam technique.

In a recent study, we found that students who attempt more than half the assignments have significantly higher pass rates.

There are two different types of marking product: Series Marking and Marking Vouchers.

Series Marking

Series Marking applies to a specified subject, session and student. If you purchase Series Marking, you will **not** be able to defer the marking to a future exam sitting or transfer it to a different subject or student.

We typically send out full solutions with the Series X Assignments. However, if you order Series Marking at the same time as you order the Series X Assignments, you can choose whether or not to receive a copy of the solutions in advance. If you choose not to receive them with the study material, you will be able to download the solutions via a secure link on the internet when your marked script is returned (or following the final deadline date if you do not submit a script).

If you are having your attempts at the assignments marked by ActEd, you should submit your scripts regularly throughout the session, in accordance with the schedule of recommended dates set out in information provided with the assignments. This will help you to pace your study throughout the session and leave an adequate amount of time for revision and question practice.

The recommended submission dates are realistic targets for the majority of students. Your scripts will be returned more quickly if you submit them well before the final deadline dates.

Any script submitted *after* the relevant final deadline date will not be marked. It is your responsibility to ensure that we receive scripts in good time.

Marking Vouchers

Marking Vouchers give the holder the right to submit a script for marking at any time, irrespective of the individual assignment deadlines, study session, subject or person.

Marking Vouchers can be used for any assignment. They are valid for four years from the date of purchase and can be refunded at any time up to the expiry date.

Although you may submit your script with a Marking Voucher at any time, you will need to adhere to the explicit Marking Voucher deadline dates to ensure that your script is returned before the date of the exam. The deadline dates are provided with the assignments.

Tutorials

Our tutorials are specifically designed to develop the knowledge that you will acquire from the course material into the higher-level understanding that is needed to pass the exam.

We run a range of different tutorials including face-to-face tutorials at various locations, and Live Online tutorials. Full details are set out in our *Tuition Bulletin*, which is available on our website at www.ActEd.co.uk.

Regular and Block Tutorials

In preparation for these tutorials, we expect you to have read the relevant part(s) of the Course Notes before attending the tutorial so that the group can spend time on exam questions and discussion to develop understanding rather than basic bookwork.

You can choose **one** of the following types of tutorial:

- **Regular Tutorials** spread over the session.
- **A Block Tutorial** held two to eight weeks before the exam.

Online Classroom

The Online Classroom acts as either a valuable add-on or a great alternative to a face-to-face or Live Online tutorial.

At the heart of the Online Classroom in each subject is a comprehensive, easily-searched collection of tutorial units. These are a mix of:

- teaching units, helping you to really get to grips with the course material, and
- guided questions, enabling you to learn the most efficient ways to answer questions and avoid common exam pitfalls.

The best way to discover the Online Classroom is to see it in action. You can watch a sample of the Online Classroom tutorial units on our website at www.ActEd.co.uk.

‘Revision’ products

For most subjects, there is **a lot of material** to revise. Finding a way to fit revision into your routine as painlessly as possible has got to be a good strategy.

Flashcards

Flashcards are an inexpensive option that can provide a massive boost. They can also provide a variation in activities during a study day, and so help you to maintain concentration and effectiveness.

Flashcards are a set of A6-sized cards that cover the key points of the subject that most students want to commit to memory. Each flashcard has questions on one side and the answers on the reverse. We recommend that you use the cards actively and test yourself as you go.

Flashcards are available in **eBook** format for viewing on a range of electronic devices. eBooks can be ordered separately or as an addition to paper products. Visit www.ActEd.co.uk for full details about the eBooks that are available, compatibility with different devices, software requirements and printing restrictions.

The following questions and comments might help you to decide if flashcards are suitable for you:

Flashcards

- Do you have a regular train or bus journey?

Flashcards are ideal for regular bursts of revision on the move.

- Do you want to fit more study into your routine?

Flashcards are a good option for 'dead time', eg using flashcards on your phone or sticking them on the wall in your study.

- Do you find yourself cramming for exams (even if that's not your original plan)?

Flashcards are an extremely efficient way to do your pre-exam memorising.

If you are retaking a subject, then you might consider using flashcards if you didn't use them on a previous attempt.

'Revision & rehearsal' products

Revision Notes

Our Revision Notes have been designed with input from students to help you revise efficiently. They are suitable for first-time sitters who have worked through the ActEd Course Notes or for retakers (who should find them much more useful and challenging than simply reading through the course again).

The Revision Notes are a set of A5 booklets – perfect for revising on the train or tube to work. Each booklet covers one main theme or a set of related topics from the course and includes:

- Core Reading with a set of integrated short questions to develop your bookwork knowledge
- relevant past exam questions with concise solutions for the ten years to 2017
- other useful revision aids.

ActEd Solutions with Exam Technique (ASET)

The ActEd Solutions with Exam Technique (ASET) contains our solutions to eight past exam papers, plus comment and explanation. In particular, it highlights how questions might have been analysed and interpreted so as to produce a good solution with a wide range of relevant points. This will be valuable in approaching questions in subsequent examinations.

'Rehearsal' products

Mock Exam

The Mock Exam consists of two 100-mark mock exam papers that provides a realistic test of your exam preparation.

Mock Marking

We are happy to mark your attempts at the mock exams. The same general principles apply as for the X Assignment Marking. In particular:

- Mock Exam Marking is available for the Mock Exam and it applies to a specified subject, session and student
- Marking Vouchers can be used for the Mock Exam.

Recall that:

- marking is not included with the products themselves and you need to order it separately
- you should submit your script as a PDF attached to an email
- your script will be marked electronically and you will be able to download your marked script via a secure link on the internet.

1.4 Skills

The Subject CP1 exams

It is important to recognise that the Subject CP1 exam is very different from the Core Principles subject exams in both the nature of the material covered and the skills being examined.

Both the Core Reading and the exam papers themselves are generally much less numerical and more 'wordy' than the Core Principles subjects. The exam will primarily require you to explain a particular point in words and sentences, rather than to manipulate formulae or do calculations. Numerical questions are possible in Subject CP1, but were rare in its predecessor (Subject CA1). If you haven't sat this type of exam for some time, you need to start practising again now. Many students find that it takes time to adjust to the different style of the Subject CP1 exam questions. As ever, practice is the key to success.

The aim of the two Subject CP1 exam papers is to test your ability to apply your knowledge and understanding of the key principles described in the Core Reading to specific situations presented to you in the form of exam questions. Therefore your aim should be to identify and understand the key principles, and then to practise applying them. You will also need a good knowledge of the Core Reading to score well and quickly on any bookwork questions.

Both exam papers will cover material from throughout the entire Subject CP1 course. The second paper will consist of one or two case studies, further information on the exams is provided in [Chapter 0](#).

Study skills

Overall study plan

We suggest that you develop a realistic study plan, building in time for relaxation and allowing some time for contingencies. Be aware of busy times at work, when you may not be able to take as much study leave as you would like. Once you have set your plan, be determined to stick to it. You don't have to be too prescriptive at this stage about what precisely you do on each study day. The main thing is to be clear that you will cover all the important activities in an appropriate manner and leave plenty of time for revision and question practice.

Aim to manage your study so as to allow plenty of time for the concepts you meet in this course to 'bed down' in your mind. Most successful students will probably aim to complete the course at least six weeks before the exam, thereby leaving a sufficient amount of time for revision. By finishing the course as quickly as possible, you will have a much clearer view of the *big picture*. It will also allow you to structure your revision so that you can concentrate on the important and difficult areas of the course.

You can also try looking at our discussion forum on the internet, which can be accessed at www.ActEd.co.uk/forums (or use the link from our home page at www.ActEd.co.uk). There are some good suggestions from students on how to study.

Study sessions

Only do activities that will increase your chance of passing. Try to avoid including activities for the sake of it and don't spend time reviewing material that you already understand. You will only improve your chances of passing the exam by getting on top of the material that you currently find difficult.

In particular, you may already be familiar with the content of some of the chapters (from the Core Principles (CS, CM or CB subjects) or the SP subjects). Try to cover these chapters quickly to give yourself more time on the material with which you are less comfortable. Also, some chapters refer back to material from the Core Principles subjects. You don't have to follow these links up unless you are feeling curious or clueless.

Ideally, each study session should have a specific purpose and be based on a specific task, *eg 'Finish reading Chapter 3 and attempt Practice Questions 1.4, 1.7 and 1.12', as opposed to a specific amount of time, eg 'Three hours studying the material in Chapter 3'.*

Try to study somewhere quiet and free from distractions (*eg* a library or a desk at home dedicated to study). Find out when you operate at your peak, and endeavour to study at those times of the day. This might be between 8am and 10am or could be in the evening. Take short breaks during your study to remain focused – it's definitely time for a short break if you find that your brain is tired and that your concentration has started to drift from the information in front of you.

Order of study

We suggest that you work through each of the chapters in turn. To get the maximum benefit from each chapter you should proceed in the following order:

1. Read the Syllabus Objectives. These are set out in the box at the start of each chapter.
2. Read the Chapter Summary at the end of each chapter. This will give you a useful overview of the material that you are about to study and help you to appreciate the context of the ideas that you meet.
3. Study the Course Notes in detail, annotating them and possibly making your own notes. Try the self-assessment questions and Core Reading example questions as you come to them. As you study, pay particular attention to the listing of the Syllabus Objectives and to the Core Reading.
4. Read the Chapter Summary again carefully. If there are any ideas that you can't remember covering in the Course Notes, read the relevant section of the notes again to refresh your memory.
5. Attempt (at least some of) the Practice Questions that appear at the end of the chapter.

It's a fact that people are more likely to remember something if they review it several times. So, do look over the chapters you have studied so far from time to time. It is useful to re-read the Chapter Summaries or to try the Practice Questions again a few days after reading the chapter itself. It's a good idea to annotate the questions with details of when you attempted each one. This makes it easier to ensure that you try all of the questions as part of your revision without repeating any that you got right first time.

Once you've read the relevant part of the notes and tried a selection of questions from the Practice Questions (and attended a tutorial, if appropriate) you should attempt the corresponding assignment. If you submit your assignment for marking, spend some time looking through it carefully when it is returned. It can seem a bit depressing to analyse the errors you made, but you will increase your chances of passing the exam by learning from your mistakes. The markers will try their best to provide practical comments to help you to improve.

To be really prepared for the exam, you should not only know and understand the Core Reading but also be aware of what the examiners will expect. Your revision programme should include plenty of question practice so that you are aware of the typical style, content and marking structure of exam questions. You should attempt as many past exam questions as you can.

As ActEd tutors, it is very illuminating to see/hear how different students study for the exams. We hear quite a few students make comments such as:

- Assignment questions are not relevant to the exam.
- It's quicker just to read through the assignment questions and solutions.
- There isn't enough time to get the assignments done.

Sound familiar?

It may be worth thinking again for Subject CP1 as, when we look at the pass lists, we are finding that there is a correlation between students who are making the effort to do assignment, mock exam and past exam questions, and those who are happy on exam results day.

Active study

Here are some techniques that may help you to study actively.

1. Don't believe everything you read. Good students tend to question everything that they read. They will ask 'why, how, what for, when?' when confronted with a new concept, and they will apply their own judgement. This contrasts with those who unquestioningly believe what they are told, learn it thoroughly, and reproduce it (unquestioningly?) in response to exam questions.
2. Another useful technique as you read the Course Notes is to think of possible questions that the examiners could ask. This will help you to understand the examiners' point of view and should mean that there are fewer nasty surprises in the exam room. Use the Syllabus to help you make up questions.
3. Annotate your notes with your own ideas and questions. This will make you study more actively and will help when you come to review and revise the material. Do not simply copy out the notes without thinking about the issues.
4. As you study each chapter, condense the *key* points (not whole chunks of text) on to a double side of A4 or less. This is essential as otherwise, when you come to revision, you will end up having to re-read the whole course again, and there won't be time.
5. Try to come up with memory aids, such as mind maps and acronyms, to help remember the material when you come back to it later.

6. Attempt the questions in the notes as you work through the course. Write down your answer before you refer to the solution.
7. Attempt other questions and assignments on a similar basis, *ie* write down your answer before looking at the solution provided. Attempting the assignments under exam conditions has some particular benefits:
 - It forces you to think and act in a way that is similar to how you will behave in the exam.
 - When you have your assignments marked it is *much* more useful if the marker's comments can show you how to improve your performance under exam conditions than your performance when you have access to the notes and are under no time pressure.
 - The knowledge that you are going to do an assignment under exam conditions and then submit it (however good or bad) for marking can act as a powerful incentive to make you study each part as well as possible.
 - It is also quicker than trying to write perfect answers.
8. Sit a mock exam four to six weeks before the real exam to identify your weaknesses and work to improve them. You could use a mock exam written by ActEd or a past exam paper.

You can find further information on how to study in the profession's Student Handbook, which you can download from their website at:

www.actuaries.org.uk/studying

Revision and exam skills

Revision skills

You will have sat many exams before and will have mastered the exam and revision techniques that suit you. However it is important to note that due to the high volume of work involved in Subject CP1, it is not possible to leave all your revision to the last minute. Students who prepare well in advance have a better chance of passing the exam on the first sitting.

We recommend that you prepare for the exam by practising a large number of exam-style questions under exam conditions. This will:

- help you to develop the necessary knowledge and understanding of the key principles described in the Core Reading
- highlight exactly which are the key principles that crop up time and time again in many different contexts and questions
- help you to practise the specific skills that you will need to pass the exam.

There are many sources of exam-style questions. You can use past exam papers, the Practice Questions at the end of each chapter (which include many past exam questions), assignments, mock exams, the Revision Notes and ASET.

Exam question skill levels

Exam questions are not designed to be of similar difficulty. The Institute and Faculty of Actuaries specifies different skill levels that questions may be set with reference to.

Questions may be set at any skill level:

- Knowledge – demonstration of a detailed knowledge and understanding of the topic
- Application – demonstration of an ability to apply the principles underlying the topic within a given context
- Higher Order – demonstration of an ability to perform deeper analysis and assessment of situations, including forming judgements, taking into account different points of view, comparing and contrasting situations, suggesting possible solutions and actions, and making recommendations.

Command verbs

The Institute and Faculty of Actuaries use command verbs (such as 'Define', 'Discuss' and 'Explain') to help students to identify what the question requires. The profession has produced a document, 'Command verbs used in the Associate and Fellowship written examinations', to help students to understand what each command verb is asking them to do.

It also gives the following advice:

- The use of a specific command verb within a syllabus objective does not indicate that this is the only form of question which can be asked on the topic covered by that objective.
- The Examiners may ask a question on any syllabus topic using any of the agreed command verbs, as are defined in the document.

You can find the relevant document on the profession's website at:

<https://www.actuaries.org.uk/studying/prepare-your-exams>

1.5 The examination

What to take to the exam

IMPORTANT NOTE: The following information was correct at the time of printing, however it is important to keep up-to-date with any changes. See the profession's website for the latest guidance.

For the written exam, the examination room will be equipped with:

- the question paper
- an answer booklet
- rough paper
- a copy of the Yellow Tables.

Remember to take with you:

- black pens
- a permitted scientific calculator – please refer to www.actuaries.org.uk for the latest advice.

Past exam papers

You can download some past exam papers and Examiners' Reports from the profession's website at www.actuaries.org.uk. However, please be aware that these exam papers are for the pre-2019 syllabus and not all questions will be relevant.

1.6 Queries and feedback

Questions and queries

From time to time you may come across something in the study material that is unclear to you. The easiest way to solve such problems is often through discussion with friends, colleagues and peers – they will probably have had similar experiences whilst studying. If there's no-one at work to talk to then use our discussion forum at www.ActEd.co.uk/forums (or use the link from our home page at www.ActEd.co.uk).

Our online forum is dedicated to actuarial students so that you can get help from fellow students on any aspect of your studies from technical issues to study advice. You could also use it to get ideas for revision or for further reading around the subject that you are studying. ActEd tutors will visit the site from time to time to ensure that you are not being led astray and we also post other frequently asked questions from students on the forum as they arise.

If you are still stuck, then you can send queries by email to the relevant subject email address (see [Section 2.6](#)), but we recommend that you try the forum first. We will endeavour to contact you as soon as possible after receiving your query but you should be aware that it may take some time to reply to queries, particularly when tutors are away from the office running tutorials. At the busiest teaching times of year, it may take us more than a week to get back to you.

If you have many queries on the course material, you should raise them at a tutorial or book a personal tuition session with an ActEd tutor. Information about personal tuition is set out in our current brochure. Please email ActEd@bpp.com for more details.

Feedback

If you find an error in the course, please check the corrections page of our website (www.ActEd.co.uk/paper_corrections.html) to see if the correction has already been dealt with. Otherwise please send details via email to the relevant subject email address (see [Section 2.6](#)).

Each year our tutors work hard to improve the quality of the study material and to ensure that the courses are as clear as possible and free from errors. We are always happy to receive feedback from students, particularly details concerning any errors, contradictions or unclear statements in the courses. If you have any comments on this course please email them to the relevant subject email address (see [Section 2.6](#)).

Our tutors also work with the profession to suggest developments and improvements to the Syllabus and Core Reading. If you have any comments or concerns about the Syllabus or Core Reading, these can be passed on via ActEd. Alternatively, you can send them directly to the Institute and Faculty of Actuaries' Examination Team by email to education.services@actuaries.org.uk.

2.1 Subject CP1 – background

History

The Core Practices subjects (Subjects CP1, CP2 and CP3) are new subjects in the Institute and Faculty of Actuaries 2019 Curriculum.

Subject CP1 is *Actuarial Practice*.

Predecessors

The topics covered in the Core Practices subjects (Subjects CP1, CP2 and CP3) cover content previously in Subjects CA1, CA2 and CA3:

- Subject CP1 replaces Subject CA1.
- Subject CP2 replaces Subject CA2.
- Subject CP3 replaces Subject CA3.

Exemptions

You will need to have passed or been granted an exemption from Subject CA1 to be eligible for a pass in Subject CP1 during the transfer process.

Links to other subjects

- Subject CS1, CS2, CM1, CM2, CB1 and CB2 – These subjects provide principles and tools that are built upon in Subject CP1.
- Subjects SP1-9 and SA1-7 – The Specialist Principles and Specialist Advanced subjects use the concepts developed in this subject to solve more complex problems, to produce coherent advice, and to make recommendations in specific practice areas.
- It is also an essential introduction to Subject SP9, Enterprise Risk Management, and the Chartered Enterprise Risk Actuary qualification.

2.2 Subject CP1 – Syllabus and Core Reading

Syllabus

The Syllabus for Subject CP1 is given here. To the right of each objective are the chapter numbers in which the objective is covered in the ActEd course.

Aim

The aim of the Actuarial Practice subject is to use the technical and business skills learnt in the Actuarial Statistics, Actuarial Modelling and Business subjects combining them with new material on how the skills are applied to solve real world problems.

The course provides the essential knowledge of risk management techniques and processes required by all actuaries and is an essential introduction to Enterprise Risk Management, Subject SP9 and the Chartered Enterprise Risk Actuary qualification.

The course also underpins the SP and SA subjects, covering essential background material that is common to a number of specialisms.

Competences

On successful completion of this subject, a student will be able to:

1. understand strategic concepts in the management of financial institutions and products
2. understand the risks faced both by individuals and groups who might effect financial products and also by the providers of such products
3. explain the principles and techniques used to manage these risks
4. understand the key techniques used by the providers of financial products to ensure that promised liabilities can be met
5. apply this knowledge, together with the skills learned from other subjects, to analyse the issues and formulate, justify, and present plausible solutions to business problems.

Syllabus topics

Note: In this syllabus the phrase ‘financial products’ is used to encompass all types of financial product, scheme, contract or other arrangements.

1.	Actuarial advice	(2.5%)
2.	Meeting the needs of stakeholders	(2.5%)
3.	The actuarial control cycle	(2.5%)
4.	Risk governance	(5%)
5.	Risk identification and classification	(5%)
6.	Risk measurement and monitoring	(5%)
7.	Responses to risk	(7.5%)
8.	Capital management and monitoring	(5%)
9.	The general business environment	(20%)
10.	Specifying the problem	(5%)
11.	Producing the solution	(30%)
12.	Living with the solution	(7.5%)
13.	Monitoring	(2.5%)
14.	Principal terms	(0%)

The weightings are indicative of the approximate balance of the assessment of this subject between the main syllabus topics, averaged over a number of examination sessions.

The weightings also correspond with the amount of learning material underlying each syllabus topic. However, this will also reflect aspects such as:

- the relative complexity of each topic, and hence the amount of explanation and support required for it
- the need to provide thorough foundation understanding on which to build the other objectives
- the extent of prior knowledge which is expected
- the degree to which each topic area is more knowledge or application based.

Detailed syllabus objectives

1. Actuarial advice (2.5%) (Chapter 1)
 - 1.1 Identify the clients that actuaries advise in both the public and private sectors and the stakeholders affected by that advice.
 - 1.2 Describe how stakeholders other than the client might be affected by any actuarial advice given.
 - 1.3 Describe the functions of the clients that actuaries advise and the types of advice that actuaries might give to their clients.
 - 1.4 Explain why and how certain factual information about the client should be sought in order to be able to give advice.
 - 1.5 Explain why subjective attitudes of clients and other stakeholders – especially towards risk – are relevant to giving advice.
 - 1.6 Distinguish between the responsibility for giving advice and the responsibility for taking decisions.
 - 1.7 Discuss the professional and technical standards that might apply to actuarial advice.
2. Meeting the needs of stakeholders (2.5%) (Chapters 4, 5, 6 and 7)
 - 2.1 Describe the main providers of benefits on contingent events.
 - 2.2 Describe the main types of social security benefits and financial products and explain how they can provide benefits on contingent events which meet the needs of clients and stakeholders.
 - 2.3 Explain the main principles of insurance and pensions that impact on these benefits and products.
 - 2.4 Describe the ways of analysing the needs of clients and stakeholders to determine the appropriate benefits on contingent events to be provided by financial products.
3. The actuarial control cycle (2.5%) (Chapter 0)
 - 3.1 Describe the actuarial control cycle and explain the purpose of each of its components.
 - 3.2 Demonstrate how the actuarial control cycle can be applied in a variety of practical commercial situations, including its use as a risk management control cycle.

4. Risk governance (5%) (Chapters [24](#) and [27](#))
- 4.1 Describe the risk management process for a business that can aid in the design of financial products to provide benefits on contingent events.
 - 4.2 Discuss the differences between risk and uncertainty and between systematic and diversifiable risk.
 - 4.3 Describe how enterprise risk management can add value to the management of a business.
 - 4.4 Discuss the roles and responsibilities of various stakeholders in the management of risk.
 - 4.5 Discuss risk appetite and the attainment of risk efficiency.
5. Risk identification and classification (5%) (Chapters [25](#), [26](#) and [27](#))
- 5.1 Describe the techniques that can be used to identify the risks associated with financial products or with the providers of benefits on contingent events.
 - 5.2 Discuss how the risks of a project are taken into account in project management.
 - 5.3 Describe the risks and uncertainties affecting:
 - the level and incidence of benefits payable on contingent events
 - the overall security of benefits payable on contingent events.
 - 5.4 Describe how risk classification can aid the design of financial products that provide benefits on contingent events.
 - 5.5 Show an awareness and understanding of the risk categories that apply to businesses in general, and particularly financial services businesses.
6. Risk measurement and monitoring (5%) ([Chapter 28](#))
- 6.1 Describe the various methods used to quantify risk.
 - 6.2 Discuss the uses of scenario analysis, stress testing and stochastic modelling in the evaluation of risk.
 - 6.3 Describe different methods of risk aggregation and explain their relative advantages and disadvantages.
 - 6.4 Explain the importance of risk reporting to managers and other stakeholders.
 - 6.5 Discuss the methods of measuring and reporting risk that can be used by the main providers of benefits on contingent events.

7. Responses to risk (7.5%) (Chapter 27, 29 and 30)
- 7.1 Describe attitudes to and methods of risk acceptance, rejection, transfer and management for stakeholders.
 - 7.2 Distinguish between the risks taken as an opportunity for profit and the risks to be mitigated.
 - 7.3 Describe the principle of pooling risks.
 - 7.4 Describe the methods of transferring risks.
 - 7.5 Analyse the risk management aspects of a particular business issue and recommend an appropriate risk management strategy.
 - 7.6 Describe the tools that can be used to aid the management and control of risk.
 - 7.7 Discuss the issues surrounding the management of risk for financial product providers.
 - 7.8 Describe how risks with low likelihood but high impact might be managed.
8. Capital management and monitoring (5%) (Chapters 35 and 36)
- 8.1 Discuss the interrelationship between risk and capital management.
 - 8.2 Explain the implication of risk for capital requirement, including economic and regulatory capital requirements.
 - 8.3 Describe how the main providers of benefits on contingent events can meet, manage and match their capital requirements.
 - 8.4 Discuss the implications of the regulatory environment in which the business is written for provisioning and capital requirements.
 - 8.5 Discuss risk-based capital and compare with other measures of capital needs.
 - 8.6 Discuss the merits of looking at an economic balance sheet in order to determine the risk-based capital requirements of a provider of benefits on contingent events.
 - 8.7 Discuss the use of internal models for assessment of economic and regulatory capital requirements.

9 The general business environment (20%)

9.1 Regulatory environment (Chapter 3)

- 9.1.1 Describe the principles and aims of prudential and market conduct regulatory regimes.
- 9.1.2 Discuss the role that major financial institutions can play in supporting the regulatory and business environment.
- 9.1.3 Explain the concept of information asymmetry.
- 9.1.4 Explain how certain features of financial contracts might be identified as unfair.
- 9.1.5 Discuss the implications of a requirement to treat the customer fairly.

9.2 External environment (Chapter 2)

Describe the implications for the main providers of benefits on contingent events of:

- legislation — regulations
- State benefits
- tax
- accounting standards
- capital adequacy and solvency
- corporate governance
- risk management requirements
- competitive advantage
- commercial requirements
- changing cultural and social trends
- climate change
- demographic changes
- environmental issues
- lifestyle considerations
- international practice
- technological changes.

9.3 Investment environment (Chapters 8, 9, 10, 11 and 15)

- 9.3.1 Discuss the cashflows of simple financial arrangements and the need to invest appropriately to provide for financial benefits on contingent events.
- 9.3.2 Demonstrate a knowledge and understanding of the characteristics of the principal investment assets and of the markets in such assets.
- 9.3.3 Describe how the risk profile of the principal investment assets affects the market in such assets.
- 9.3.4 Explain the principal economic influences on investment markets.
- 9.3.5 Describe other factors affecting supply and demand in investment markets.

10 Specifying the problem (5%)

10.1 Contract design (Chapter 22)

Discuss the factors to be considered in determining a suitable design for financial products that will provide benefits on contingent events in relation to:

- the characteristics of the parties involved
- the risk appetite or risk aversion of the parties involved
- the regulatory environment
- the market for the product
- competitive pressures
- the level and form of benefits to be provided
- any options or guarantees that may be included
- the benefits payable on discontinuance or transfer of rights
- the method of financing the benefits to be provided
- the choice of assets when benefits are funded
- administrative issues
- the charges that will be levied
- the capital requirements.

10.2 Data (Chapter 18)

- 10.2.1 Explain the ethical and regulatory issues involved in working with personal data and extremely large data sets.
- 10.2.2 Explain the main issues to be addressed by a data governance policy and its importance for an organization.
- 10.2.3 Explain the risks associated with use of data (including algorithmic decision making).
- 10.2.4 Discuss the data requirements for determining values for assets, future benefits and future funding requirements.
- 10.2.5 Describe the checks that can and should be made on data.
- 10.2.6 Describe the circumstances under which the ideal data required might not be available and discuss ways in which this problem may be overcome.
- 10.2.7 Describe how to determine the appropriate grouping of data to achieve the optimal level of homogeneity.

11 Producing the solution (30%)

11.1 Modelling (Chapter 17)

- 11.1.1 Describe the approaches available to produce the solution to an actuarial or financial problem.
- 11.1.2 Describe the construction of actuarial models to produce solutions in terms of:
 - the objectives of the model
 - the operational issues that should be considered in designing and running models.
- 11.1.3 Describe the use of models for:
 - pricing or setting future financing strategies
 - risk management: assessing the capital requirements and the return on capital or the funding levels required
 - assessing the provisions needed for existing commitments to provide benefits on contingent events
 - pricing and valuing options and guarantees.
- 11.1.4 Describe how sensitivity analysis of the results of the models can be used to help decision making.

11.2 Assumption setting (Chapter 19)

Describe the principles behind the determination of assumptions as input to a model relevant to producing a specific solution having regard to:

- the types of information that may be available to help in determining the assumptions to be used
- the extent to which each type of information may be useful, and the other considerations that may be taken into account, in deciding the assumptions
- the level of prudence in the assumptions required to meet the objectives of the client.

11.3 Mortality and morbidity (Chapter 20)

- 11.3.1 Describe the principal forms of heterogeneity within a population, the ways in which selection can occur, and how the use of risk classification can address the consequences of selection.
- 11.3.2 Explain why it is necessary to have different mortality tables for different classes of lives.
- 11.3.3 State the principal factors which contribute to the variation in mortality and morbidity by region and according to the social and economic environment, specifically:
 - occupation
 - nutrition
 - housing
 - climate / geography
 - education
 - genetics.
- 11.3.4 Explain how various types of selection (*eg* temporary initial selection, class selection) can be expected to occur among individuals or groups effecting financial products.
- 11.3.5 Explain the concept of mortality convergence.
- 11.3.6 Describe how decrements can have a selective effect on the remaining business.

11.4 Expenses (Chapter 21)

- 11.4.1 Describe the types of expenses that the providers of benefits on contingent events must meet.
- 11.4.2 Describe how expenses might be allocated when pricing financial products.

11.5 Developing the cost and the price (Chapter 23)

- 11.5.1 Discuss how to determine the cost of providing benefits on contingent events.
- 11.5.2 Discuss the factors to take into account when determining the appropriate level and incidence of contributions to provide benefits on contingent events.
- 11.5.3 Discuss the factors to take into account when determining the price or the contributions to charge for benefits on contingent events.
- 11.5.4 Discuss the influence of provisioning, or regulatory capital requirements on pricing or setting financing strategies.

11.6 Investment management (Chapters 12, 13, 14 and 16)

- 11.6.1 Discuss the principles and objectives of investment management and analyse the investment needs of an investor, taking into account liabilities, liquidity requirements and the risk appetite of the investor.
- 11.6.2 Discuss the different methods for the valuation of individual investments and demonstrate an understanding of their appropriateness in different situations.
- 11.6.3 Discuss the theoretical relationships between the total returns and the components of total returns, on equities, bonds and cash, and price and earnings inflation.
- 11.6.4 Discuss the different methods for the valuation of portfolios of investments and demonstrate an understanding of their appropriateness in different situations.
- 11.6.5 Discuss methods of quantifying the risk of investing in different classes and sub-classes of investment.

11.7 Provisioning (Chapters 31 and 32)

- 11.7.1 Discuss the different reasons for the valuation of the benefits from financial products and the impact on the choice of methodology and assumptions.

11.7.2 Discuss how to determine values for provisions in terms of:

- the need for placing values on provisions and the extent to which values should reflect risk management strategy
- the principles of 'fair valuation' of assets and liabilities and other 'market consistent' methods of valuing the liabilities
- the reasons why the assumptions used may differ in different circumstances
- the reasons why the assumptions and methods used to place a value on guarantees and options may differ from those used for calculating the accounting provisions needed
- how sensitivity analysis can be used to check the appropriateness of the values
- be able to perform calculations to demonstrate an understanding of the valuation methods.

11.7.3 Describe different methods of allowing for risk in cashflows.

11.7.4 Discuss different methods of allowing for uncertainty in present values of liabilities.

11.7.5 Discuss the purpose of and uses for equalisation reserves.

11.7.6 Describe the influence of comparisons with market values.

11.8 Relationship between assets and liabilities (Chapters 15 and 16)

11.8.1 Describe the principles of investment and the asset / liability matching requirements of the main providers of benefits on contingent events.

11.8.2 Show how actuarial techniques such as asset / liability modelling may be used to develop an appropriate investment strategy.

11.8.3 Describe the use of a risk budget for controlling risks in a portfolio.

11.8.4 Describe the techniques used to construct and monitor a specific asset portfolio.

11.8.5 Discuss the need to monitor investment performance and to review investment strategy.

12 Living with the solution (7.5%)

12.1 Maintaining profitability (Chapters 35, 36 and 37)

12.1.1 Describe how the main providers of benefits on contingent events can control and manage the cost of:

- payments arising on contingent events
- expenses associated with the payment of benefits on contingent events.

12.1.2 Discuss how regulatory capital requirements impact on a provider's profitability.

12.1.3 Describe the tools available for capital management.

12.2 Determining the actual results (Chapters 16 and 37)

12.2.1 Describe how a provider can analyse actual performance against expected performance.

12.2.2 Describe how a provider can analyse performance of an investment portfolio against a benchmark.

12.2.3 Discuss the possible sources of surplus / profit and the management actions that can control the amount of surplus / profit.

12.2.4 Describe why a provider will carry out an analysis of the changes in its surplus / profit.

12.2.5 Describe how any surplus / profit arising may be distributed.

12.2.6 Discuss the issues surrounding the amount of surplus / profit that may be distributed at any time and the rationale for retention of surplus / profit.

12.3 Reporting actual results (Chapters 28 and 33)

12.3.1 Describe the reports and systems which may be set up to control the progress of the financial condition of the main providers of benefits on contingent events.

12.3.2 Describe the reports and systems which may be set up to monitor and manage risk at the enterprise level.

12.3.3 Discuss the issues facing the main providers of benefits on contingent events relating to reporting of risk.

12.4 Insolvency and closure (Chapter 34)

Discuss the issues that need to be taken into account on the insolvency or closure of a provider of benefits on contingent events.

12.5 Options and guarantees (Chapters 22 and 30)

Discuss the issues surrounding the management of options and guarantees.

13 Monitoring (2.5%) (Chapters 21 and 38)

13.1 Describe how the actual experience can be monitored and assessed, in terms of:

- the reasons for monitoring experience
- the data required
- the process of analysis of the various factors affecting the experience
- the use of the results to revise models and assumptions.

13.2 Describe how the results of the monitoring process in the actuarial control cycle or the risk management control cycle are used to update the financial planning in a subsequent period.

14 Principal terms (0%) (Chapters 5, 6, 7, 29 and 39)

Have an understanding of the principal terms used in financial services, investments, asset management and risk management.

Core Reading

The Subject CP1 Course Notes include the Core Reading in full, integrated throughout the course.

The exam will be based on the relevant Syllabus and Core Reading and the ActEd course material will be the main source of tuition for students.

2.3 Subject CP1 – the course structure

There are ten parts to the Subject CP1 course. The parts cover related topics and have broadly equal marks in the exam. The parts are broken down into chapters.

The following table shows how the parts, the chapters and the syllabus items relate to each other. The end columns show how the chapters relate to the days of the regular tutorials. We have also given you a broad indication of the length of each chapter. This table should help you plan your progress across the study session.

Part	Chapter	Title	No of pages	Syllabus objectives	5 full days
1	0	Introduction to Subject CP1	29	3	1
	1	Actuarial advice	33	1	
	2	External environment	29	9.2	
	3	Regulation	36	9.1	
	4	Financial products & customer needs	22	2.2 (part), 2.3, 2.4	
2	5	Providers of benefits	32	2.1, 14 (part)	1
	6	Life insurance products	39	2.2 (part), 14 (part)	
	7	General insurance products	31	2.2 (part), 14 (part)	
3	8	Bond and money markets	30	9.3.2 (part)	2
	9	Equity and property markets	29	9.3.2 (part)	
	10	Other investment classes	36	9.3.2 (part)	
	11	Behaviour of the markets	48	9.3.2 (part), 9.3.3 – 9.3.5	
	12	Valuation of investments	35	11.6.2, 11.6.4	
4	13	Relationship between returns	15	11.6.3	
	14	Choosing an investment strategy	32	11.6.1 (part)	
	15	Asset-liability management	35	9.3.1, 11.8.1, 11.8.2	
	16	Investment management	28	11.6.1, 11.6.5, 11.8.3 – 11.8.5, 12.2.2	

Part	Chapter	Title	No of pages	Syllabus objectives	5 full days
5	17	Modelling	35	11.1	3
	18	Data	42	10.2	
	19	Setting assumptions	31	11.2	
6	20	Mortality and morbidity	27	11.3	
	21	Expenses	22	11.4, 13.1 (part)	
	22	Contract design	50	10.1, 12.5 (part)	
	23	Pricing and financing	27	11.5	
7	24	Risk governance	23	4.1 – 4.4	4
	25	Risk identification & classification	32	5.1, 5.2, 5.5 (part)	
	26	Financial product and benefit scheme risks	41	5.3, 5.5 (part)	
	27	Accepting risk	21	4.5, 5.4, 7.2, 7.3	
8	28	Risk measurement & reporting	35	6, 12.3.2, 12.3.3	
	29	Risk transfer	50	7.1 (part), 7.4, 7.7 (part), 14 (part)	
	30	Other risk controls	44	7.1 (part), 7.5, 7.6, 7.7 (part), 7.8, 12.5 (part)	
9	31	Provisions	28	11.7.1, 11.7.2 (part)	5
	32	Valuation of liabilities	34	11.7.2 (part), 11.7.3 – 11.7.6	
	33	Reporting results	24	12.3.1	
	34	Insolvency and closure	22	12.4	
10	35	Capital management	28	8.1 – 8.3, 12.1.3	
	36	Capital requirements	24	8.4 – 8.7, 12.1.2	
	37	Surplus & surplus management	44	12.1.1, 12.2.1, 12.2.3 – 12.2.6	
	38	Monitoring	34	13	
	39	Glossary	25	14 (part)	

2.4 Subject CP1 – summary of ActEd products

The following products are available for Subject CP1:

- Course Notes
 - X Assignments – six assignments:
 - X1-X3: 80-mark tests containing a mix of short-answer and longer case-study questions from specific parts of the course (you are allowed 2¾ hours to complete these)
 - X4 and X5: 100-mark tests containing a mix of short-answer and longer case-study questions from specific parts of the course (you are allowed 3¾ hours to complete these)
 - X6: a 100-mark test containing two case studies testing material across the whole course (you are allowed 3¾ hours to complete this)and X Assignment marking (Series Marking and Marking Vouchers)
 - Online Classroom
 - Flashcards
 - Revision Notes – ten A5 booklets
 - ASET – four years' exam papers, *ie* eight papers, covering the period April 2014 to September 2017
- Mock Exam and marking (Series Marking and Marking Vouchers).

We will endeavour to release as much material as possible but unfortunately some revision products may not be available until the September 2019 or even April 2020 exam sessions. Please check the ActEd website or email ActEd@bpp.com for more information.

The following tutorials are typically available for Subject CP1:

- regular tutorials (five days)
- block tutorials (five days).

Full details are set out in our *Tuition Bulletin*, which is available on our website at www.ActEd.co.uk.

2.5 Subject CP1 – skills and assessment

Exam skills

Exam question skill levels

In Subject CP1:

- Paper 1 will primarily test knowledge and application skills
- Paper 2 will primarily test the application and higher order skills.

The approximate split of assessment across the three skill types is:

<i>Skill type</i>	<i>Paper 1</i>	<i>Paper 2</i>	<i>Overall</i>
Knowledge	30%	10%	20%
Application	55%	45%	50%
Higher Order skills	15%	45%	30%

Assessment

Assessment consists of:

- Paper 1 – a 3¼-hour paper-based examination consisting of short questions (ranging from around 5 to 15 marks)
- Paper 2 – a 3¼-hour paper-based examination consisting of one or two case studies. Students will have 45 minutes planning time, during which they will be able to make notes and plan their responses. The remaining 2½ hours is writing time. Background detail will be provided for each case study and students will be required to provide written answers to various questions on each scenario.

These two examinations must be sat (and passed) together.

Each paper will be marked out of 100 and the scores for the two papers will be aggregated. There will be no requirement to pass or to reach a minimum standard on either paper on a stand-alone basis.

In the examination, questions may be set on any area of work in which actuaries participate, including wider fields such as banking, environmental issues, management of natural resources, and other topics. Questions will not require technical knowledge of the subject context beyond the material covered in this and the Actuarial Statistics (CS subjects), Actuarial Management (CM subjects) and Business subjects (CB subjects), but a general understanding of the business, commercial, social and natural environment will be assumed.

2.6 Subject CP1 – questions, queries and feedback

Q: *What knowledge of earlier subjects should I have?*

A: The Course Notes are written on the assumption that students have studied the Core Principles subjects (the CS, CM and CB subjects) or the equivalent CT subjects. However, the key areas that needed (*eg* a knowledge and understanding of the principal characteristics of the main asset classes and of the key macroeconomic variables and their inter-relationships) are revisited at the relevant points in this course.

Exam questions will not require technical knowledge of the subject context beyond the material covered in this and the Actuarial Statistics (CS subjects), Actuarial Management (CM subjects) and Business subjects (CB subjects), but a general understanding of the business, commercial, social and natural environment will be assumed

Further details can be found in Sections 2.1 and 2.5.

Q: *How long is the exam?*

A: Details of the exams are given in Section 2.5.

Q: *Are both the papers sat on the same day?*

A: No. The papers will be sat on different days.

Q: *Are the two papers designated as testing different things?*

A: No, there's no distinction in what they can test. Both papers can test any aspect of the Subject CP1 course.

Q: *What should I do if I discover an error in the course?*

A: If you find an error in the course, please check our website at:

www.ActEd.co.uk/paper_corrections.html

to see if the correction has already been dealt with. Otherwise please send details via email to CP1@bpp.com.

Q: *Who should I send feedback to?*

A: We are always happy to receive feedback from students, particularly details concerning any errors, contradictions or unclear statements in the courses.

If you have any comments on this course in general, please email to CP1@bpp.com.

If you have any comments or concerns about the Syllabus or Core Reading, these can be passed on to the profession via ActEd. Alternatively, you can send them directly to the Institute and Faculty of Actuaries' Examination Team by email to education.services@actuaries.org.uk.

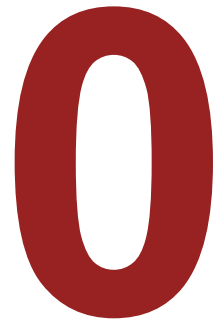
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These conditions remain in force after you have finished using the course.



What is Subject CP1 all about?

Syllabus objectives

- 3.1 Describe the actuarial control cycle and explain the purpose of each of its components.
- 3.2 Demonstrate how the actuarial control cycle can be applied in a variety of practical commercial situations, including its use as a risk management control cycle.

0 Introduction

When you first receive your Subject CP1 Course Notes, it is difficult to get over the sheer size of them! However, it's worth remembering that this subject is comparable in size to two SP subjects, so it is going to be big. Once you have unpacked the material into binders and taken a deep breath, we hope that you will feel ready for a gentle introduction to the subject.



It is important that you read this chapter since it **does** contain some (examinable) Core Reading.

In this chapter we will:

- give you an overview of the course structure
- introduce you to the important topic of the actuarial control cycle around which the Subject CP1 course is based
- give an introduction to the important topic of risk
- explain how to study the course productively
- explain the structure of the exam and give advice on good exam technique
- cover a Core Reading example on the actuarial control cycle.

1 Subject CP1 – the big picture

1.1 The rationale behind Subject CP1

Subject CP1, or Actuarial Practice, is a course about concepts. As a precursor to developing the Core Reading, several practising actuaries were asked about the concepts that were of most importance in their day-to-day work. They came up with ideas such as:

- the importance of understanding assets and liabilities and matching
- understanding and managing different types of risk
- balancing risk and return
- using different assumptions dependent upon the task and clients.

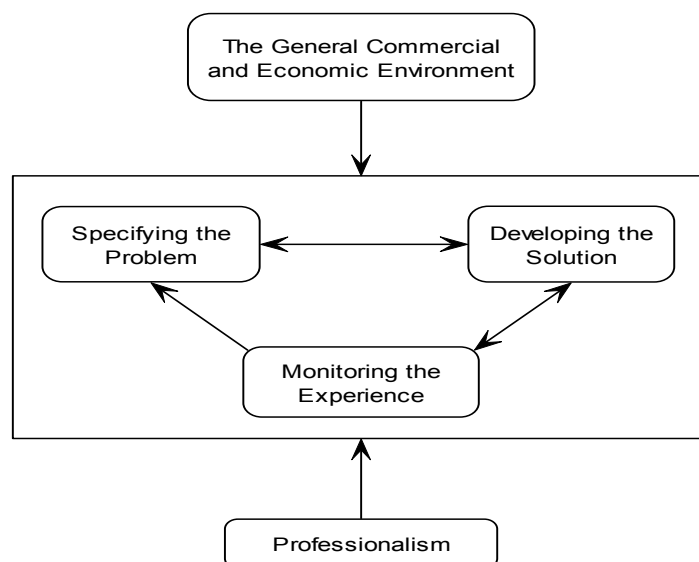
Many of these concepts span several actuarial disciplines, *eg* investment, general insurance, life insurance and pensions. Therefore, rather than splitting the Subject CP1 course into disciplines, the course is split into concepts. Within each concept, reference is made to how it relates similarly to, or differently between, the various disciplines.

1.2 The framework of the actuarial control cycle



The Subject CP1 course is written around the actuarial control cycle (ACC). This is the first important concept to get to grips with.

The ACC gives a framework for solving actuarial problems. The ACC looks like this:

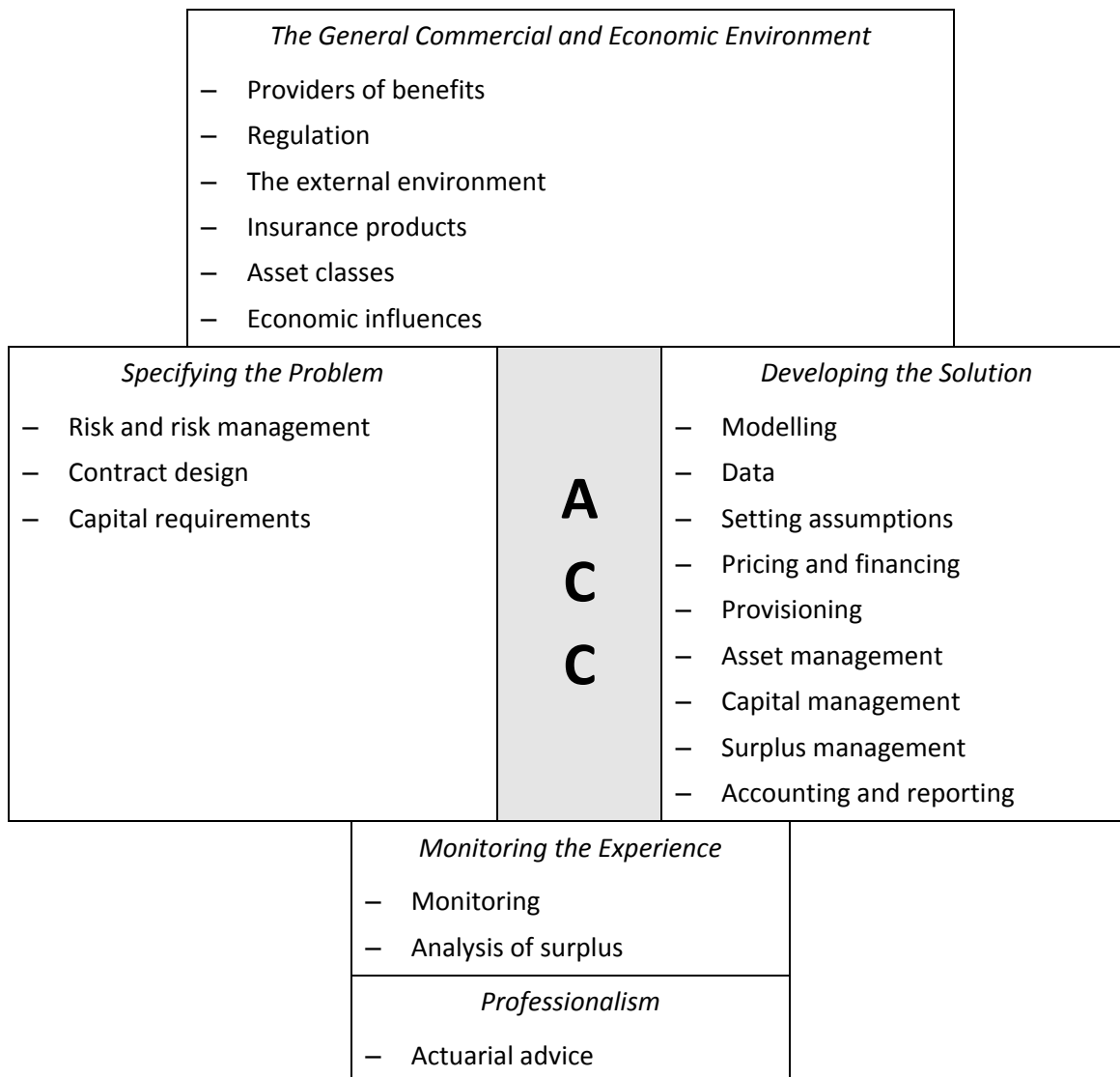


You may well be thinking that this is not a terribly exciting way to solve actuarial problems and that the steps in the ACC are largely common sense. This is fair enough, but bear in mind that when an actuarial task fails, it is often due to a breakdown in part of the ACC process.

For example, you may have come across situations at work where the assumptions used in a model are really outdated (*ie the monitoring the experience stage of the ACC has broken down*) or where colleagues have failed to provide adequate documentation for a task (*ie it could be viewed that they have not been professional*).

1.3 How does the ACC relate to Subject CP1?

The Core Reading for Subject CP1 is built around the actuarial control cycle. The diagram below shows how the key topics from Subject CP1 fit into the ACC.



2 The actuarial control cycle

The actuarial control cycle is a model that can be applied to many aspects of actuarial work. Like all models, it does not necessarily always fit the problem under consideration at all times or in all circumstances. However, like all good models, it is simple, and it helps the user to obtain a clearer understanding of the situation.

The actuarial control cycle is a fundamental tool of risk management – the process of analysing, quantifying, mitigating and monitoring risks.

The central part of the model is based on a simple approach to problem solving:

- firstly, define the problem
- then design and implement a solution
- then monitor the effectiveness of the solution and revise it if necessary.

This involves the following processes:

- Analyse situations, products and projects to determine the risks to which they are exposed.
- Quantify the financial consequences of the risk events occurring.
- Consider and quantify appropriate methods of managing, mitigating or transferring the risks.
- Monitor the situation and the risk management procedures implemented as time develops.
- In the light of experience modify or change the risk management approaches adopted.

The final bullet point above indicates that the process is cyclical. The approach used in almost all risk management tasks is that of the actuarial control cycle.

The actuarial control cycle can be represented diagrammatically, as:



The actuarial control cycle must of course be considered in the context of the specific economic and commercial environment in which it is being used. For example, in a particular scenario it might be necessary to consider legislation, taxation, and economic trends.

In addition the requirements of professionalism must be recognised at all stages of the cycle.

2.1 What makes the actuarial control cycle a 'control cycle'?

Actuarial work usually includes all phases of the cycle. The term 'cycle', and the use of two-way arrows in the diagram, highlights the importance of monitoring and feedback, and the inter-relationships between elements of the cycle.

In actuarial and risk management work, the feedback mechanism within the cycle is not an automatic process resulting in a pre-determined, unconscious adjustment, as happens in some engineering systems. The feedback mechanism in the actuarial control cycle requires the actuary to exercise professional judgement.

2.2 What makes the actuarial control cycle 'actuarial'?

Although the underlying problem-solving model is completely general, the actuarial control cycle incorporates the following basic elements, which are common to all actuarial and risk management work:

- the estimation of the financial impact of uncertain future events
- a long-term rather than short-term horizon
- the recognition of stakeholders' requirements and risk profiles
- decisions need to be made in the short term in the light of likely future outcomes
- the use of models to represent future financial outcomes
- the use of assumptions based on appropriate historical experience
- the need to allow for the general business environment – the impact of legislation, regulation, taxation, competition
- interpretation of the results of modelling to enable practical strategies to be developed
- monitoring and periodically analysing the emerging experience
- modifying models / strategies in the light of this analysis of the emerging experience
- the application of professional judgement.

2.3 The steps in the actuarial control cycle

The following sections discuss the individual components of the actuarial control cycle.

The general economic and commercial environment

This step of the process sets the scene and ensures the actuary is fully aware of the environment in which the problem is being solved and the impact of the environment on the decisions made.

Clearly the context or environment will depend on the field in which the actuary is working.

Example

An actuary working in the field of investment and asset management will want to be aware of the:

- terminology used in investment and asset management
- characteristics of the assets and the markets in which a fund might invest
- possible returns from both income and capital gain on major asset classes and the variability of these returns
- correlation of returns between asset classes and correlation of the returns with changes in the value of the investor's liabilities
- legislative and regulatory framework for investment management and the securities industry
- ways in which investment returns are taxed and how this affects investor behaviour
- assets invested in by competitors and any performance benchmarks
- impact of any relevant professional guidance.



Question

List the factors that would make up the general economic and commercial environment for an actuary working in general insurance.

Solution

The general economic and commercial environment of an actuary working in general insurance includes:

- customer needs and how those needs are changing over time
 - different types of general insurance products, who uses these products and the associated risks
 - the competition, the products they offer and the prices they charge
 - jargon used in the industry
 - main features of the insurance market and the different marketing strategies
 - reinsurance products and the terms on which they are available
 - effect the economy has on an insurer's operations
 - rules and regulations
 - impact of professional guidance.
-

Specifying the problem

The first stage of the actuarial control cycle is to identify and analyse the risks of the various stakeholders in detail, and to set out clearly the problem from the point of view of each stakeholder.

This stage of the control cycle considers the strategic courses of action that could be used to handle the particular risks in question. It gives an assessment of the risks faced and how they can be managed, mitigated or transferred. This will reflect the desire of most institutions to manage their risk both in their core business and in activities incidental to their core business.



Question

A financial services provider is considering developing an investment product that will give access to the stock market to customers who wish to save regular, small amounts of money. The financial services provider will collect customers' premiums and manage their investments on their behalf (for an appropriate charge).

Describe the key risks to which this product gives rise for the provider.

Solution

Key risks to the financial services provider include:

- The risk of customer dissatisfaction – this is probably most likely to arise if the investment return the provider achieves for its customers is poor, especially if it is worse than that of its competitors.
- Expense risks – such as the risk that the charges the company receives from customers are insufficient to cover the expenses that the provider incurs.
- The risk of poor sales – this will result in limited spreading of fixed costs such as the development and launch costs of the new product (which will be incurred regardless of the volumes sold). Also, there will be less spreading of overhead expenses.

This stage also provides an analysis of the options for the design of solutions to the problem plans that transfer risk from one set of stakeholders to another.

Developing the solution

This stage involves:

- an examination of the major actuarial models currently in use and how they may be adjusted for the particular problem to be solved.
- selection of the most appropriate model to use for the problem, or construction of a new model.
- consideration and selection of the assumptions to be used in the model. The assumptions used in a model are critical and it is necessary for the actuary to have a good understanding of their sensitivities.
- interpretation of the results of the modelling process.
- consideration of the implications of the model results on the overall problem.
- consideration of the implications of the results for all stakeholders.
- determining a proposed solution to the problem.
- consideration of alternative solutions and their effects on the problem.
- formalising a proposal.
- communicating the proposed solution, and alternatives, to the stakeholder(s) responsible for decision taking.

The most important model is likely to be one consisting of the future cashflows expected on an individual contract or benefit scheme or a portfolio of business.

Monitoring the experience

It is critical that the models used are dynamic and reflect current experience where that is relevant. This stage deals with the monitoring of experience and its feedback into the problem specification and solution development stages of the control cycle, such as updating the investigation.

We can analyse individual elements of experience (claim rates, investment returns, mortality, salary growth, expenses *etc*) in order to compare actual experience with what had been assumed. The assumptions made will rarely turn out to be correct and may lead to a wrong solution (*eg* unprofitable premium rates). With more up-to-date information the assumptions can be revised and a new solution developed.

An important part of this monitoring will be the identification of the causes of any departure from the targeted outcome from the model and a consideration as to whether such departures are likely to recur.

Monitoring should be carried out regularly. For a new contract, where there is lots of uncertainty, monitoring should take place more frequently initially.

Feedback loops

It is vital that the results of the monitoring process are used. Monitoring might indicate that the problem was not fully or correctly specified – in other words the solution developed does not solve the problem that it now appears exists. Alternatively monitoring might indicate that the solution as developed did not take some vital feature into account ...

... or some of the initial assumptions were incorrect.

More usually, the monitoring process indicates that the solution should be refined, perhaps to bring it up to date, or to reflect current experience, rather than that the solution was not appropriate. If these results are not fed back into the cycle it is likely that unsatisfactory consequences for one or more stakeholders will result.

Professionalism

Professionalism needs to be demonstrated throughout the actuarial control cycle process and in the communication of the results.

For example, relevant Technical Actuarial Standards should be followed and the views of all stakeholders taken into account. We will consider professionalism in greater detail in the next chapter.

3 Practical applications of the actuarial control cycle

3.1 The overall picture

Each of the common actuarial issues set out below are representative of the practical problems that arise in the areas in which actuaries work.

For example:

- **identifying alternative investment and risk management options**
- **asset liability management**
- **determining the current level of profit or solvency and estimating future solvency**
- **assessing the need for capital to protect against the consequences of risk events**
- **assessing the need for and the calculation of provisions**
- **determining the contributions / premiums required to ensure that benefit promises payable on future financial events can be met**
- **determining and monitoring mortality, expense and persistency assumptions for use within the design of and reserving for contracts or schemes**
- **monitoring the effect of investment mismatching.**

Solving these problems is likely to involve the use of techniques and concepts introduced in the Core Principles subjects.

Discussing these problems and the issues that arise in addressing them forms the basis of much of the remainder of Subject CP1 as well as later subjects. The actuarial control cycle provides a framework for these discussions.

4 Risk – the story so far

The topic of risk is a key theme for Subject CP1.

If you have previously studied financial economics you may well have been introduced to the concepts of investment risk and credit risk. We will cover these and other examples of types of risk in the course.

4.1 Investment risk

Most mathematical theories of investment risk interpret risk as being the uncertainty associated with the outcome of making an investment. They might, for example, use variance of return as a measure of investment risk.

4.2 Credit risk

Credit risk may be defined as the risk that a person or an organisation will fail to make a payment that they have promised.

An example of credit risk for corporate bonds would be the failure to make interest payments on set dates or failure to repay the face value of the bond on the redemption date.

5 Risk – broadening your view

Subject CP1 builds on your prior knowledge of the concept of risk. As you work through the course you will appreciate that, rather than attempting an in-depth analysis, it takes in a very broad view. To this end, you need to step back from any earlier detailed studies of investment and credit risk and establish a wider perspective.

At a fundamental level, risk might be considered to be exposure to actual events being different from those expected (or desired!). However, this definition results in ambiguity.



Question

Suggest how an increase in real salary growth may be considered positively by one particular individual or organisation and negatively by another.

Solution

Real salary growth being higher than expected might be seen by:

- employees as good news, especially if pension benefits are based on final salary!
- employers as bad news, assuming that it reduces profit margins and increases the cost of running the business
- the Government as good news, in that income tax revenue will rise in real terms
- the Government as bad news, in that it may precipitate higher inflation.

In this sense, risk is a concept that is very much situation dependent ('in the eye of the beholder'). In Subject CP1 we consider a range of potential stakeholders, including, for example:

- investors
- lenders / creditors
- trustees
- members of benefit schemes (*eg* pension schemes)
- insurers
- beneficiaries of insurance policies
- reinsurers.



Question

For each of the above potential stakeholders give examples of where the possibility of actual events deviating from expected exposes them to risk. Try not to repeat yourself and come up with different events for each stakeholder.

Solution

Investors – market prices don't rise as fast as expected (or hoped for).

Lenders / creditors – customers to whom credit terms are given fail to pay what is owed.

Trustees – professional advice, which is relied upon in order to make decisions, proves to be flawed.

Members with pensions in payment – retail prices rise faster than pension income.

Insurers – mortality rates assumed as part of the premium rating exercise turn out to be optimistic due to poor vetting of applications, resulting in underwriting losses.

Beneficiaries – benefits under health insurance policies prove to be inadequate due to high levels of medical cost inflation.

Reinsurers – risks ceded to a single reinsurer by multiple direct insurers were believed, incorrectly, to be independent and a subsequent single event causes a catastrophic aggregate loss.

For these and other stakeholders, risk generally occurs when:

1. the value of assets and/or asset proceeds (cashflows) are not as expected, or
2. the value of liabilities and/or liability outgoes (cashflows) are not as expected.

Asset proceeds might not be as expected due to:

- market risk – risks related to changes in investment market values
- credit risk – the risk of failure of third parties to repay debts.

Liability outgoes might not be as expected due to many reasons:

- inflation risk – the risk of real liabilities being larger than had been anticipated due to inflation, *eg* of salaries, consumer prices, medical costs, court awards.
- underwriting risk – the risk of failures in underwriting leading to the insurer taking on risks at an inadequate price.
- insurance risk – the risk of more claims being made than expected (*eg* due to higher than expected mortality or morbidity rates).
- exposure risk – the risk of more claims arising than expected from a particular event due to the insurer having greater exposure to a particular peril (*eg* a tornado in Mexico) than had been appreciated. This might be due to inadequate diversification within the portfolio of business written.
- finance risk – the risk of not being able to obtain finance when required or not being able to obtain it at the anticipated cost.
- operational risk – the risk of loss due to fraud or mismanagement within the organisation itself.
- external risk – the risk arising from external events, *eg* changes in legislation.

The risks relating to asset proceeds and liability outgoes might present less of a problem if both assets and liabilities 'behave similarly'.

For example, in terms of *cashflows*, if liability outgoes correspond to asset proceeds, then actual deviations from expected will present less of a risk than they might otherwise have done in isolation.

Similarly, but thinking in terms of *values*, if assets are chosen whose values move in line with those of the liabilities, then actual deviations from expected will present less of a risk than they might otherwise have done in isolation.

Under such circumstances assets are said to be a 'good match' for the liabilities. (The full concept of asset-liability matching is considered in detail later in this course.)

So we should modify the above list to state that risk generally occurs when:

1. asset values / proceeds are important in isolation to the stakeholder and they are not as expected
2. liability values / outgoes are important in isolation to the stakeholder and they are not as expected
3. asset values / proceeds and liability values / outgoes are not important in isolation to the stakeholder, but the relative values (value of assets less value of liabilities) and/or net cashflows (asset proceeds less liability outgoes) are important and are not as expected.

Note that deviations of cashflows from expected might be in terms of:

- amount and/or
- timing.



Question

- (i) Suggest an example from your own experience where a risk has arisen because of the mismatch in the *amount* of asset and liability values and/or cashflows.
- (ii) Suggest another example where the amounts of asset and liability cashflows are equal but risk has arisen because of a mismatch in *timing*.

Solution

- (i) I've saved regularly for three years to cover the cost of buying a replacement car. A risk has arisen in that the accumulated savings may not be enough to cover the purchase price due to car-price inflation exceeding that expected and/or interest rates on my savings being less than expected.
 - (ii) My dental insurance covers the cost of having my teeth crowned but I have to pay for the treatment first and then claim on the insurance afterwards. A risk has arisen because I may need to borrow money to pay for such treatment resulting in an uncertain cost and timing.
-

6 Measuring risk

We started off our discussion of risk by reviewing what we had learned from prior studies of financial economics. The emphasis in previous exams is on measuring risk – looking at the variability of outcomes.

Now that we have an expanded view of risk it is perhaps helpful to have in mind a broader quantification for measuring risk:

$$\text{Risk} = \text{probability} \times \text{impact}$$

However, this quantification is also situation dependent in that the reaction of any one stakeholder when faced with the same quantified risk will vary according to their:

- risk appetite
- objectives.



Question

- (i) Outline why might different individuals have different appetites for risk.
 - (ii) Give examples of investors with differing objectives that make them perceive the same risk in very different ways.
-

Solution

- (i) ***Different appetites for risk***

Appetite for risk may partly be a function of:

- age – older people may be more risk averse because they have less time to make up any loss
- wealth – richer people may be more aggressive in their investment strategy and put a lower value on insurance
- dependants – those with children to support may be more cautious in their investments and place a high value on insurance.

- (ii) ***Example of differences in perception***

The risk of investing in a forest will be perceived very differently by an individual looking for a high level of income compared to a charity that aims to combat global warming!

7 Managing risk

All is not doom and gloom! When faced with risks we might take two, very positive, viewpoints:

1. 'Risk is an opportunity!'
2. 'We can manage risk successfully!'

Risk as opportunity

A price can be put on many risks faced by individuals and organisations. Anything that can be priced offers the opportunity to make trading profits.

For example, insurance is all about the assessment and pricing of risk. If the price at which one party is happy to accept a risk is less than the perceived cost of the risk to a second party, the opportunity exists for a risk transfer to the mutual satisfaction of both parties. Such differences in perception are likely to be linked to different risk appetites.

Mitigating risk

Having correctly identified the risks to which we might be exposed, the next step (using the approach given by the actuarial control cycle) is to consider how they might be mitigated. For any that can't be avoided or eliminated – and for many that won't be possible – careful management and monitoring will be required.

One way of reducing risk is to avoid exposure to it! However, the mitigation of risk can take many forms. For example, the table below shows three risks that may have a financial cost to an individual and how these risks could be mitigated.

<i>Risk</i>	<i>Mitigation strategy</i>
Death	Life insurance policy.
Unemployment	Savings to tide me over the period before I expect to be able to get a new job.
Illness	Reliance on the State-provided health service.

Obviously these mitigation strategies are a matter of personal choice. Your own choices may be very different!

Note that a mitigation strategy will change the level and/or nature of the risk but will rarely eliminate risk. For example, the first and last strategies expose the individual to failure of third parties. The second may or may not prove to be adequate, depending upon how long the individual remains unemployed and the rate of increases in the cost of living.

Mitigating risk might involve:

- avoiding
- accepting and minimising
- sharing or
- transferring

risk together with ongoing monitoring.



Question

Use each of the above mitigation strategies to suggest how each of the following risks can be mitigated:

- the risk of poor investment performance to a life insurance company
- the risk of terrorist attacks on aeroplanes to an individual.

Solution

Avoiding:

- ceasing to write contracts with any investment guarantees
- not flying by air to avoid the risk of terrorist action

Minimising:

- designing a unit-linked insurance contract with investment guarantees that have an upper limit
- only flying from airports that meet an internationally recognised security standard

Sharing:

- writing with-profit insurance contracts so as to share the investment risks with policyholders
- pooling resources with other travellers and hiring executive jets as a group so as to have more direct control over flight security

Transferring:

- using derivatives (*eg* options) to offset (or hedge) potential future losses from any investment guarantees that are made or only offering unit-linked contracts under which the policyholder accepts all of the investment risk
 - delegating all tasks that require travel by air to others!
-

We'll look at the risk management process and strategies for mitigating risks in more detail later in the course.

8 Getting the most out of your study sessions

The Subject CP1 study guide gives some good advice on studying and is worth reading. As a summary, here are our top study tips:

1. As you read each chapter, condense the key ideas onto a single or double side of A4 – you will retain a lot more by doing this recap and it will come in handy for revision, as you will not need to trawl all the way through the course again. Alternatively you can annotate the summary pages from each chapter.
2. Make your study as active as possible – this means having a go at all the questions (you will learn very little by just looking at the solutions) and annotating the notes with your own comments as you work through.
3. Attempt the assignments – the students who pass the exams tend to be the ones who are practising a *significant* number of questions in advance of the exam and getting some regular feedback from markers.
4. Make sure that you work through all the relevant past exam papers (prior to 2019, this exam was called Subject CA1). Practising these questions will be useful as preparation for both Paper 1 and Paper 2. You need to start looking at exam questions early on in your studies – don't leave this until the last couple of weeks!
5. Make sure that each study session contains a range of activities to keep up your interest, including:
 - reading new material
 - recapping old material
 - attempting questions.

9 The Subject CP1 exam and good exam technique

9.1 The Subject CP1 exam

The Subject CP1 exam consists of two exam papers sat on different days. Each exam paper is marked out of 100 and the scores of the two papers aggregated. There is no requirement to pass or reach a minimum standard on each individual paper.

The X Assignments include both Paper 1 and Paper 2 style questions to help you prepare for the exam.

Paper 1

The Paper 1 exam is 3 hours and 15 minutes long. The questions are expected to be between 5 and 15 marks in length. This paper will primarily test knowledge and straightforward application skills.

Paper 2

The Paper 2 exam is 3 hours and 15 minutes long. At the time of writing this course it is expected that this will consist of 45 minutes of planning time and 2 hour 30 minutes of writing time. During the planning time candidates can make notes and plan their responses but not write in the answer booklet.

Paper 2 is expected to consist of one or two case studies. The case study will provide background detail relating to a scenario and there will be various questions to answer. This paper will test more difficult application and higher order skills.

9.2 Doing well in the Subject CP1 exam

Subject CP1 may be the first wordy exam you have sat in a long time. Below are some exam technique ideas that successful students have found useful in the past.

Bookwork vs applications

Some of the exam questions may be based purely on bookwork, requiring you to remember a set of ideas from the course material. However, it is more likely that the questions will be *applications* based with Core Reading underlying them.

Applications questions require you to take one or more concepts from the Core Reading and apply them to a specific situation.

Being general and specific

In applications questions, the examiners are looking for you to be both *general* and *specific*.

- The *general* comes from considering which bits of Core Reading are relevant to the question.
- The *specific* comes from looking at the information given in the question and tailoring your answer towards this. In particular for Paper 2 there is likely to be a large amount of background information given to you and it will be important to understand this information and use it well to illustrate your points.

Example

An exam question might say:

'Explain why a multinational pharmaceutical company may require capital.'

The *general* points to mention will come from the Core Reading on why companies require capital.

The *specific* points to mention come from the words *multinational* and *pharmaceutical company* in the question. For example, because the company is *multinational* it will have operations in different countries, you need to think about currency risks. Because it is a *pharmaceutical company* you need to think about its day-to-day operations:

- research and development
- purchasing stock
- manufacturing drugs.

(Note that it's quite normal not to be able to generate these thoughts if this is your first read through of [Chapter 0](#). They will hopefully come more naturally once you have finished the whole course!)

When students go for exam counselling with the Institute and Faculty of Actuaries, they often find that they are being either TOO GENERAL (and regurgitating Core Reading) or TOO SPECIFIC (and forgetting the Core Reading altogether).

9.3 Idea generation

As you start to tackle past exam questions, you will realise that the examiners are looking for a good *breadth* of ideas. Breadth of thinking rather than great depth on any one point is the key to success in Subject CP1.

It is so important to develop techniques for generating ideas. Some of the things that successful students have found useful for idea generation include:

Acronyms

Study
Hard
And
Practice
Exam questions

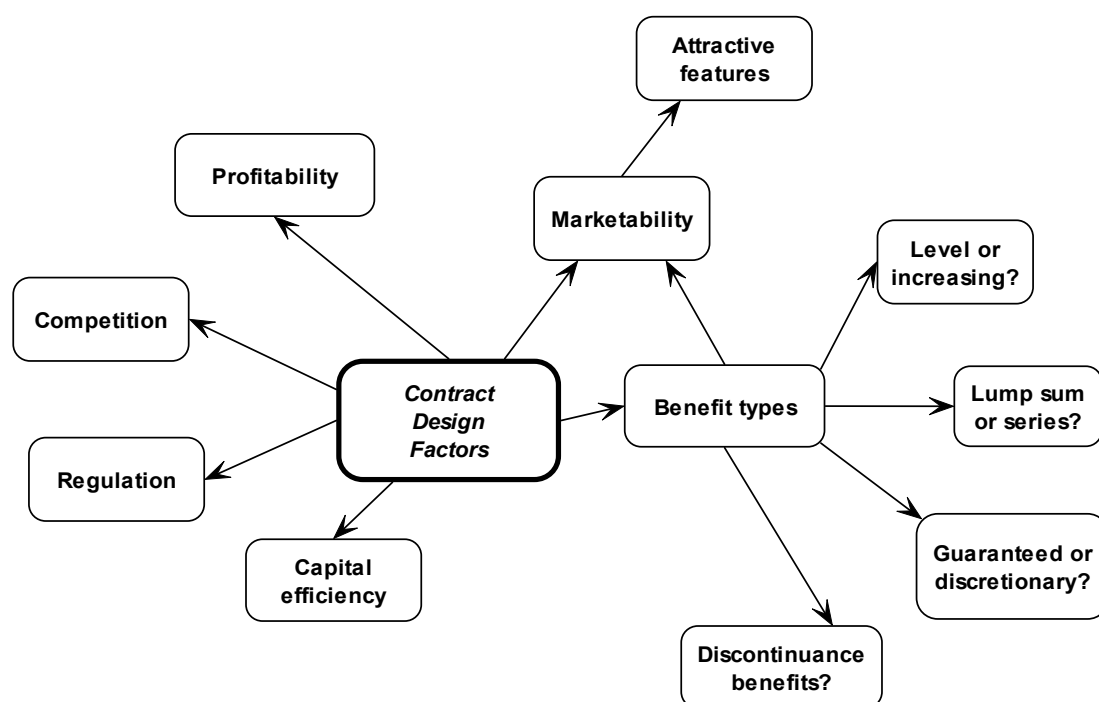
(Whilst acronyms are useful for generating ideas, be careful not to abuse them. Be discerning about which points are relevant to the actual question.)

Tables

	<i>Investment trust companies</i>	<i>Unit trusts</i>
Investor buys ...	Shares	units
Purpose is ...	to gain access to a well-diversified portfolio of assets and investment expertise	
Share / unit priced at ...	discount / premium to net asset value	net asset value
...	...	...

Diagrams

Using the words in the question



As we saw in our previous example you can use the words in the question to help you generate ideas, eg *'multinational'*, *'pharmaceutical'*.

We recommend that you start to draw up a grid of word associations, eg:

Word	Association
multinational	currency risk
pharmaceutical	research and development, stock, manufacturing
small company	lack of data, lack of capital, lack of diversification

It may sometimes seem like an impossible task to generate enough ideas for the exam. It is something that gets easier once you start practising questions (and see that there are common themes that come up time and time again).

9.4 How much should I write?

You need to generate many ideas on each question. As a rule of thumb (please note that this is not an absolute statement), you can expect half a mark for each distinct idea made. Very important, or complex ideas may get a full mark. It is important to get each point down succinctly and then move on.

Adopting a bullet point style is great as long as you say just enough given the instruction word in the question. This same concise style is appropriate in answering questions for both Paper 1 and Paper 2.

Writing big, waffly paragraphs is not a good idea, as the distinction between your points will become blurred – the harder your script is to mark, the less likely you are to get credit for ideas, which you thought were distinct, but which the examiners cannot distinguish as they are buried in a big long sentence (just like this one)!

If the question asks you to 'List' or 'State', then each point is almost certainly worth half a mark. You just need to put the point down with no explanation.

For any of the other instruction words, such as 'Describe', 'Discuss', 'Explain' or 'Outline' you will need to give a bit of detail, briefly explain why it is a relevant point or maybe give an example. 'Discuss' questions often require you to look at advantages and disadvantages.

Example 1

An exam question might say: *'List the reasons for investing overseas.'*

A good solution would be:

- match overseas liabilities
- diversification

- increase expected returns.

Example 2

An exam question might say:

‘Explain the reasons for investing overseas.’

A good solution would be:

- Match overseas liabilities – choosing assets of the same currency as that in which the liabilities are denominated hedges currency risk.
- Diversification – investing overseas gives access to different economies, stock markets, industries and individual companies.

Investing in a number of different countries or economies with a low degree of correlation helps to reduce portfolio risk.
- Increase expected returns – returns on overseas investments can be higher than domestic returns because they are fair compensation for the higher risk involved.
- Alternatively, inefficiencies in the global market may allow fund managers to find individual countries whose markets, or currencies are undervalued.

10 Core Reading example

We will now look at a Core Reading example question on the actuarial control cycle.

Example

A life insurance company is about to enter the annuity market for the first time. It intends to sell without-profit immediate annuities with higher annuities for those lives in ill health.

Describe how the actuarial control cycle can be used in the pricing and ongoing financial management of the product. It is not necessary to discuss how the product might be administered.

Although it will be difficult (especially on your first read through of the course), we recommend that you have a go at answering this question, otherwise your study is likely to be passive and ineffective. Some hints are given below.

Hints

It is helpful to start by highlighting the important features of the contract given in the question – in this case a without-profit immediate annuity:

- The customer invests a lump sum.
- The life insurance company decides on the guaranteed amount of income to pay to the customer, *ie* the annuity rate.
- The annuity payments start immediately and cease on the death of the customer.
- There are no benefits paid on other events, *eg* on surrender.

The best way to tackle *actuarial control cycle* questions is to consider each of the five stages of the cycle in turn. Here are some things to think about at each stage:

Specifying the problem

- Set an objective – give an example that is specific to the question.
- Identify the risks / mitigation options – give examples specific to the question.

Developing the solution

- Often this involves building a model – suggest a type of model.
- Identify the assumptions for the model – give examples specific to the question.
- Suggest ways of dealing with any uncertainty in the assumptions.
- Talk about sensitivity testing – *ie* rerunning the model on different assumptions.

Monitoring the experience

- Compare actual vs expected experience – give examples specific to the question.
- Analyse the differences in actual vs expected experience and suggest how you might deal with them.
- Discuss how frequently the monitoring should occur.

Professionalism

- Think about the characteristics of a professional.

The general economic and commercial environment

- What external issues should be considered? Think about what you would like to know about the competition.
- Why is the state of the economy potentially an issue?

Solution*Specifying the problem*

The client will be transferring risk to the insurance company:

- Longevity risk will be transferred, as the annuity will be paid to the client regardless of how long they live.
- Investment risk (including credit and market risk) will be transferred, as the client will receive a guaranteed income, irrespective of market conditions.

The problem is to determine appropriate premium rates that:

- deliver an acceptable profit to the company
- are competitive in the market place otherwise little business will be written

bearing in mind that the company is new in the market and has little or no experience of the product.

Developing the solution

The company will need a pricing (or profit testing) model that can project the future development of this line of business in various circumstances. The model needs to be developed or acquired, or an existing model modified.

The first stage in pricing the product is to determine the initial assumptions about future experience.

The actuary will need to discuss the mortality basis with the underwriter to ensure that the underwriting decisions are consistent with the pricing basis.

The actuary will need to discuss investment returns and the appropriate matching assets with the investment managers ...

... bonds are likely to be the appropriate matching assets.

Judgement will need to be applied as to the extent of any margin for prudence included in the reserving basis and/or whether capital requirements should be allowed for explicitly. The assumed reserving basis and capital requirements will also be an input to the profit testing of the product.

As this is a new development, the model will be run several times to test the sensitivity of premium rates and profit emergence to changes in assumptions. This is important data to have available for the monitoring stage.

The actuary should be mindful of compliance with relevant regulation and professional guidance when pricing the product.

The actuary will take account of the commercial and economic environment when deciding on the resultant rates, for example by comparing the resultant rates with those available elsewhere in the market.

Monitoring the experience

After the launch of the annuities the experience will be monitored regularly to determine how it compares with the assumptions made at launch.

It may take time for significant volumes of data to build up, particularly if mortality experience is being monitored by type of illness. The smaller the volume of business, the greater the likely volatility of the experience.

If the experience differs markedly from the initial assumptions, revised assumptions may be determined. The product will be profit tested once more, which may lead to a change in premium rates. Deviations between experience and assumptions may also lead to a change in the reserving basis.

The experience should be discussed with the underwriters as it may indicate inconsistencies between the approaches taken by the underwriters and that assumed in the pricing assumptions.

Changes to the premium rates offered by competitors will also be monitored to ensure that the rates do not become uncompetitive. This may also lead to a change in the premium rates. The monitoring of the ill-health enhancements offered by competitors may be difficult as the approach taken to grouping illnesses may vary significantly between companies.

It is possible that the company finds that it cannot offer premium rates that are both competitive and profitable, in which case it may withdraw from the marketplace. If the rates appear too competitive it may be an indication that the standard mortality assumption or ratings used are inappropriate, or that the market is not competitive, in which case larger profits can be made.

You will notice that the Core Reading solution structures the answer around the first three stages of the actuarial control cycle. However, professionalism and the general economic and commercial environment have been covered within the developing the solution stage.

Chapter 0 Summary

The actuarial control cycle

A fundamental tool for risk management.

Involves:

- analysing situations, products and projects to understand risk exposure
- quantifying consequences of risk events
- determining appropriate approaches to risk management
- monitoring situation and risk management procedures.

Steps of the process:

- the general economic and commercial environment
- specifying the problem
- developing the solution
- monitoring the experience
- professionalism.

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1

Actuarial advice

Syllabus objectives

- 1.1 Identify the clients that actuaries advise in both the public and private sectors and the stakeholders affected by that advice.
- 1.2 Describe how stakeholders other than the client might be affected by any actuarial advice given.
- 1.3 Describe the functions of the clients that actuaries advise and the types of advice that actuaries might give to their clients.
- 1.4 Explain why and how certain factual information about the client should be sought in order to be able to give advice.
- 1.5 Explain why subjective attitudes of clients and other stakeholders – especially towards risk – are relevant to giving advice.
- 1.6 Distinguish between the responsibility for giving advice and the responsibility for taking decisions.
- 1.7 Discuss the professional and technical standards that might apply to actuarial advice.

0 Introduction

This chapter looks at the different clients that actuaries are called on to advise, and other stakeholders who may be affected by that advice in the wider context. It considers the information that should be sought from the client before advice is given and the types of advice that the actuary might give. It also discusses the professionalism framework of the Institute and Faculty of Actuaries.

The chapter has relatively little explanation added to the information in the Core Reading, since it largely contains knowledge rather than conceptually difficult ideas. However, it is important to take it on board, as failure to act in a professional manner could result in fines and disqualification from the actuarial profession.

The majority of the additional material in this chapter is in the form of examples and questions, to encourage you to think about and apply the information as you read.

On your first reading of the course, you may find that you have questions about the finer details of some of the issues mentioned, *eg* setting premium rates for insurance policies and funding retirement benefit provision. These, and many other areas, will be considered throughout the rest of Subject CP1. The purpose of this chapter is to give an overview of the types of advice actuaries give and the recipients of that advice.

1 The clients actuaries advise

1.1 Possible clients

There are many clients whom actuaries can advise. In the private sector these include:

- **policyholders**
- **prospective policyholders**
- **members of benefit schemes and their dependants**
- **employers**
- **insurance company – board of directors**
- **insurance company – shareholders**
- **insurance company creditors**
- **trustees of benefit schemes**
- **sponsors of benefits schemes**
- **employees**
- **auditors of insurance companies**
- **auditors of the sponsors of benefit schemes**
- **investment fund managers**
- **members of investment schemes**
- **sponsors of capital projects**
- **banks.**

In the public sector actuaries advise central and local government departments and related organisations, such as central banks and regulatory bodies. As in the private sector, advising actuaries might be employees of the relevant organisation, or independent consultants.

2 Other stakeholders affected by actuarial advice given to clients

It is important to identify all the stakeholders involved when any actuarial advice is given.

As well as the client, there will be other interested parties.

In most circumstances different categories of stakeholder have different interests. In most situations one or more stakeholders will remunerate the actuary, but there will be several other stakeholders with significant interests who do not contribute directly to the actuary's remuneration.



In many cases the advice given to a client by an actuary will impact on other stakeholders. The actuary needs to consider the interests of all stakeholders, and not only those who seek (and pay for) advice.

It is important to consider all stakeholders because omitting a stakeholder will distort the context, eg one stakeholder's risk can be a source of another stakeholder's gain.

For example, consider the level of contributions to be made by the sponsor of a benefit scheme. A lower level of contributions may reduce the sponsor's costs (at least in the short term) but increase the risk of insufficient funds being available to meet the members' expected benefits.

It is also necessary to retain a sense of proportion in considering who else may be affected by advice given.

The actuary should consider the extent of each stakeholder's interest and how significant it is compared to those of the other stakeholders. Where stakeholders' interests conflict, difficult judgements may be required.

The following sections gives examples of the range of stakeholders who might be involved in what may initially appear to be a simple situation.

2.1 Example: business expansion

For example, where an actuary is advising the board of directors of an insurance company that is planning a large expansion in business, the advice may have an impact on:

- the level of benefits that the company's policyholders receive
- the level of premium charged to the company's new and existing policyholders
- the level of dividend that the shareholders of the insurance company receive
- the volume of new business the company can write
- the level of taxes that the Government receives on the profits earned by the company
- other insurance companies that are competing in the same market
- reinsurance companies through the level of reinsurance business that the company requires
- the employees of the insurance company through the employment benefits they receive

- **job security for the employees of the insurance company**
- **the work of the regulatory authorities that monitor the insurance company**
- **other insurance companies who may be required by legislation to contribute to a compensation scheme that pays benefits to the policyholders of insurance companies that fail**
- **employed sales staff and independent intermediaries.**

Similar lists of stakeholders can be developed in other scenarios where actuarial advice is given.

2.2 Example: pension scheme investment policy

Where an actuary is advising the trustees on the investment policy for the assets of a pension scheme, the main other stakeholders who could be impacted by that advice are:

- the employer who sponsors the scheme
- the providers of capital to the sponsoring employer
- the members of the scheme
- the dependants of the members of the scheme.

However there are many other potential stakeholders in this advice, including:

- the fund managers who will be responsible for implementing the policy and will consider issues such as their expertise and experience in the proposed investment style and the associated costs
- employees who are not members of the scheme who may be affected if their employer is faced with unanticipated pension scheme liabilities in the future as a result of the investment policy chosen
- creditors and customers of the sponsor of the scheme, who may be similarly affected if the employer faces unexpectedly large pension scheme contributions in the future.

This is a good example of the need to retain a sense of proportion when considering who may be impacted by actuarial advice. The stakeholders identified in the first list are the more significant and so should be given greater weight by the actuary giving the advice.

2.3 Example: insurance company takeover

Where an actuary is advising an insurance company (Company A) that is taking over another insurance company (Company B), that advice can have an impact on:

- the shareholders of Company A
- the shareholders of Company B
- the policyholders of Company A
- the policyholders of Company B
- the employees of Company A
- the employees of Company B
- the future policyholders of the combined company.



Question

Suggest other less significant stakeholders on whom this advice may have an impact.

Solution

Other stakeholders in this advice may include:

- the auditors of the two companies
 - the regulator (who is likely to be particularly interested in the security of the benefits of the existing policyholders)
 - the Government (which may be interested in, for example, the level of competition in the market)
 - any providers of finance to the insurance companies in addition to the shareholders
 - the board of directors of the two companies as a new joint board will need to be established
 - competitors, as the new merged company may be a bigger rival.
-

3 The interests and functions of the clients

The stakeholders listed earlier have a wide range of interests and functions that actuaries can provide advice on.

Before going on to read the Core Reading, you may find it helpful to make your own list of potential areas of advice for each potential client. Aim for two areas of advice for each client, wherever possible.

3.1 Policyholders and prospective policyholders

The interests and functions about which actuaries can provide current and potential future policyholders with advice include:

- **personal protection against death and illness**
- **protection of property**
- **investment.**

Other examples are:

- retirement planning
- protection against requiring long-term home or nursing care
- protection against personal liability claims (*eg* for causing a motor accident).

3.2 Members of benefit schemes and their dependants

Actuarial advice that affects benefit scheme members and their dependants mainly concerns the provision of benefits on future events such as death, retirement, illness and withdrawal.

3.3 Employers

Actuaries may advise on aspects such as:

- protection against financial loss arising from the death or ill-health of employees
- protection of assets
- provision of work-related benefits that will attract and retain good quality staff
- meeting legislative requirements
- managing the costs of running the business
- quantification of the amount of surplus capital in the business
- investment of surplus capital.

3.4 Insurance company board of directors

Actuaries may advise on aspects such as:

- meeting legislative requirements for the management of the business
- investing and managing the assets of the company
- managing the liabilities of the company
- determining the levels of provisions to hold to meet future liabilities
- setting premium rates
- meeting policyholders' reasonable expectations
- good corporate governance
- obtaining appropriate and adequate reinsurance to protect the business.

3.5 Insurance company shareholders

The main area of interest to shareholders is likely to be obtaining a good return on their investment that appropriately reflects the level of risk that has been taken.

3.6 Insurance company creditors

In this case, the main issue of interest is likely to be the certainty that the monies owed to them will be paid.

3.7 Trustees of benefit schemes

Trustees are likely to require advice on:

- **managing the assets of the scheme**
- **paying the benefits promised under the scheme as they fall due**
- **maintaining solvency.**

3.8 Sponsors of benefits schemes

The interests and functions that actuaries can provide advice on include:

- **providing protection benefits that meet the needs of the members and their dependants**
- **providing retirement benefits that meet the needs of the members**
- **managing the cost of providing the benefits**
- **meeting legislative requirements.**

3.9 Employees

The key areas where actuaries' advice may be of interest to employees are likely to be:

- provision of protection benefits on death or sickness
- provision of pension benefits on retirement
- investment of surplus personal funds.

3.10 Auditors of insurance companies

Insurance company auditors may require advice on the assessment of provisions.

3.11 Auditors of the sponsors of benefit schemes

Benefit scheme auditors may require advice on the assessment of the future liability to pay benefits.

3.12 Investment fund managers

Investment fund managers may require advice on investment strategy, particularly taking into consideration the need to meet liabilities.

3.13 Members of investment schemes

Investment scheme members may be interested in understanding how to invest in order to meet specific liabilities or objectives, such as saving for retirement.

3.14 Sponsors of capital projects

A capital project is any project where there is initial capital expenditure and which is expected to generate future revenues in order to recoup that outlay.

Actuaries may be required to advise on:

- assessment of the risks underlying the project
- consideration of potential risk mitigation techniques
- evaluation of the future cashflows.

3.15 Banks

Actuaries may be required to advise banks on aspects such as the provision of investment and savings products and the use or investment of surplus funds.

Actuaries may be required to advise the central bank on aspects such as monetary strategy.

3.16 Government

Actuaries may advise the Government on:

- **setting legislation that impacts on the provision of financial products, schemes, contracts and transactions that provide benefits on future financial events**
- **monitoring the adherence to this legislation**
- **funding benefit provision by the State**
- **monitoring the funding of benefit provision by the State.**

3.17 Regulators

Actuaries can help regulators in ensuring that regulatory requirements are met.

4 Information about the client

4.1 Gathering the required information

Often in their work actuaries are giving advice to a client with a particular problem. Such advice will often set out alternative solutions and the implications of each solution. These solutions must always be relevant to the specific circumstances of the client.

In many cases the client will give a brief to, or agree terms of reference with, an actuary without specifying the client's position. This is normally not because the client is trying to hide information, but because the client is so knowledgeable about his/her own position that he/she inadvertently thinks everyone else is equally well-informed.

It is important that before starting analysis of the problem, the actuary is fully briefed about the client. There will be a significant amount of information in the public domain, for example information in any company accounts or similar publications. Many clients also have websites that contain important information. Before starting on the specific task, the actuary should research and assimilate such information. This exercise might then require a follow-up pre-project meeting with the client to ensure that their position has been fully understood.

4.2 Conflicts of interest

At all times the actuary should be aware of any conflict of interest.

An example of when a conflict of interest could arise is when an actuary is advising both the trustees and the sponsor of a benefit scheme. The primary concern of the trustees will be the security of members' benefits, whereas the employer will also be concerned about costs.

It may not always be possible for conflicts of interest to be avoided. At the very least, potential conflicts should be disclosed and any appropriate safeguards put in place. For example, measures should be put in place to ensure the independence of teams working for different clients within a firm. These measures are commonly called 'Chinese walls'. Originally it was sufficient to have physical separation of the different teams, but it has become increasingly important to ensure that electronic communications and data are also kept secure and separate.

5 Attitudes of clients and other stakeholders

5.1 The client

As well as the factual information referred to in the previous section, there is a wealth of subjective information that the actuary needs to assimilate before giving advice.

As with the information discussed in the previous section, if the actuary is not aware of information regarding the client's background, ethical position and culture, there is a risk that the advice given will be inappropriate. For example, most charities have objectives that cannot be quantified in financial terms and that they would expect advice given to consider.

Charities will have objectives that relate to meeting the charitable purpose, but are also likely to have ethical objectives that must be taken into account, *eg* when providing advice on investment strategy.

Corporate bodies have a risk appetite, which is essentially driven by the risk appetite of their stakeholders, particularly their owners. Corporate bodies frequently describe their risk appetite openly in the annual accounts or other published statements.

Companies may describe their risk appetite in terms of a certain risk tolerance or limits. Companies may also detail their key risks and strategies in place to manage these risks.



Question

Outline examples of the key risks that an insurance company may highlight in its report and accounts.

Solution

Key risk examples include:

- Market risk – adverse changes in the prices of assets, liquidity risk, currency risk.
- Credit risk – defaults of assets, reinsurers, customers, suppliers.
- Insurance risk – longevity, mortality, morbidity, persistency, expense, reinsurance.
- Operational risk – fraud, IT, human resources, outsourcing, branding, reporting.
- External risk – catastrophes, war, regulation, tax.

These risk categories will be covered in more detail later in the course.

It is also important for the actuary to be aware of the general style and culture of the client. This is often best achieved by an initial meeting at the client's premises, or the opportunity for a more general discussion with the client in a less formal session than a business meeting.

5.2 The end customer

Frequently a provider of financial products is required to give advice to its customers. A provider should seek from customers it advises any information about their circumstances and objectives which might reasonably be expected to be relevant in enabling it to fulfil its responsibilities to them. In some jurisdictions this takes the form of an analysis that is part of a regulated sales process.



Question

List information that would be sought from a customer before advising on an appropriate savings vehicle.

Solution

Information could include:

- amount of funds to invest
- timing of investment, *eg* lump sum or regular investment
- risk appetite
- need for liquidity
- short / long-term plans / objectives
- age
- state of health
- tax status
- amount of control desired over the investments
- other assets held
- inheritance issues / dependants
- liabilities
- need for flexibility.

As well as this analysis of customer information, the following other areas might be covered in a regulated sales process:

- types of product brought to the market
- who can sell (certain qualifications may be required)
- information to be disclosed
- basis for any illustrations
- cooling-off period.

A provider should take reasonable steps to give a customer it advises, in a comprehensible and timely way, any information needed to enable the customer to make a balanced and informed decision.

Providers should similarly be ready to provide customers with a full and fair account of how they have fulfilled their responsibilities to them.

5.3 Marketing issues

The role of actuaries in the marketing of financial services is to present their results in the full business context. This means that actuaries need to think through the implications for all the stakeholders involved. In particular actuaries need to look at the impact on the customer. This approach will require an actuary to balance conflicting priorities.

For example, in saying ‘we will design a pension scheme so that it gives the best pension payments’, the meaning of the word ‘best’ will be crucial because it means different things to pensioners, members with deferred benefits, current members of the scheme working for the sponsor and future employees of the sponsor. Getting the balance right between the various stakeholders is very important.

There is a practice question at the end of this chapter which considers the concept of ‘best’ within this context.

6 Advice and decisions

6.1 Types of advice

There are different types of advice that can be given. These include:

- **indicative advice** – giving an opinion without fully investigating the issues – such as in response to a direct oral question
- **factual advice** – based on research of facts, eg legislation
- **recommendations** – researched and modelled forecasts, alternatives weighted, recommendations made consistent with requirements, work normally peer-reviewed.

Peer review means the review of an actuary's work by another actuary or suitably qualified professional, before submission to the client.

There will also be occasions when other professionals need to be involved in providing the advice, such as accountants or lawyers.

6.2 Giving advice

In this section we look at the situation where an actuary gives advice but does not make the decision as to which solution to adopt.

The actuary will have made specific assumptions in reaching the advice and recommendations that are given. The assumptions must also be relevant to the circumstances of the client.

Later on in the course we will consider different types of valuations that might be carried out and the appropriate assumptions for different clients.

Part of the process of advising the client will be to explain to the client the reasons for making those specific assumptions. The actuary should explain the implications of making alternative assumptions and of any alternative solutions that may have been considered but eventually not recommended on both the client and other stakeholders who may be affected.

However at the end of any discussions it will be the client who decides which solution to adopt.

An example of where an actuary would only be giving advice would be in the recommendation of bonus rates on with-profit policies to the Board of Directors of an insurance company in the UK, who will make the final decision on the level of bonuses to be declared.

However, the actuary may have made some implicit decisions in formulating the advice, for example the grouping of policyholders for the purpose of bonus allocation. These implicit decisions should be disclosed as part of the process of giving advice.

With-profit policies are a form of life insurance policy and are introduced in more detail later in the course. The feature of these policies that the paragraphs above refer to is that some of the benefits provided under such policies are at the discretion of the insurance company. This is achieved by the company periodically (usually annually) granting a bonus to policyholders that depends on the company's experience (*eg* investment performance) over the period. A final (terminal) bonus is usually also awarded.

6.3 Making decisions

Sometimes the actuary may be responsible for making a business decision.

An example of where an actuary may make the decision is in the determination of surrender values under life insurance policies, where the policy wording permits.

Sometimes, an actuary may also have an executive role within an organisation and may be making decisions on matters such as provisioning, reinsurance programmes and asset allocation. In such situations there is a danger that the actuary will take decisions based on his or her own conclusions and the actuary should seek further advice or peer review of the decision made.

When the same person is involved in both giving and receiving advice on an issue, not only does the process need to *be* robust – it needs to be *seen to be* robust. Seeking further advice or peer review is a good demonstration to, for example, regulators, auditors and customers that sound practices are being followed.

It is vital that the rationale behind any decisions taken is properly documented, including documentation of alternatives that have been considered.

7 Professional and technical standards

The professionalism framework of the Institute and Faculty of Actuaries comprises professional conduct, technical and ethical standards.

7.1 Professional conduct standards

The Institute and Faculty of Actuaries' requirements in relation to professional conduct are set out in the Actuaries' Code. Detailed knowledge of the Actuaries' Code is not required for this examination, but all actuaries should be aware of the issues that are addressed in the Actuaries' Code.

The Actuaries' Code came into force on 1 October 2009 and forms part the Institute and Faculty of Actuaries Standards framework. The code is structured around the following six principles:

- integrity
- competence and care
- impartiality
- compliance
- speaking up
- communication.

Further details on the framework can be found on the Institute and Faculty of Actuaries website: www.actuaries.org.uk.

Professional skills and detailed consideration of the Actuaries' Code are covered in an online post-qualification course, and actuaries subject to the continuing professional development scheme are required to keep their professional as well as their technical skills up to date.

Professionalism is essential in setting the scene for the context in which the actuary will operate. The basic principles of professionalism will determine the suitability of solutions to the problems raised. The Actuaries' Code is therefore essential background to the consideration of the solution to any actuarial problem.

7.2 Technical and ethical standards

Ethical and professional best practice and standards are the responsibility of the Institute and Faculty of Actuaries, and apply to all members of the profession, regardless of the territory or area of work in which they operate. These are referred to as Institute and Faculty of Actuaries Standards. Institute and Faculty of Actuaries Standards comprise the Actuaries' Code together with Standards developed since the introduction of the current professional framework in 2006.

In the UK, technical actuarial standards are the responsibility of the Financial Reporting Council (FRC). This is a body that is independent from the Institute and Faculty of Actuaries. The FRC issues Technical Actuarial Standards (TASs). The aim of the TASs is to ensure that ‘users for whom actuarial information is created should be able to place a high degree of reliance on that information’s relevance, transparency of assumptions, completeness and comprehensibility, including the communication of any uncertainty inherent in the information’ (the Reliability Objective).

Technical Actuarial Standards comprise:

- **TAS 100: Principles for Technical Actuarial Work.** This is a short statement of high level principles covering judgement, data, assumptions, models, communications, and documentation
- **Specific TASs.**

There are currently three of these Specific TASs, covering practice areas:

- **TAS 200: Insurance**
- **TAS 300: Pensions**
- **TAS 400: Funeral plan trusts.**

The TASs are developed in the context of UK legislation and regulations. They apply to work done in relation to the UK operations of entities and any non-UK operations which report in to the UK. However, for TAS 100 wider adoption is encouraged by the FRC.

Work may depart from the requirements of a TAS if the departure is considered not to be material. In this context, something is material if, at the time the work is performed, the effect of the departure (or the combined effect if there is more than one departure) could influence the decisions to be taken by the users of the resulting actuarial information.

The TASs are principles based, which means that they aim to move away from detailed, prescriptive rules and allow actuaries to focus instead on achieving desirable outcomes.

Most major actuarial organisations around the world have their own frameworks of professional standards of practice and codes of professional conduct. Whilst there are some differences, there is a considerable amount of consistency in the approach taken to standard-setting by many of the major actuarial organisations around the world.

One reason for this consistency in approach is the influence of the International Actuarial Association (IAA). The IAA is a worldwide association of professional actuarial bodies. Its aim is to represent the actuarial profession and promote its role, reputation and recognition in the international domain.

Knowledge of the detailed technical content of actuarial standards is not required for this examination.

More information about the TASs can be found on the FRC website, at www.frc.org.uk.

More information about the IAA and its role can be found at www.actuaries.org.

7.3 The Actuarial Quality Framework

The Financial Reporting Council has developed an Actuarial Quality Framework which is designed to support effective communication between actuaries and other stakeholders in actuarial work. These stakeholders include the clients and employers of actuaries, senior management and members of governing and review bodies, other professionals such as lawyers and accountants, end-users and their representatives, policymakers and regulators.

The Framework is intended to be complementary to professional and other regulation affecting actuaries and those who rely on their work.

It aims to promote the following drivers of actuarial quality:

- methods – reliability and usefulness of actuarial methods
- communication – communication of actuarial information and advice
- actuaries – technical skills of actuaries and ethics and professionalism of actuaries
- environment – working environment for actuaries and other factors outside the control of actuaries.

Detailed knowledge of the Actuarial Quality Framework is not required for this examination.

More information can be found on the FRC website.

The chapter summary starts on the next page so that you can keep all the chapter summaries together for revision purposes.

Chapter 1 Summary

Stakeholders

There are many private sector stakeholders whom actuaries can advise, including:

- insurance companies – policyholders and prospective policyholders, board of directors, shareholders, creditors, auditors
- benefit schemes – members (and their dependants), sponsors, trustees, auditors
- employers
- employees
- investment fund managers
- members of investment schemes
- sponsors of capital projects
- banks.

Actuaries may also advise the public sector, such as:

- government departments
- related organisations, *eg* regulatory bodies.

Consideration of all stakeholders

In many cases the advice given to a client by an actuary will impact on other stakeholders. The actuary needs to consider the interests of all stakeholders, and not only those who seek (and pay for) advice.

The stakeholders listed above have a wide range of interests and functions on which actuaries can provide advice.

For example, actuaries might advise:

- *policyholders* on:
 - personal protection against death and illness
 - protection of property
 - investment
- *trustees of benefit schemes* on:
 - managing the assets of the scheme
 - paying the benefits promised under the scheme as they fall due
 - maintaining solvency

- *sponsors of benefits schemes* on:
 - providing protection and retirement benefits that meet the needs of the members and their dependants
 - managing the cost of providing the benefits
 - meeting legislative requirements
- *the Government* on:
 - setting and monitoring adherence to legislation
 - funding benefit provision by the State and monitoring this funding.

Information about the client

Before analysis of a problem, the actuary should ensure they are fully briefed on the client. Consider:

- information in the public domain, *eg* accounts, websites
- a pre-project meeting with the client
- attitude of client, in particular risk appetite and culture
- potential conflicts of interest
- the circumstances and objectives.

Results should be produced:

- in a comprehensible format and timely way
- taking into account the implications for all the stakeholders involved.

Advice and decisions

There are different types of advice that can be given. These include:

- indicative advice – an opinion
- factual advice – based on research of facts
- recommendations – involving research, modelling, consideration of alternatives.

In giving advice actuaries should:

- set out alternative solutions and the implications of each solution on both the client and on other affected stakeholders
- outline the assumptions made and the reasons for making them.

Ultimately the client decides which solution to adopt.

The actuary needs to be aware of whether he/she is being asked solely to give advice, *eg* to *recommend* bonus rates on with-profit policies or to make a business decision, *eg* to *determine* surrender values.

Professional framework

Actuaries who are members of the Institute and Faculty of Actuaries must comply with:

- the Actuaries' Code
- ethical and professional standards, which are set out in the Institute and Faculty of Actuaries Standards
- Technical Actuarial Standards (TASs), which are set and maintained by the Financial Reporting Council (FRC).

The International Actuarial Association (IAA) influences standard-setting by actuarial organisations around the world, and there is thus much consistency in the approaches taken.

The FRC's Actuarial Quality Framework aims to promote actuarial quality through four main drivers: methods, communication, actuaries and the environment. It is designed by the Financial Reporting Council and aims to complement professional and other regulation affecting actuaries and their clients.

The practice questions start on the next page so that you can keep the chapter summaries together for revision purposes.



Chapter 1 Practice Questions

- 1.1 List the stakeholders that an actuary might advise in relation to a life insurance company.
- 1.2 (i) List eight stakeholders of a final salary pension scheme. [4]
- Exam style** (ii) State the interests and financial needs of these stakeholders. [8]
- [Total 12]
- 1.3 A new company has recently been set up. Explain the areas on which actuarial advice may be beneficial to the employer.
- 1.4 Explain the ways in which a pensions actuary may have interaction with the State.
- 1.5 Identify, for each of the following examples of actuarial advice, the principal stakeholders involved and their aims / interests:
- Exam style**
- (a) advising a country's government on a new type of savings regime as a way of encouraging the population of the country to save more for retirement
 - (b) advising an insurance company on whether to offer motor insurance only to a subset of drivers who meet some criteria enabling them to be classified as 'low-risk' drivers
 - (c) advising the management group of a government hospital on whether a new hospital wing should be entirely government built and financed or built and financed in conjunction with a private sector company
 - (d) advising the sponsor of a benefit scheme on the level of their contribution to the scheme. [12]
- 1.6 Describe five examples of conflicts of interest that may arise for actuaries carrying out their duties.
- 1.7 An adviser should ensure that sufficient information is provided to a customer in order to enable them to make a balanced and informed decision about investing in a savings vehicle.
- Outline examples of what this information should include.
- 1.8 A pension scheme is being designed with the objective 'that it gives the best pension payments'. Explain what 'best' might mean to each of the following stakeholders:
- (i) pensioners
 - (ii) members with deferred benefits
 - (iii) current members of the scheme working for the sponsor
 - (iv) future employees of the sponsor.

- 1.9 Define the three types of advice that an actuary may provide.
- 1.10 Outline the framework for the actuarial standards of the UK actuarial profession.



Chapter 1 Solutions

1.1 Life insurance company stakeholders:

- existing policyholders
- prospective policyholders
- the board of directors
- shareholders
- employees
- auditors
- regulators
- investment fund managers
- the Government
- creditors
- reinsurers.

1.2 (i) ***Stakeholders of final salary pension schemes***

- sponsor, *ie* contributing employer
- members (active, deferred and current pensioners)
- members' dependants
- non-member employees
- the Government
- regulators
- auditors
- tax authorities
- trustees.

[½ each, maximum 4]

(ii) ***Interests / needs of the stakeholders***

- the sponsor:
 - to provide benefits that meet the needs of the members and their dependants
 - to manage the cost of providing the benefits
 - to control the pace of funding of the scheme
 - to meet legislative requirements

- members:
 - provision of benefits on events such as death, retirement, illness, withdrawal
 - flexible / optional benefits
 - flexible / optional contributions
 - security of benefits
- members' dependants:
 - protection in the event of the death of the member
- non-member employees:
 - to have the option to join the scheme
 - to not be unfairly disadvantaged relative to scheme members
- the Government:
 - to set and monitor legislation impacting on private pension provision
 - to fund and monitor State pension provision
- regulators:
 - to ensure that regulatory requirements are met, eg a required funding level
- auditors:
 - to assess the extent of the future liability to pay benefits
 - to verify that the accounts are true and fair
- tax authority:
 - to ensure that the pension scheme is not be used for tax evasion
- trustees:
 - to manage the assets of the scheme
 - to ensure security of benefits for members
 - to maintain solvency in the scheme. [½ for each interest / need, maximum 8]

1.3 Actuarial advice may be beneficial:

- with regard to the provision of suitable employee benefits, for example:
 - pension payments
 - death or ill-health benefits
- regarding capital, this can include:
 - how to invest surplus capital
 - how to raise additional capital
 - quantification of the amount of surplus capital owned by the business

- with regard to protecting tangible or intangible assets
- with regard to meeting legislation
- with regard to managing the costs of running the business.

1.4 A pensions actuary may be a scheme actuary for a private pension arrangement, and in this role be responsible for:

- the need to monitor adherence to legislation, for example any minimum or maximum funding levels
- ensuring that regulatory requirements are met, for example, whistle-blowing (*ie* reporting to the regulator) if trustees or the sponsor do not meet their responsibilities.

A pensions actuary may work for the State and in this role be responsible for:

- determining the funding requirement for the State's retirement benefit scheme
- monitoring the funding of the State's retirement benefit provision on an ongoing basis
- setting the legislation to apply to private pension schemes, for example funding requirements, disclosure requirements and winding-up provisions
- monitoring whether the legislation that has been set is being applied.

1.5 (a) ***Government encouraging population to save***

The Government may be looking to maximise the amount of savings in order to minimise dependence on the State, *eg* for reasons of managing public sector finances, political reasons, or improving standards of living. [1]

The Government will also want the regime to have favourable macroeconomic effects (since increased saving will potentially have a big impact on the investment markets and levels of economic activity). [1]

Prospective customers of the new products are likely to want attractive, understandable products that meet their needs (*eg* products that are flexible when customers' situations change). [1]

Prospective product providers are likely to want a regime that enables them to design and sell marketable products that meet customers' needs and also generate appropriate returns for the provider. [1]

The regulator may be interested in the clarity of the rules in the new regime and how it will be implemented and monitored. They will consider policyholder issues, *eg* fair products, appropriate selling, checks on the financial strength of the product providers. [1]

(b) ***Insurance company 'cherry-picking' low-risk drivers***

Current and potential future policyholders are likely to find the cost of insurance cheaper if they satisfy the 'good driver' criteria. They will no longer be able to obtain insurance with the company if they do not meet the criteria. [1]

Competitors will be affected by this move. They might find that, unless they introduce a similar categorisation, they attract mainly worse drivers (as the good drivers may obtain cheaper cover with the company introducing the scheme). [1]

The insurance company's shareholders are stakeholders in this decision. If the business is profitable and the volumes sold are good, their profits may increase. [1]

The regulator may have a view on the proposed scheme. In the country where the insurer operates, there may be legal or regulatory requirements to offer cover to all drivers, at least to some minimum level. [1]

(c) ***Government hospital building a new wing***

The Government (and the management group as the representative of the Government) are likely to be critically interested in the levels of cost of the two options and how the 'sharing' of the second option would operate (*eg* sharing of costs and risks). [1]

The Government will also be interested in wider political implications. [½]

The general public may be concerned about the quality of care and buildings. [½]

The employees of the hospital will be affected by whether or not the private sector is involved. There may be issues of future job security for certain employees. [1]

Potential private sector partners and sponsors will be interested in risk vs return. [1]

(d) ***Sponsor of benefit scheme considering level of contributions***

The sponsor may want to minimise their contribution subject to meeting their aims in providing the scheme and depending on their available resources. They may be keen to manage the contribution pattern so that they are contributing at the optimum time. [1]

Members of the scheme (and their dependants) would have a preference for high contributions if this makes their benefits more secure and, possibly, reduces their own contribution or increases the amount of their benefits. [1]

The trustees of the scheme act on behalf of the members and will be concerned with security of benefits and managing investments. This suggests a preference for high contributions, but balanced against wanting the sponsor to continue to offer the scheme. [1]

The auditors of the scheme and the regulator(s) will be particularly keen that all regulations and guidance have been adhered to, *eg* any requirements to demonstrate a minimum level of funding. [1]

[Maximum 12]

1.6 **Examples of potential conflicts of interest**

Several actuaries of the same consulting firm acting to advise both the vendor and possibly a number of prospective purchasers in the case of a takeover or merger of two insurers.

Where an actuary has statutory responsibilities, these frequently include the requirement to notify the regulatory authorities if the actuary believes that the client (*eg* an insurance company) is acting in a way that would prejudice the interests of its customers (*eg* policyholders).

An actuarial consultancy asked to provide advice in the case of a bulk transfer of pension scheme liabilities, where the consultancy has previously acted as scheme manager to both parties.

An actuary being approached to provide advice on a particular issue, when they are already, or have been previously, asked to provide such advice to another party.

A life insurance actuary who sits on the board, and therefore is directly responsible to shareholders, but needs to set bonus rates to meet policyholders' expectations.

Actuaries operating within an investment house who may act to advise a client and potential bidders in the case of a share issue.

An actuary who takes more than one role within a pension scheme, *eg* who is a member of the scheme and a significant shareholder of the sponsoring company, or advisor to the sponsor, and the trustees.

1.7 The adviser should provide a range of options that are compared in terms of:

- past performance
- projected range of future performance
- charges / penalties
- investment strategy
- commission levels
- constraints, *eg* ease of access to funds
- flexibility, *eg* changing investments, amount invested
- risk levels
- financial strength of providers
- tax treatment.

1.8 (i) **Pensioners**

- most secure
- maintain standard of living
- high chance of additional discretionary benefits.

(ii) *Members with deferred benefits*

- most secure
- predictable benefits
- pays high transfer values
- provides protection benefits (*eg* ill-health or death benefits if die before retirement).

(iii) *Current members of the scheme working for the sponsor*

- likely to lead to highest benefits ...
- ... without jeopardising the likelihood of the sponsor continuing (so the member still has a job)
- predictable benefits
- portable
- flexible
- provides protection benefits (*eg* ill-health or death benefits if die before retirement).

(iv) *Future employees of the sponsor*

- not too much money paid into scheme so security of sponsor and ability to offer work is paramount
- not too much paid into scheme so sponsor is not wary about continuing to support it in the long run.

1.9 Factual advice – giving an opinion based on research of the facts.

Indicative advice – giving an opinion without investigating the issues.

Recommendations – giving an opinion based on researched and modelled forecasts, with the alternative scenarios considered, and recommendations supplied based on research of the facts.

1.10 The professional framework of the UK actuarial profession comprises professional conduct, ethical and technical standards.

The Institute and Faculty of Actuaries' requirements in relation to professional conduct standards are set out in the Actuaries' Code.

Professional skills and detailed consideration of the Actuaries' Code are covered in an online post-qualification course.

Actuaries subject to the continuing professional development scheme are required to keep their professional as well as their technical skills up to date.

Ethical and professional best practice and standards are the responsibility of the Institute and Faculty of Actuaries.

They apply to all members of the profession, regardless of the territory or area of work in which they operate.

Actuaries are also subject to Technical Actuarial Standards (TASs), which are set and maintained by the Financial Reporting Council (FRC).

These can be on either specific or generic topics.

The TASs apply to work done in relation to UK operations of entities and any non-UK operations which report in the UK.

The aim of the TASs is to ensure that users for whom actuarial information is created can place a high degree of reliance on the information's 'relevance, transparency of assumptions, completeness and comprehensibility'.

Actuaries may only depart from these standards if the departure is not considered to be material.

The Actuarial Quality Framework aims to promote actuarial quality through four main drivers: methods, communication, actuaries and the environment.

It is designed by the Financial Reporting Council and aims to complement professional and other regulation affecting actuaries and their clients.

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2

External environment

Syllabus objectives

9.2 Describe the implications for the main providers of benefits on contingent events of:

- legislation – regulations
- State benefits
- tax
- accounting standards
- risk management requirements
- capital adequacy and solvency
- corporate governance
- competitive advantage
- commercial requirements
- changing cultural and social trends
- demographic changes
- climate change
- environmental issues
- lifestyle considerations
- international practice
- technological changes.

0 Introduction

It is important to bear in mind the external environment when providing actuarial advice. The following sections look at some aspects of the external environment which can have implications for the main providers of benefits on future financial events.

The issues identified are not intended to be exhaustive. Actuaries frequently have to interpret these broad aspects in a specific, and frequently unfamiliar, situation. This usually requires general knowledge, business awareness and a considerable measure of common sense.

The various impacts of economic conditions / exchange rates are discussed elsewhere in this course. This chapter covers other impacts of the external environment.

It is true that the list covered is not exhaustive. Nevertheless the list of external influences covered in this chapter is a fantastic checklist to remember, being great for generating ideas in questions in Subject CP1 in general – so it is important to study this chapter carefully.

1 Legislation and regulations

Legislation is law that has been formally declared by a parliament or congress or other governing body.

Regulation is a form of secondary legislation that is used to implement a primary piece of legislation appropriately or to take account of particular circumstances or factors.

In some countries there are forms of insurance that are compulsory. There is legislation that requires certain individuals or organisations to hold them.

Examples include:

- **employers' liability insurance**
- **motor third party liability insurance.**

Regulations may influence the type of financial product most suited to a consumer's needs when there are several otherwise acceptable products. For example, limitations on charges for certain types of collective investment scheme may make that type of contract more suitable than another without the charge limitation, even though there are other disadvantageous features.

The regulation of the sales process for different types of product may influence the types of product that are brought to market by product providers.

Most consumers are not sophisticated investors. Due to information and knowledge asymmetries, regulation often places responsibility on product providers to demonstrate that consumers fully understand the product and risks.

Information asymmetries are explained in more detail in the next chapter.

This requirement for detailed explanation to consumers may mean that complex products, in particular those involving benefit smoothing processes or derivative investment strategies, are not marketed however suitable they might be for consumers' needs.

An example of a product involving benefit smoothing would be a with-profit product.

An example of a product involving derivative investment strategies would be a single premium investment bond that pays on maturity the higher of the initial premium and the return on a specified investment index.

2 State benefits

Where the State provides benefits to its citizens, these are often at a low level which may only be sufficient to keep individuals just out of poverty. Many individuals will require a higher level of benefit. An employer may provide this through a retirement benefits scheme or membership of a private health arrangement. Alternatively the individual may wish to provide personal benefits either through saving or through the purchase of insurance.

The level and form of the State benefits will influence the level and form of additional non-State benefits provided.

State benefits should be taken into account when considering the financial planning needs of an individual. There are two aspects to this:

1. Individuals may need to provide less for themselves.

For example, in the UK where emergency hospital treatment is free, very few individuals will take out insurance against this, but they may take out private medical insurance against the need to have non-urgent treatment such as a hip replacement or dental care.

Another example is an employer sponsoring a benefit scheme. When considering the total benefit needed by employees, the employer may deduct any State benefits in order to minimise the cost of the scheme.

2. There may not be a savings incentive.

Where State benefits are means-tested, individuals on a low income who only have a limited ability to save may find that it is better value for them not to save at all, as any savings they have will be offset against the benefits that they are entitled to from the State and result in a lower level of income.

For example, the amount of long-term care or housing benefit provided by the State may be reduced for those with assets worth more than a certain value.

In financial planning, normally no allowance is taken for possible changes to the structure or amount of State benefits, even though this represents a significant unquantifiable risk.

An example of significant State involvement in controlling benefit provision is Singapore's Central Provident Fund. This was set up in 1955 to provide financial security for workers in their retirement or when they were no longer able to work. It requires compulsory contributions from employees and employers. Since 1955, it has evolved into a comprehensive social security savings scheme, which not only covers members' retirement needs but also their needs for:

- home ownership
- healthcare
- education of their children
- financial protection through insurance.

If the State requires individuals to save for their retirement or other benefits, this will reduce the amount that individuals feel they can or need to invest in individual arrangements.

3 Tax

3.1 Benefits

The tax treatment of benefits arising from financial products and schemes can have an impact on the needs of individuals.

The following are examples of the possible tax treatment of such benefits:

- **Benefits can be received free of tax.**
- **The excess of the benefit received over the contributions paid can be taxed, either as income or as a capital gain.**
- **The benefit can be taxed entirely as income.**

There are common hybrid options where a portion of the benefit can be taken tax-free, with the balance being taxed. In these cases, the portion can be a monetary amount, a percentage of the total benefit or a combination of these approaches.

For example, in the UK part of an individual's pension benefits can be taken as a tax-free cash sum.

Where benefits are taxed, the normal or special tax rates can be used.

For example, if the individual is subject to a higher rate of income tax than the basic rate, the benefit could be taxed at a rate equal to the excess of the higher rate over the basic rate.

Some territories use all these options, depending on the legislation under which the product or scheme is written.

3.2 Contributions

The impact of tax on contributions towards financial products should also be considered.

Some arrangements may offer tax relief on contributions paid. These would normally be coupled with tax on the resulting benefits.

Other types of arrangement require contributions to be paid from taxed income. These arrangements normally offer some relief from tax on the ultimate benefit.

3.3 Accumulation of return

Governments also have the option of taxing the income and gains of products and schemes during the accumulation phase.

This refers to tax that the provider has to pay on the investment income and capital gains on assets backing financial products and schemes.

In developed countries, to provide an incentive to save, the general principle is that double taxation is avoided. Therefore if a provider is taxed on income and gains in the accumulation phase of a product, there is unlikely to be a charge to tax on the policyholder's gain.

3.4 Inheritance tax

Tax may also need to be considered when considering the inheritance that an individual will pass on.

If tax is payable on the individual's estate on death, it may be possible to take out insurance to cover this tax liability.

3.5 Influence on products

As a result of all of the above, tax systems can influence the types and forms of products made available by the financial services industry.

Examples of products and benefits that are heavily focused around a particular tax system include:

- pension provision and lump sum benefits payable upon retirement
- tax-free savings vehicles (*eg* Individual Savings Accounts – ISAs – in the UK)
- tax-free government savings schemes (*eg* so-called 'National Savings' in the UK)
- 'qualifying' life assurance policies that benefit from reduced rates of tax.

4 Accounting standards

The way that benefit schemes need to be reported in company accounts may influence the types of benefits that employers are prepared to provide for their employees.

The presentation of financial instruments in the accounts of product providers also impacts on the range of products that is brought to market.

For example, the different accounting requirements for setting the provisions for different types of insurance contract in different territories can influence the design of contracts.

Similarly whether a fund manager brings investments to market within an insurance wrapper through a subsidiary company, or through a collective investment scheme, might depend on the presentation and results shown in the company's accounts.

A *wrapper* is just a way of bringing a contract to market. Think of a birthday present wrapped in paper. It's generally the present itself that is important, not the wrapping paper; the same applies for financial contracts.

For example, the underlying contract might be a simple savings plan. However, it can be *wrapped up* as an endowment assurance, a unit trust, an investment trust company, an open-ended investment company, a with-profit savings plan, a unit-linked savings plan, a bond, an ISA (as mentioned earlier) *etc.*

5 Risk management requirements, capital adequacy and solvency

Some regulatory regimes impose minimum standards of risk governance, and there may also be specific regulatory requirements relating to risk management roles within a firm.

Capital adequacy and solvency form part of banking and insurance regulation which sets a framework on how financial institutions measure their capital adequacy and solvency.

Financial institutions need to determine the minimum capital that they are required to hold. Capital adequacy is then measured as the excess of assets over the sum of liabilities and capital requirements. This might be expressed as a monetary amount but is more commonly stated as a percentage of liabilities plus capital requirements or a multiple of the capital requirements.

Capital requirements for financial product providers are discussed in more detail in Chapter 36.

Increasingly, and largely driven by the availability of computing power, states are moving towards risk-based capital requirements such as the structures behind the European Solvency II regime. Simple formulae-based approaches are used in some countries, but the general global trend is towards a more risk-based capital framework.

Solvency II is the solvency regime that applies to insurance companies in the EU. The principles for measuring capital adequacy are risk-based, meaning that the level of capital that has to be held in excess of provisions (or liabilities) depends on the amount of risk taken on: the higher the risk, the higher the capital requirement.

Under Solvency II Pillar 2, companies are also required to meet minimum standards in relation to the quality of their risk management processes. We will look at Solvency II in more detail later in the course.



Question

Suggest likely aims of regulatory requirements relating to capital adequacy and solvency for insurers.

Solution

Aims of the regulatory requirements:

- to reduce the risk of insurers being unable to meet claims
 - to reduce the losses suffered by policyholders in the event that an insurer is unable to meet claims
 - to provide an early warning system so that regulators can intervene if capital is not adequate
 - to ensure confidence in the insurance sector.
-

6 Corporate governance

Corporate governance refers to the high-level framework within which a company's managerial decisions are made.

6.1 Aims

The aim of good corporate governance is that a company should be managed efficiently in order to meet the requirements of its stakeholders – the shareholders, employees, pensioners, customers, suppliers and others who may be affected by the company's operations.

One concern of regulators is that management might make decisions based more on their own personal interests than on those of other stakeholders.

6.2 Strategies

Good corporate governance can be enhanced by ensuring that remuneration incentivises management to act in the interests of stakeholders. Share options may be part of this, though the lack of sufficient downside for management can limit how well share options achieve this objective.

In other words, share option packages may not provide a sufficient incentive for management to control risk.

Non-executive directors are also often part of a structure aimed at good corporate governance.

The role of the non-executives in corporate governance is to:

- provide an impartial view and represent the shareholders' interests
- play a leading role in setting the remuneration for executive directors' pay
- play a leading role in the audit committee, *eg* in relations with external auditors with no members of the executive present.

The governance arrangements of the product provider have a major influence on the ways in which stakeholder needs are addressed.

Guidance on corporate governance is often developed by regulatory bodies as well as by governments. For example, in the UK, the Financial Reporting Council has issued a Code of Practice on corporate governance.

For those interested in reading more about corporate governance, we recommend the following SIAS paper (which can be downloaded from the website www.sias.org.uk):

Frost, Alan; Lewis, Malcolm; Taylor, Nick (2002). Topics in Actuarial and Corporate Governance. SIAS, London.

7 Corporate structure

Product providers might be mutual societies or proprietary companies, and the latter might be private or public companies.

7.1 Mutual societies

Many mutuals were founded by a benefactor or group who were concerned about the welfare of a defined group of people, *eg* members of a particular profession or trade group, such as teachers, farmers, doctors or church ministers. Mutuals can only start by an altruistic gesture. Essentially this involves someone lending the initial capital, but without any requirement for the loan to be repaid unless profits emerge.



Mutual societies have no shareholders and profits belong entirely to policyholders.

On the face of it mutuals should be able to provide better benefits for the same cost than proprietaries, because no funds are diverted to provide a dividend stream to shareholders.

The disadvantage of mutuality is that finance cannot readily be raised from capital markets. This is likely to restrict the products that a mutual might be prepared to offer. In particular, products that are capital intensive will be less attractive to the mutual and may be priced accordingly.

There are two ways in which mutuals approach product pricing: surplus distribution and pricing at cost.

1. *Surplus distribution*

Mutuals may offer specific distributions of surplus to their members. With-profit insurance companies, friendly societies and co-operative organisations tend to do this.

2. *Pricing at cost*

The alternative is to design products with the lowest margins in the price consistent with the risks undertaken and benefit members by that route.

7.2 Proprietaries



Public proprietary companies benefit from easier access to capital markets for finance, and may also have greater economies of scale and more dynamic management than mutuals.

These benefits may pay for the dividends to shareholders themselves, and the company may have a competitive edge over the mutual.

Private companies may be as restricted as mutuals for raising capital, but often benefit from the close involvement of the owners, which is a management advantage. The owners of private companies may have access to significant additional capital, providing an edge over both mutual and public proprietary companies.

For proprietary life insurance companies the apportionment of surpluses between with-profit policyholders and shareholders is also important.

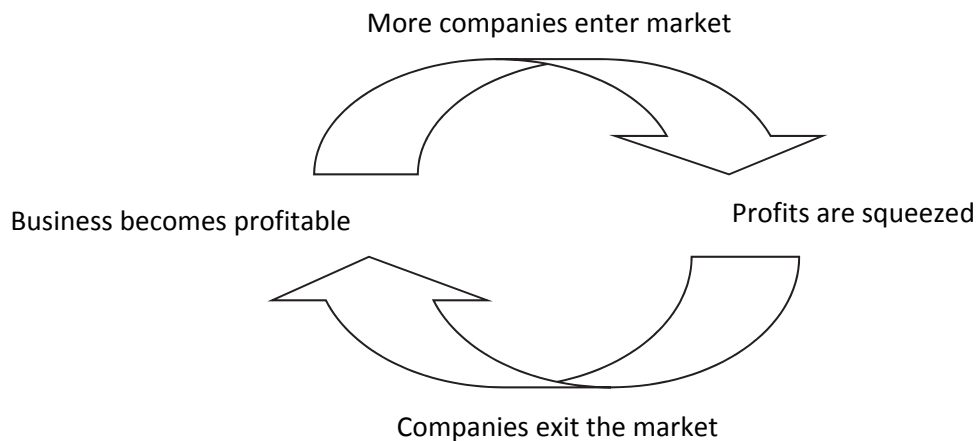
8 Competitive advantage and commercial requirements

8.1 The underwriting cycle

A consequence of the competitive nature of the insurance business is what is known as the underwriting cycle. Profitability in the various insurance classes tends to go in cycles, which are driven by market forces of supply and demand combined with actual claims experience and the economic climate.

When business is profitable, more insurers enter the market. Premium rates will reduce as insurers compete for market share. This will lead to reduced profits or to losses, and the cycle will go into depression. The position is often accentuated by catastrophes or by the economic climate.

At the bottom of the cycle, insurers will leave the market or reduce their involvement in the classes concerned, as premiums are too low to be profitable. Eventually premium rates will increase to cover the losses being incurred. The speed with which this occurs will depend on the position adopted by the leading insurers in that business, and insurers' continuing demand for market share.



Question

Explain why an insurer might stay in a market that was loss-making.

Solution

An insurer may believe that the accumulated losses, during the bottom of the cycle, are outweighed by the expected profits during the anticipated subsequent upswing in the market.

Alternatively, the cycles of two (or more) insurance markets may be out of phase. A company working in these markets may use losses in one to offset, or 'cross-subsidise', the other.

In addition, the costs of withdrawing from a market and subsequently re-entering that market when it picks up might be prohibitive.

The insurer may need to offer such a product in order to attract sales of other more profitable products that it sells. In this case the loss-making product is known as a *loss leader*.

In the long term, the pattern of profits and losses should even out. In the short term, profitable classes may be able to cross-subsidise losses in other classes. However, new entrants in the market will restrict the ability of other insurers to recoup historical exceptional losses.

More extremely, the inability to make profits at the bottom of the underwriting cycle could lead to:

- **loss of business, putting pressure on the ability to recoup fixed expenses and future growth prospects**
- **a reduced solvency position, requiring additional capital support or other remedial action.**

The position of a class of business in the underwriting cycle is, therefore, an important consideration when making strategic decisions.

9 Other external issues

9.1 Changing cultural and social trends

Changing cultural and social trends can have an impact on the financial products, schemes, contracts and transactions available.

For example:

- As home ownership becomes more widespread in the population there will be a greater demand for mortgages.
- If the State cuts back on healthcare provision for its citizens there will be a greater demand for products that meet the cost of private healthcare.
- If individuals have increased amounts of 'spare' income there may be an increased demand for savings products.
- In many countries, for motor insurance business, there has been an increase in the use of telematics, whereby to assess the risk factors for an individual, the policyholder's driving behaviour and other factors are monitored through a black box device, installed in the insured vehicle, or through a smart phone app. This makes information available to the insurer on some risk factors which would not normally be readily measureable. Examples of possible additional information include:
 - information on the ability of the driver
 - the speed at which the vehicle is usually driven
 - the vehicle's general level of performance.

The insurer could then use this additional information to help price the risks more accurately.

9.2 Demographic changes

Demographic changes to a population can have a major impact on the main providers of benefits on contingent events, particularly the State. There are two main sources of demographic changes leading to population ageing:

- rising life expectancy and
- declining fertility.

The significant decline in the total fertility rate over the last 50 years is primarily responsible for the population ageing that is taking place in the world's most developed countries. Many developing countries are going through faster fertility transitions and they will experience even faster population ageing than the currently developed countries in the future.

The effects of an ageing population are considerable:

- Economically, older people are more likely to be saving money (eg for retirement) and less likely to be spending it. This leads to lower interest rates and deflationary pressures on economies.
- Social welfare systems have also begun to experience problems. Some pay-as-you-go State pension systems are becoming unsustainable.

Under a State-run pay-as-you-go system, taxes (or their equivalent) from the current working population are used to pay benefits of current pensioners.

This may become unsustainable because there are:

- fewer people in the working population over time, therefore falling contributions
- more people surviving to retirement age to start receiving the benefit
- people living longer in retirement, so the benefit is paid for longer.
- The cost of healthcare systems will increase dramatically as populations age. Governments will be faced with a choice between requiring higher levels of tax to be paid or accepting reduced government role in providing healthcare.
- However, the second largest area of expenditure for many governments is education. The cost of educating the population will tend to fall with an ageing population.

9.3 Climate change and other environmental issues

Climate change

It is increasingly apparent that climate change will have a material impact on financial markets and financial institutions. The key findings from the Intergovernmental Panel on Climate Change Fifth Assessment Report (2014) [<https://ipcc.ch/report/ar5/>] for investors and financial institutions are as follows:

- Climate change will affect all sectors of the economy, and is relevant to investors and financial institutions. However, not all macroeconomic changes and microeconomic conditions will apply equally to all investments.
- There are risks and opportunities associated with policy measures directed at reducing greenhouse gas emissions. To meet the internationally agreed target of keeping the global average temperature rise since pre-industrial times below 2°C, patterns of investment will need to change considerably.
- Physical impacts of climate change will affect assets and investments. Climate change and extreme weather events will affect agriculture and food supply, infrastructure, precipitation and the water supply in ways that are only partially understood.
- Decisions made by private sector investors and financial institutions will have a major influence on how society responds to climate change.
- There will be significant demand for capital, with governments looking to the private sector to provide much of it. To keep the global temperature increase below 2°C, additional investment required in the energy supply sector alone is estimated to be between USD 190 and 900 billion per year through to 2051, accompanied by a significant shift away from fossil fuels towards low-carbon sources such as renewables and nuclear.

Climate change can also affect demographic experience. For example, increasing temperature can have an impact on the spread of diseases such as malaria. It can also increase instances of natural disasters such as floods and worsen issues such as pollution, and there may be related impacts on the availability and security of water and food. These effects are generally negative for mortality and morbidity experience. However, there is a possibility of 'positive' impacts, such as reduced cold-related deaths in some northern hemisphere countries.

These climate change issues may impact pension schemes, life, health and general insurers.

Impact of environmental and ethical issues on providers

Governments, advocacy groups and the observed preferences of individual participants in investment markets have acted to ensure that the concern felt by the public on the environment and ethical issues impacts the behaviour of financial markets.

Providers that want to be attractive to the widest possible range of investors will provide products where environmental and ethical issues are part of the investment process and decision making.

These products have a 'socially responsible overlay' and the investment managers commit to engaging in a constructive dialogue with company management to promote environmental and ethical objectives.

The environmental impact of the way providers communicate with the public may also need to be considered, especially with regard to the volumes of paper produced which is never read.

Emissions trading

Emissions trading is a market-based approach, among others, to address pollution. The overall goal of an emissions trading plan is to minimize the cost of meeting a set emissions target.

The government sets an overall limit on emissions and issues permits to emit, up to the overall limit. The government may sell the permits, but in many existing schemes, it gives permits to participants (regulated polluters) equal to each participant's historical emissions.

Usually, the government lowers the overall limit over time, with an aim towards a national emissions reduction target.

To avoid penalties, a participant must hold permits at least equal to the quantity of pollution it actually emitted during the time period. If every participant complies, the total pollution emitted will be at most equal to the sum of individual limits.

Because permits can be bought and sold, a participant can choose either:

- **to use its permits exactly (by reducing its own emissions), or**
- **to emit less than its permits, and perhaps sell the excess permits, or**
- **to emit more than its permits, and buy permits from other participants.**

In effect, the buyer pays a charge for polluting, while the seller gains a reward for having reduced emissions.

In many emission trading schemes, organisations which do not pollute (and therefore have no obligations) may also trade permits and financial derivatives of permits. This creates a market in which financial institutions and product providers can participate.

9.4 Lifestyle considerations

Younger members of the population will have a high demand for loans and mortgages and are less likely to be saving towards retirement.

As individuals age they will pay off some of their loans and begin to save. They may also have an increased demand for life insurance protection products as they have dependent children and longer working lifetime.

The phrase 'longer working lifetime' in the previous paragraph refers to the expectation of needing to stay in work to a higher age than may have been the case for previous generations.

Once members of the population retire from employment, they are likely to reduce the amount they save and start spending the funds they have saved. They may have a need for annuities and products providing long-term care. Their need for life insurance may decline, if their dependants become more self-sufficient. However, longer working lifetimes and increases in life expectancy will increase the amount of life insurance required and increase the age to which it is required.

At the time at which investors move from savings accumulation to savings decumulation, many may wish to secure certainty of value and avoid investment in volatile markets and volatile instruments. This suggests a gradual move from equity-type towards fixed interest-type assets. However, better-off investors may be able to afford to take more risk during the decumulation phase in order to gain a better investment return.

As people live longer they will need to save more and/or save for longer to ensure that their assets do not run out before they die.

9.5 International practice

Providers may need to look to the international markets to see if products sold in other countries could be replicated in their own country. Often the difference in tax and legislative requirements between countries makes this difficult.

One example of a product that has been imported successfully to the UK from Australia is a mortgage product under which the homeowner can offset any monies held in current and savings accounts against the capital owed on the mortgage loan. Interest is usually calculated daily and charged on the balance of the difference between the loan and balances in the borrower's current and savings accounts.

Another example is critical illness cover, which was developed in South Africa.

9.6 Technological changes

The ways in which financial products are provided for individuals have changed significantly over recent years.

Examples include:

- **Financial products used to be mainly sold by insurance intermediaries who would aim to find the best contract in terms of benefits and premiums for their client. Now, many of these products are sold over the internet with clients being able to obtain a range of quotations for themselves. Clients can purchase the product without ever speaking to a representative of the provider.**
- **For commodity products (motor insurance, household insurance, term life insurance and annuities) there are price comparison websites that save the individual accessing many companies' sites – although not all providers choose to be included on price comparison sites, for which there is a substantial fee to be paid.**
- **Banking and savings services are also now provided over the internet and by telephone as well as in the traditional bank and building society branches.**
- **Insurance companies increasingly use websites to:**
 - **capture enquiries from clients**
 - **record changes to clients' personal details**
 - **register claims**
 - **perform other administrative tasks.**
- **Financial product providers are establishing presences on social media, not only for general advertising purposes but also to provide direct links to product sales and customer enquiry websites.**
- **Email is a fully accepted and widely used means of communication.**

Technological changes may also come through in terms of improved healthcare and medical techniques, impacting profitability, and possibly pricing, of relevant products in the future.

Increased access to mobile phone technology in developing nations has contributed to a growth in the provision of microinsurance, *ie* protection products sold to those on low incomes. Mobile phones can be used to make distribution and administration (including premium collection and claims processing) of microinsurance products more efficient, thus lowering costs and broadening access to the intended target market.

The chapter summary starts on the next page so that you can keep all the chapter summaries together for revision purposes.

Chapter 2 Summary

Legislation and regulations

- require compulsory insurance in certain circumstances
- influence the types of product available
- regulate the sales process

State benefits

- raise employers' awareness of the need to top-up State benefits
- raise individuals' awareness of the need to top-up State benefits
- reduce levels of saving if benefits are means-tested
- may require compulsory contributions
- can introduce moral hazard, *ie* the risk of individuals relying on the State and not purchasing their own cover

Tax

- affects the form of benefits within products
- means that product innovations may be designed to avoid paying tax, *eg* inheritance tax
- directs savings towards the most tax-effective forms (*ie* preference for income or capital gains) or tax shelters (*eg* ISAs)

Accounting standards

- influence an employer's provision of employee benefits
- influence the range of products marketed

Risk management requirements, capital adequacy and solvency

- form part of banking and insurance regulation
- may impose minimum standards of risk governance, including risk management roles within a firm, as well as minimum capital requirements
- are moving towards risk-based frameworks, *eg* Solvency II for insurers

Corporate governance

- encourages managers to act in the best interests of stakeholders
- incentivises managers accordingly
- may utilise non-executive directors
- influences the way in which stakeholders' needs are met

Private companies

- may find the same difficulties as mutuals in raising capital, but
- benefit from a close involvement of the owners and potential access to significant additional capital

All proprietary companies have the issue of how to distribute surplus between shareholders and any with-profit policyholders.

Competitive advantage and commercial considerations

An important concept is the underwriting cycle. The position in the cycle is an important consideration when making strategic decisions.

The *underwriting cycle* relates to:

- profitable business leading to new entrants, greater competition, 'soft' premium rates and reduced profits, leading to ...
- ... insurers leaving the market or reducing their involvement, increased premium rates or loss of business or reduced solvency and the need for capital.

Changing cultural and social trends

- include aspects such as the level of home ownership
- impact on the financial products, schemes, transactions and risk assessment approaches available

Demographic changes

- can have a major impact on main benefit providers, *eg* the State
- include increasing longevity and falling birth rates
- may result in an ageing population, which leads to:
 - less spending, as people of working age save more as they get older
 - a strain on social welfare systems
 - an increased cost of healthcare
 - the cost of education falling

Climate change and other environmental issues

- influence the ways in which the Government, advocacy groups and individual participants act, and hence the behaviour of the financial markets
- have led to providers offering products that promote environmental and ethical issues
- affect how providers communicate with customers, *eg* reducing the amount of paperwork

Lifestyle considerations

- younger people have preferences for loans rather than savings
- people with children may have a need for life insurance protection products
- older people may have a need for annuities and long-term care products

International practice

- may lead to overseas products being replicated in the domestic market, subject to tax and legislative considerations

Technological changes

- impact on the way in which financial products are provided, *eg* internet, price comparison websites, telephone banking, social media
- impact on wider administration processes, *eg* registering claims, customer enquiries.

The practice questions start on the next page so that you can keep the chapter summaries together for revision purposes.



Chapter 2 Practice Questions

2.1 List the effects that State benefits will have upon the provision or purchase of additional benefits by employers and employees.

2.2 (i) Explain the phrase *good corporate governance*.

A UK company is planning to expand by setting up a subsidiary in the USA.

(ii) Outline actions that might be taken to ensure that good corporate governance is observed within the subsidiary.

2.3 The only tax imposed on providers of financial products in a specific country is a premium tax, under which a stated percentage of each premium received by the company is paid to the Government.

Exam style

(i) Discuss the advantages and disadvantages of this method of taxation from the perspective of the Government. [4]

(ii) Suggest other practical ways of taxing the business of financial product providers. [3]

Hint for part (ii): consider the different items that could be taxed. Some (if not all) of these items may be found in the company's accounts.

[Total 7]

2.4 List the stakeholders concerned with environmental issues and the actions they may take as a result.

2.5 (i) Explain why younger individuals might have a high demand for loans.

(ii) Suggest, with reasons, life and health insurance products that would be associated with dependent children.

(iii) Explain why the need for insurance might NOT decline as an individual gets older.

2.6 Outline the features of financial service providers' business operations that have been impacted by technological change.

2.7 A company in a medium-sized developed country reprocesses radioactive material from nuclear power stations around the globe. The radioactive material arrives by sea and the re-processed material is transported by air.

Exam style

An insurer is considering the launch of a product that will indemnify the shipping company against all losses arising from leaks of material from the shipping containers, up to a pre-agreed limit.

Describe the impact the external environment might have on the design and launch of the insurer's product. [7]

The solutions start on the next page so that you can
separate the questions and solutions.



Chapter 2 Solutions

2.1 The provision of State benefits may have the following influences:

- raise awareness amongst employees of the importance of certain benefits
- raise employees' awareness of the need to invest in or purchase top-up benefits
- increase pressure on employers for the need to provide top-up benefits for employees
- conversely, it may introduce moral hazard where individuals rely on State benefits based upon the assumption that 'the State will provide'
- reduce levels of additional saving if State benefits are means-tested
- where State benefits are contributory, make individuals less able to provide for themselves or make them *feel* that they cannot do so.

The extent of these effects will depend upon the level of State provision provided.

2.2 (i) ***Explanation of good corporate governance***

Corporate governance is the name given to a high level framework within which managerial decisions are made within a company.

Corporate governance is deemed 'good' if it ensures that the company is managed *efficiently* in a way that meets the requirements of *all* of its stakeholders.

A particular concern of corporate governance is that managers do not make decisions based more on their own personal interests rather than on the interests of the shareholders.

(ii) ***Actions to ensure good corporate governance***

- The establishment of clear corporate aims and objectives, linked to those of the parent company.
- The setting of realistic short- and long-term company targets to meet the expectations of the key stakeholders.
- The production of regular internal management reports to compare actual performance with the aims, objectives and targets of the company.
- The establishment of clear operating procedures for all critical processes and a system that checks that such procedures are being implemented.
- The establishment of an audit committee and clear audit trails.
- The appointment of non-executive directors to provide a more impartial view.
- The regular publishing of audited internal and published accounts.
- The development and recording of job descriptions for management with key accountabilities and limits on authority.
- The establishment of effective performance measurement practices to include the setting of performance standards, regular monitoring and feedback.

- The implementation of remuneration schemes linked to individual performance (*eg* profit related pay), and/or corporate performance (*eg* share options schemes).

2.3 (i) **Premium tax**

The advantages to the Government of this method are that the tax is:

- simple to calculate
- easy to collect
- hard to avoid. [½ each]

It is also consistent between different types of business, thereby avoiding the introduction of distortions into the market. [1]

The disadvantages to the Government of this method are:

A high profile front-end tax on savings may be unpopular with customers and reduce the volume of financial products sold. [1]

This may conflict with other government objectives such as encouraging individuals to fund their pensions privately. [1]

The tax may also be politically unpopular, particularly with the voting population. [1]

The amount of tax collected will not increase if the profits of providers increase (unless the increase in profit is directly related to an increase in premium). [1]

If the tax were not applied to the whole premium (*eg* to avoid taxing any savings element) a company would have freedom to manipulate the notional premium split in order to minimise the tax due, removing all the advantages of simplicity. [1]

[Maximum 4]

(ii) **Other practical ways of taxing the business of financial providers**

The Government could impose a tax on:

- profits, *ie* tax on a change in the value of assets less the change in the value of liabilities
- investment income, ...
- ... possibly with some sort of relief for management expenses
- realised capital gains, ...
- ... possibly with some allowance for inflation over the period held
- unrealised capital gains
- policy proceeds
- the excess of policy proceeds over premiums paid
- policy proceeds only in the event of non-contractual termination.

Alternatively:

- depending how policy proceeds are taxed, tax relief might be given on premiums
 - policy values could be considered as assets and be subject to a wealth tax.
- [½ each, maximum 3]

2.4 Stakeholders and their actions include:

- government – legislate, supervise
- advocacy groups – collect public opinion, lobby
- individual participants in the investment markets – lobby, choose what to buy (*eg* on ethical grounds, to avoid adverse impact of climate change)
- public – have opinions, are surveyed, give feedback, lobby
- financial markets:
 - providers – choose what to offer as products
 - distributors – choose how to promote products (*eg* from an ethical stance)
 - capital market operators – provide capital to deal with climate change, trade in emissions permits
 - support services – choose what services to offer (*eg* ‘green’ services such as printing on recycled paper).

2.5 (i) ***Younger individuals and the demand for loans***

Younger individuals are often at the start of their career and thus the bottom of an increasing salary curve.

In addition, they may have high outgoings in respect of setting up a home and bringing up children.

Loans outstanding from university days may also need servicing.

(ii) ***Suitable products where there are dependent children***

Life assurance products that are associated with dependent children include school fee plans and savings plans under trust for the benefit of a child. These would provide proceeds that directly benefit the child.

In addition, life assurance cover and health insurance cover for both parents would provide funds in the case of the death or sickness of either parent. Suitable products include term assurance, whole life assurance, income protection and critical illness insurance cover.

(These products will be discussed in more detail later in the course.)

(iii) ***The need for insurance at older ages***

Insurance needs may increase, *eg* in respect of inheritance tax planning, healthcare insurance, funeral costs, annuities and long-term care.

2.6 Examples of areas upon which technological changes have impacted are:

- information processing
- distribution of information, *eg* text messages, email
- marketing channels, *eg* company websites, price comparison sites, social media
- sales channels, *eg* telephone sales
- policy administration, *eg* customer enquiries, changing personal details
- claims administration, *eg* registering a claim
- target markets, by making it possible to reach more focused target markets, *eg* mobile phone or PC users.

2.7 *Legislation*

The State may require companies shipping radioactive materials to take out such insurance. [½]

The insurer should ensure that the details of the proposed product meet the minimum requirements of the State. [½]

Competitive advantage and commercial requirements

The insurer should investigate whether competitors provide similar cover and at what price. [½]

If possible, the product should include valuable features or options that are not present in competitors' products. [½]

The launch of the product should be timed to be at the top of the underwriting cycle ... [½]

...so as to maximise profits in the initial phase. [½]

Risk management requirements, capital adequacy and solvency

This product should be designed in such a way that the capital requirements are not too onerous. [½]

For example, the pre-agreed limit should not be ridiculously high. [½]

Key risks should be identified and appropriate risk controls put in place. [1]

For example, the risks could include:

- the risks of higher than expected numbers of claims or claim amounts from leakages
- the risk of a catastrophic radioactive disaster
- default of counterparties such as reinsurers or the shipping company (premiums)

[½ for any valid risk, maximum 1]

Social trends and lifestyle considerations

The pricing of the product should take into account its potential lifespan. [½]

For example, if nuclear power is to become unattractive (commercially or otherwise) then the lifespan, over which initial costs are to be recovered, may be short. [½]

Climate change and other environmental issues

The association with the nuclear industry may present challenges. The views of certain key stakeholders might need to be considered before launching such a product. [½]

For example, if key corporate shareholders of the insurance company are anti-nuclear, then the launch of such a product might be opposed. [½]

However, nuclear power may become more widely used if non-sustainable energy sources (such as coal and oil powered generation) reduce. This might increase the volume of this type of business that can be sold. [½]

International practice

The design of similar insurance products offered by insurers in overseas markets should be considered for ideas when setting the terms for the product. [1]

Technological changes

The product should be capable of being marketed, sold and administered using up-to-date technology such as the internet. [1]

[Maximum 7]

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3

Regulation

Syllabus objectives

- 9.1.1 Describe the principles and aims of prudential and market conduct regulatory regimes.
- 9.1.2 Discuss the role that major financial institutions can play in supporting the regulatory and business environment.
- 9.1.3 Explain the concept of information asymmetry.
- 9.1.4 Explain how certain features of financial contracts might be identified as unfair.
- 9.1.5 Discuss the implications of a requirement to treat the customer fairly.

0 Introduction

Like many markets, an unregulated market for financial services may not produce an economically optimal outcome, in which all investors make the best investment decisions and risk is allocated optimally throughout the economy.

The most important cause of market failure in financial services markets is likely to be the lack of (perfect) information available, in particular to private investors, concerning the financial services that they are buying and the risks being taken by the institutions in which they invest.

To counteract this problem, the market for financial services is usually subject to some form of regulation. Indeed, given the nature of financial services – *ie* their complexity, their often long-term nature and the potentially large sums of money involved – the extent of regulation within the financial service sector is often much greater than that found in the markets for other goods and services.

This chapter therefore outlines:

- the aims of financial services regulation (Section 1)
- the costs and benefits of regulation (Sections 2 and 3)
- the functions of a regulator (Section 4)
- the areas addressed by regulation (Sections 5 and 6)
- some of the possible regulatory regimes that may operate in practice, with particular emphasis on self-regulation and statutory regulation (Section 7)
- the role of major financial institutions in supporting the regulatory and business environment (Section 8).

In Section 9 we consider a Core Reading question on this topic.

Questions on regulation can cover a wide range of material from this chapter, both in the form of tests of the bookwork and also some quite tricky application questions. It is important to practise plenty of questions.

1 The aims of regulation

The extent and form of the regulation of any market is sometimes a controversial matter and this is certainly true of financial markets. However, the financial markets of all developed economies are regulated to a greater or lesser extent.

In most developed economies, the government acts ultimately as lender of last resort because the consequences of complete financial market failure would be so severe for country, economy and society. One aim of regulation will be to limit the likelihood and potential cost of failures of financial services companies, and to limit the need to step in as lender of last resort.

Being a lender of last resort means that the government, usually through the central bank, lends money to banks and other institutions that are in serious financial difficulties, when they have no other borrowing option.

The principal aims of regulation are:

- **to correct perceived market inefficiencies and to promote efficient and orderly markets**
- **to protect consumers of financial products**
- **to maintain confidence in the financial system**
- **to help reduce financial crime.**

These aims are, of course, related.

The market for financial services may be inefficient in the sense that consumers of financial services make inefficient, *ie* incorrect, choices. In practice, the main cause of this is likely to be the lack of information available to and expertise of private investors, with regard to the often complex financial services traded.

2 The cost of regulation



Regulation has a cost. Regulators must attempt to develop a system that can achieve the aims specified above at minimum cost and hope that the benefits, which are difficult to measure, outweigh the costs.

In economic terms, the optimal level of regulation should be such that the marginal benefits of regulation are equal to the marginal costs. The benefits arise from meeting the aims outlined above. The costs are of two main types – direct costs and indirect costs.

2.1 Direct costs

Direct costs arise in:

- **administering the regulation**
This includes, for example, collection and examination of information provided by market participants and otherwise monitoring their activities.
- **compliance for the regulated firms.**
This includes, for example, maintaining appropriate records, collating the requisite information and supplying it to the regulator and/or the investor.

In practice, most of these direct costs are borne ultimately by the investor in the form of either higher taxation to fund the regulator and/or higher charges and fees for the financial services that are purchased.

2.2 Indirect costs

Other economic costs of regulation have been claimed to arise from:

- **an alteration in the behaviour of consumers, who may be given a false sense of security and a reduced sense of responsibility for their own actions**
- **an undermining of the sense of professional responsibility amongst intermediaries and advisors**
- **a reduction in consumer protection mechanisms developed by the market itself**
- **reduced product innovation**
- **reduced competition.**

The behaviours outlined in the first three points above are examples of *moral hazard*. This concept is explored further later in this chapter.

As financial markets become increasingly globalised, regulators are having to co-ordinate their activities on an international basis.

Even personal investors can invest quickly and easily overseas, both directly and by means of collective investment vehicles. In addition, a lack of co-ordination might lead trading to gravitate towards the least well-regulated markets.

3 The need for regulation

It is often claimed that the need for regulation of financial markets is greater than the need for regulation of most other markets for two reasons:

- confidence
- asymmetric information.

3.1 Confidence

The first reason is the importance of confidence in the financial system, the dangers of problems in one area spreading to other parts of the system, and the damage that would be done by a systemic financial collapse.

In this context, the systemic risk is the risk of the failure of one financial institution leading to the failure of another, which in turn causes difficulties for a third institution and so on. Such risks arise when the financial positions of different institutions are very closely interlinked, and can result in failure of the overall financial system.

The collapse of a clearing bank, for example, could lead to a loss of faith in the banking system as a whole and consequently a 'run' on banks in which investors attempt to withdraw all of their money.

An example of this is the American bank Bear Stearns. A crisis of confidence in March 2008 led to clients fleeing and lenders withdrawing the funding on which the bank had become dependent.

The crisis pushed Bear Stearns to the brink of bankruptcy before the USA Federal Reserve and other regulators stepped in to help arrange the sale to JPMorgan.

A UK example is the run on Northern Rock in September 2007; Northern Rock was nationalised in February 2008.

Similar problems could arise from the failure of an insurance company or pension scheme, leading to a loss of faith in the sector as a whole.



Question

Explain why a run on the banking system as outlined above could cause particular difficulties.

Solution

A run on the banking system could prove calamitous because banks hold cash reserves equal to only a fraction of the value of the deposits placed with them by the customers. This is precisely because they do not expect everyone to withdraw their money at once. (This same principle also applies to other financial institutions.)

Banks could then react to a shortage of deposits by calling in (*ie* requiring repayment of) loans to borrowers – *eg* overdrafts – leading to widespread bankruptcies.

To prevent systemic collapse or loss of confidence it is not necessary to guarantee the solvency of every financial institution, but merely to ensure that the failure of one participant does not threaten the whole system.

This could arise if the financial fortunes of different financial institutions are very closely interlinked, as might be the case with, for example, reinsurers.

3.2 Asymmetric information

The second reason for the importance of regulating financial markets is the asymmetry of information between the product provider and the end customer. This is discussed later in this chapter.

Information is an economic resource like any other. In any transaction the better-informed party could potentially use its informational advantage for its own benefit and to the detriment of the other party.

An obvious example is the purchase of a second-hand car, where the seller knows whether or not the car is a 'lemon' (*ie* defective or in poor condition) but the buyer does not and often cannot find out until some time after the sale occurs.

4 The functions of a regulator

The main functions of a regulator are typically:

- influencing and reviewing government policy
- vetting and registration of firms and individuals authorised to conduct certain types of business
- supervising the prudential management of financial organisations and the way in which they conduct their business
- enforcing regulations, investigating suspected breaches and imposing sanctions
- providing information to consumers and the public.

The regulator will also have to decide exactly what is meant by financial services business, *ie* which investments and which activities relating to those investments.



Question

List possible activities relating to investment business that might be covered by financial services regulation.

Solution

Financial services regulation might typically cover the following activities relating to investment business:

- dealing in investments as principal (*ie* on one's own behalf) or agent (*ie* on behalf of a third party)
- arranging for a third party to make investment deals
- managing investments for another person
- giving advice on investments
- operating collective investment schemes
- assessing the solvency of investment business providers
- specifying the design of investment products.

For practical purposes, regulation may be segregated by type of financial business, such as insurance or investment.

This may, however, prove difficult where providers of financial services provide more than one type of financial service or products have aspects of both / multiple types of business.

It will be necessary to regulate:

- **deposit-taking institutions**
- **financial intermediaries**
- **securities markets**
- **professional advisers**
- **non-financial companies offering securities to the public.**



Question

Give an example of each of the above parties.

Solution

Possible examples are as follows:

- A clearing bank is a deposit-taking institution.
- Insurance companies, pension funds and collective investment vehicles are examples of financial intermediaries.
- Securities markets are markets in financial securities such as money market instruments, bonds, equities and derivatives. Property is not strictly a security, and different regulations may apply to the operation of property markets.
- A merchant / investment / wholesale bank often acts as a professional financial adviser. Stockbrokers and specialist independent financial advisers also give financial advice.
- Non-financial companies may offer new issues of shares or debt directly to the public in order to raise additional funds. The regulation here will primarily be aimed at ensuring that sufficient information is included in the prospectus to enable potential investors to make a suitably informed choice.

Many firms offer more than one of the financial services mentioned above. For example, a bank may act as a deposit-taking institution as well as operating in the securities market.

5 Areas addressed by regulation – information asymmetry

5.1 Introduction

Information asymmetry is the situation where at least one party to a transaction has relevant information which the other party or parties do not have.

If all parties in a market do not enjoy (free) access to perfect information, then the less than perfectly informed parties will make sub-optimal choices, leading to an inefficient allocation of (financial) resources.

Information asymmetry can be in the favour of the individual rather than the financial institution.

The concepts of anti-selection and moral hazard are relevant to information asymmetry. (It is important to bear in mind that moral hazard differs from anti-selection.)

Anti-selection

The following is the Glossary definition of anti-selection:

People will be more likely to take out contracts when they believe their risk is higher than the insurance company has allowed for in its premiums. This is known as anti-selection.

Anti-selection can also arise where existing policyholders have the opportunity of exercising a guarantee or an option. Those who have most to gain from the guarantee or option will be the most likely to exercise it.

Moral hazard

The following is the Glossary definition of moral hazard:

The action of a party who behaves differently from the way they would behave if they were fully exposed to the consequences of that action. The party behaves inappropriately or less carefully than they would otherwise, leaving the organisation to bear some of the consequences of the action. Moral hazard is related to information asymmetry, with the party causing the action generally having more information than the organisation that bears the consequences.

This is not the same as *anti-selection*, which is also taking advantage of particular aspects of an insurance contract, but within the terms offered by the insurer.

Information asymmetry can lead to anti-selection. If a contract has an option that can be exercised by the policyholder or benefit scheme member, it is more likely that the option will be exercised by an individual who would find it most beneficial.

For example:

- **Insurability options, where an individual can increase the level of life cover without supplying medical evidence, are more likely to be exercised by lives in poor health. Lives in good health may find it cheaper just to buy a new policy, subject to full underwriting.**

- **Individuals in normal health are more likely to exercise guaranteed annuity rate options that are attached to their pension fund at the point of retirement. Even if the guaranteed rates are in the money for lives in normal health, lives with health impairments may be able to purchase an impaired life annuity at a better rate.**

In the second example, the guaranteed annuity rates offered under the option might be better than the annuity rates that are available on the open market if the individual is in normal / good health. However, those in poor health may be able to buy a higher annuity on the open market, as they could choose to undergo medical underwriting in order to obtain an annuity rate that would reflect their lower potential life expectancy.

Therefore, an individual who knows themselves to be of normal / good health is more likely to exercise the option than an individual who knows themselves to be of poor health. The individual has this information at the time at which the option can be exercised, but the insurance company does not – so there is information asymmetry.

Another source of information asymmetry is where a prospective policyholder tries to avoid divulging information to a product provider.

For example, an individual who believes that special terms for a contract might be imposed were a medical examination required might propose for a sum assured just below the limit that would trigger an automatic medical examination, and not answer questions on a proposal truthfully. This is an example of fraud.

It is the act of deliberately lying on the insurance application form that would be considered to be fraud.



Question

Explain whether or not the following are examples of moral hazard:

- (i) Not admitting to having high blood pressure on the application form when applying for a term assurance contract.
- (ii) A person in poor health applying for a life insurance contract which has very limited underwriting.
- (iii) An insured driver not bothering to put the car in the garage at night.

Solution

- (i) This is an example of a policyholder intentionally withholding relevant information from the insurer, or even lying on the proposal form. It is therefore an example of fraud, rather than moral hazard.
 - (ii) This is an example of anti-selection rather than moral hazard, since it involves taking advantage of the insurer's inadequate underwriting process.
 - (iii) This is an example of moral hazard, because the insured is behaving differently as a result of having insurance in place.
-

As we have seen, individuals can use asymmetry to their advantage in financial transactions.



The area of information asymmetry that is of most concern to regulators is the asymmetry of information between the product provider and the end customer. There is a difference in expertise and negotiating strength that often exists in financial transactions, particularly in retail markets.

In other words, the product provider having access to more information and expertise than the customer is of more concern to regulators than the opposite situation.

Although information concerning financial services may be widely available, obtaining the required information will normally involve a cost. It is in the interests of any investor to obtain additional information up to the point at which the marginal cost of obtaining further information is equal to the marginal benefit from doing so.

This is made more significant by the fact that financial transactions related to investment, insurance and pensions have a significant impact on the future economic welfare of individuals.

For example, if an individual buys a tin of baked beans that turn out to be different from the picture on the tin or that do not taste nice, then they can either demand their money back or just throw them away. Rarely are either of these options available to an investor who has committed a large amount of money to a long-term investment – potentially of up to 40 or 50 years in the case of a pension plan. The latter option is too expensive, whilst even the former may be possible only after incurring significant costs.

In addition, any problems due to lack of information, or even the provision of misinformation, may come to light only after a period of several years has elapsed.

Furthermore, in most countries the majority of the population is not well educated in financial matters, and find the range of solutions offered to meet their needs complex and confusing.

5.2 Dealing with information asymmetry

Disclosure and education

Information asymmetry can be reduced or mitigated by requirements for a service provider to disclose full information about its products or itself in an understandable form and perhaps by consumer education by the regulator.

Conflicts of interest

Knowledge held by a service provider about third parties can be restricted to that which is publicly available by insider-trading regulations and by techniques such as 'Chinese walls' or separation of functions between different organisations.

Negotiation

The weakness of an individual in negotiating a deal with a large institution may be addressed by price controls or the regulation of selling practices. The customer's position can be strengthened by devices such as giving them the right to terminate the sales process at any time, or by providing a 'cooling off' period, during which a consumer can cancel a contract with no penalty.

Price controls could involve:

- the setting of maximum commission scales
- a requirement for a fee basis (*ie* the customer pays a fixed fee for receiving advice) rather than a commission basis (*ie* the customer pays an amount which depends on the product sold, the provider of the product and the size of the premium paid), in order to ensure that the advice provided is in the best interest of the consumer (and not just that of the advisor)
- maximum premium rates and/or levels of management charges.

Unfair features of insurance contracts

In all retail financial products, the product provider writes the legal contract document. Financial product providers have great expertise in designing contracts and legal teams that ensure the contract wording is in their favour. The retail customer has none of these advantages. Hence in many countries there is consumer protection legislation that provides for unfair terms in insurance contracts to be set aside.

Examples of areas that might be regulated include:

- literature, *eg* a requirement for plain, easy to understand language
- contract terms, *eg* the company not being able to change the contract terms significantly without a valid reason and without allowing the consumer to have sufficient notice and the opportunity to immediately dissolve the contract
- discontinuance benefits, *ie* the size and payment of surrender values.

Treating the customer fairly

In some countries there is legislation or regulation to ensure that providers of financial products consider the interests of their customers. In many jurisdictions there is a general regulatory requirement on regulated bodies to treat their customers fairly. However, the interpretation of what treating customers fairly means can vary significantly by jurisdiction.

The regulation of financial services in the UK has made treating customers fairly (TCF) a main priority. The Financial Conduct Authority (FCA) sets out a number of key activities and one of these is to 'regulate financial services firms so they give consumers a fair deal'. The FCA expects firms to ensure they run their businesses in the best interests of consumers.

The FCA has outlined the six key outcomes that should be achieved as a result of TCF:

- 1 Consumers can be confident that they are dealing with firms where the fair treatment of customers is central to the corporate culture.
- 2 Products and services marketed and sold in the retail market are designed to meet the needs of identified consumer groups and are targeted accordingly.
- 3 Consumers are provided with clear information and are kept appropriately informed before, during and after the point of sale.
- 4 Where consumers receive advice, the advice is suitable and takes account of their circumstances.
- 5 Consumers are provided with products that perform as firms have led them to expect, and the associated service is of an acceptable standard and as they have been led to expect.
- 6 Consumers do not face unreasonable post-sale barriers imposed by firms to change product, switch provider, submit a claim or make a complaint.

(The six outcomes above are not directly examinable in Subject CP1.)

Where an actuary has statutory responsibilities, these frequently include the requirement to notify the regulatory authorities if the actuary believes that a product provider is acting in a way that would prejudice the interests of its customers.

Such notification is also known as 'whistle-blowing'.

This requirement imposes a clear conflict of interest on the actuary. It is generally accepted that this type of requirement is necessary because of the complexity of financial products, their long duration, and the financial impact that unfair treatment could have on customers.

These conflicts are exacerbated by the fact that in many cases financial products and schemes have benefits or charges that can be varied at the discretion of the product provider. It is generally accepted that discretionary benefits and charges should not be too dissimilar from those that customers were led to believe they would receive when they entered into the contract or transaction.

There is no precise method of defining what customers were led to believe at the inception of a contract, but it is generally accepted that the main influences on policyholder expectations are:

- **statements made by the product provider, especially those made to the customer in marketing literature and other communications**
- **the past practice of the product provider**
- **the general practices of other product providers in the market.**

This concept is often referred to as PRE: policyholders' reasonable expectations.

6 Areas addressed by regulation – maintaining confidence

6.1 Capital adequacy

A key aspect to protecting consumers and reducing systematic risk is that institutions must hold sufficient financial resources to cover their liabilities. Financial resources include capital, cash, liquid securities and credit lines.

Thus, financial service providers are often required to demonstrate that their assets are sufficient to cover their liabilities at present, and also that they have sufficient margins to ensure that they are likely to be able to do so in the future in the face of adverse experience. These margins are often referred to as capital requirements or required capital.

As indicated by the types of financial resources listed, institutions must also be able to demonstrate that they have sufficient liquid assets to meet short-term expected and unexpected liability outgo.

The statutory requirements relating to coverage of liabilities could take a number of forms, *eg*:

- assets must be equal to a specified proportion of liabilities (*eg* 120%), with both assets and liabilities being valued according to a prescribed basis – this might apply globally or in respect of each individual liability class
- sufficient assets must be held to ensure that the probability of insolvency over a particular time period is lower than a specified level (*eg* 1 in 200 probability over the next year) taking into account the company's risks.

Ensuring this requires that accurate models of the business are in place to monitor risk levels and that they are used with competence and integrity.

6.2 Competence and integrity

Indeed, ensuring the competence and integrity of financial practitioners and managers is a crucial role for a financial regulator.

Competence means that they know the appropriate course of action to take on behalf of the investor and integrity means that they choose to take it.

Individuals may have to prove their competence by obtaining specified qualifications or the membership of a professional organisation.

So, one important role for the regulator is to determine which professional organisations and qualifications to recognise, *eg* actuarial.

Regulators may also be able to prevent an individual working in a particular industry or at a senior level if they are not judged to be a 'fit and proper' person.



Question

Suggest criteria that might make an individual an 'unfit' and/or 'improper' person to hold a responsible role in the financial services industry.

Solution

An unfit and/or improper person might be one:

- with a past association with the management of a financial institution that previously breached regulations, *eg* with regard to conduct or insolvency
 - with convictions for fraud
 - who has been bankrupt in the recent past
 - with no previous experience, expertise or professional qualifications with regard to the management of a financial institution.
-

6.3 Compensation schemes

Regulators may establish compensation schemes, funded either by the industry or by government which provide recompense to investors who have suffered losses. These typically cover losses due to fraud, bad advice, or failure of the service provider rather than market-related losses.

Therefore, investors are not compensated if the value of the shares that they hold goes down simply because the market as a whole does and/or the company involved performs badly.

The arguments for and against such schemes are very closely related to the general costs of regulation outlined earlier in this chapter. In order to reduce the impact of moral hazard, the amount of compensation might be limited to either a maximum percentage of any loss or to a maximum absolute amount. This ensures that the investor retains some incentive to consider the financial integrity of the provider.

6.4 Other protection for investors

Security market regulators will seek to ensure that the market is transparent, orderly and provides proper protection to investors.

Again, it is particularly important to protect private investors, who are likely to be less well informed than their institutional counterparts. Transparency is required to ensure that they are able to see more easily exactly what is happening in the marketplace. Orderliness is necessary because they will often not be able to trade immediately in response to new information or events that impact upon market prices.

6.5 Stock exchange requirements

Companies listed on a stock exchange will have to fulfil certain criteria regarding financial stability and will need to fulfil specified obligations for the disclosure of financial and other information.

These may be more onerous than the general accounting requirements that apply to all companies, listed or otherwise. Again the aim is to ensure that investors are able to make well-informed investment decisions.

Regulators will monitor aspects such as the prices at which business is done and the reporting of deals.

Trading volumes may also be recorded, in order to:

- deter and/or identify the occurrence of insider trading, based upon non-public information
- prevent substantial acquisitions of shares occurring quickly and privately, so as to protect the positions of other shareholders.

There are likely to be regulations governing issues of new shares and takeover bids for companies.

These will usually be aimed at the protection of those at an informational disadvantage – primarily individual investors – and the conduct of the directors of the company or companies involved.

For example, some or all of the following principles might be required to be observed in a takeover situation:

- protection of the interests of existing shareholders and managers, as well as the wider public interest
- in particular, that the takeover does not lead to market-dominating companies restricting competition
- prevention of a bidder from retracting an offer, other than in exceptional circumstances
- disclosure of specified information, *eg* all shareholdings above a certain level.

7 Regulatory regimes

7.1 Forms of regulation

There are several different types of regulatory regime, the most important of which are self-regulation and statutory regulation. Within each type of regime, the regulation itself can take a variety of forms.

Prescriptive

Regulation can take many forms. It can be prescriptive, with detailed rules setting out what may or may not be done.

In general, a prescriptive regime is likely to control tightly the activities of the parties affected, thereby reducing the likelihood that things go wrong. However, it often has greater costs, both direct and indirect, than the other possible approaches.

Freedom of action

Alternatively, regulation can involve freedom of action but with rules on publicity so that third parties are fully informed about the providers of financial services.

In other words, the firm can do pretty much what it wants provided that it publishes sufficient information for the regulator (or any other interested parties) to check that it is being properly managed.

Outcome-based

Finally, the regime can allow freedom of action but prescribe the outcomes that will be tolerated.

An outcome-based regime is concerned with the end result – *eg* has the investor made a well-informed decision appropriate to their individual circumstances?

The rest of this section discusses various possible regulatory regimes:

- unregulated markets and unregulated lines of business
- voluntary codes of conduct
- self-regulation
- statutory regulation
- mixed regimes.

The first four possibilities are listed in order of the increasing degree of regulation involved. In practice, however, regulatory regimes may involve a mixture of these systems.

7.2 Unregulated markets and unregulated lines of business

It has been argued that the costs of regulation in some markets outweigh the benefits.

Examples might be markets where only professionals operate or commodity products with guaranteed benefits that are sold only on price, such as term assurance.

Consequently, for markets in which the parties involved are sufficiently well-informed, the best option may involve no specific regulations. Even here though, the participants will normally still be subject to the general trading and other laws applicable in the particular legal jurisdiction in which they operate.

7.3 Voluntary codes of conduct

These operate effectively in many circumstances but are vulnerable to a lack of public confidence or to a few 'rogue' operators refusing to co-operate, leading to a breakdown of the system.



Question

Describe the main advantages and the main disadvantage of a voluntary code compared to statutory regulation.

Solution

The main advantages are likely to be the reduced cost of regulation and the fact that the rules are set by those with greatest knowledge of the industry.

The main disadvantage is likely to be the greater incentive to breach the voluntary code, which will have no legal backing and in all likelihood less severe penalties, if any, than with statutory regulation.

7.4 Self-regulation

A self-regulatory system is organised and operated by the participants in a particular market without government intervention. The incentive is that regulation is an economic good that consumers of financial services are willing to pay for and which will benefit all participants. An alternative incentive is the threat by government to impose statutory regulation if a satisfactory self-regulatory system isn't implemented.

Stock and option trading exchanges are often private sector companies. They provide a range of services for which they are able to charge fees, thereby generating profits. Prominent amongst these is the regulation of the activities of their members.

For example, a stock exchange could regulate:

- Companies listed on it – by obliging them to fulfil certain financial and accounting requirements in order to both secure and subsequently maintain a listing. Investors can then be confident that the listed companies in whose securities they invest fulfil these requirements. The listed companies themselves then gain the various advantages of listed status (*eg* greater marketability).
- Transactions that take place within the exchange – recording the time, price and volume of each trade, as this helps to discourage insider dealing based upon non-public information.
- Traders / brokers dealing on the exchange – to prevent misconduct and ensure capital adequacy.

Advantages of self-regulation

An advantage of self-regulation is that the system is implemented by the people with the greatest knowledge of the market, who also have the greatest incentive to achieve the optimal cost benefit ratio.

The parties involved in the provision of financial services have the greatest incentive to be seen to be providing those services within a soundly managed environment, as it is they who have most to lose should customers lose faith in the financial system.

Self-regulation should, in theory, be able to respond rapidly to changes in market needs.

Also, it may be easier to persuade firms and individuals to co-operate with a self-regulatory organisation than with a government bureaucracy.

Disadvantages of self-regulation

The main problem with self-regulation is the closeness of the regulator to the industry it is regulating. There is a danger that the regulator accepts the industry's point of view and is less in tune with the views of third parties.

The third parties referred to here are principally the *consumers* of financial services.

This can lead to a weaker regime than is acceptable to consumers and other members of the public. Even if the regulatory regime is operating efficiently and effectively, it can suffer from low public confidence in the system.

Not only must the regulator be fair and objective, but it must be clearly *seen* to be so in the eyes of the investing public.

Self-regulatory organisations may also inhibit new entrants to a market.

The existing participants could frame the rules in such a way as to act as a barrier to entry, *eg* by imposing very exacting capital adequacy requirements that a new entrant starting from scratch would find extremely difficult to meet.

7.5 Statutory regulation

Under a statutory regulation regime the government sets out the rules and polices them.

Advantages of statutory regulation

This has the advantage that it should be less open to abuse than the alternatives and may command greater public confidence.

Even here, there may be concerns that the regulatory body takes more heed of the views of those it is regulating, than those of the consumer.

Also, the regulatory body may be able to be run efficiently if, for example, economies of scale can be achieved through grouping its activities by function rather than type of business.

For example, separate departments could monitor different aspects of financial services provision, such as capital adequacy, product sales and security trading, across all financial markets within the jurisdiction.

An example of a split by function could be to have separate regulators responsible for monitoring market conduct and regulatory solvency.

Disadvantages of statutory regulation

The disadvantages of statutory regulation are that it can be more costly and inflexible than self-regulation.

It is argued that the market participants themselves are in the best position to devise and run the regulatory system. Outsiders may impose rules that are unnecessarily costly and may not achieve the desired aim. It is claimed that attempts by government to improve market efficiency usually fail and that financial services regulation is an economic good that is best developed by the market.

These arguments are essentially the flip side of the arguments for and against self-regulation.

7.6 Mixed regimes

In practice many regulatory regimes are a mixture of all the systems described above, with codes of practice, self-regulation and statutory regulation all operating in parallel. Even a regime that is self-regulatory in name is likely to have statutory aspects.

Regulations are often developed by market-driven private institutions (such as stock exchanges) as well as by governments.

Professionalism and professional bodies

An important source of the benefits aimed at by regulators is the professional responsibility of market practitioners and intermediaries themselves.

This source can operate in both regulated and unregulated sections of the market.

Professional bodies, such as the Institute and Faculty of Actuaries, with responsibility for ensuring that their members are appropriately qualified for the work they undertake and that they conform to professional standards of behaviour, have a long history of ensuring market stability and consumer protection.

In addition, actuaries may also have specified *statutory* obligations with regard to the financial institutions that they manage and/or advise. Such statutory roles can only be taken by actuaries and mainly relate to the certification of the adequacy of the valuation of assets and liabilities for an insurance company or pension scheme.

Actuaries may also work for a financial services regulator, for example to check that regulatory objectives are being met.

8 Role of major financial institutions

This section considers the role of the following in terms of supporting the regulatory and wider business environment:

- the central bank
- the State, *eg* through State monopoly companies
- large market participants.

8.1 Central bank

In some cases, the central bank also plays a part in the regulatory or supervisory regime for financial product providers. The possible regulatory roles the central bank may play are as discussed in the previous sections.

For example, in the UK, the insurance company regulators are part of the central bank.

This section refers to the role as central banker only.

The function of the central bank in various territories can be any of the following in order to meet government targets:

- **control the money supply**
- **determine or influence interest rates**
- **determine or influence inflation rates**
- **determine or influence exchange rates**
- **target macro-economic features such as growth and unemployment**
- **ensure stability of the financial system**
- **be the lender of last resort to commercial banks.**

Not all of the above roles are mutually exclusive and governments will normally give central banks a primary target to achieve and other secondary targets.

Some of these functions, such as interest, inflation and exchange rates, directly affect financial product providers in the terms they can offer for the products they sell. Other features affect the general economy and hence the ability of consumers to invest or to purchase financial protection.

Economic influences on financial products and providers is covered in more detail later in the course.

8.2 State intervention

In some territories, financial products of certain classes may only be sold by State monopoly companies.

In other cases, tariff premium rates are set by the government for certain classes of business or types of arrangement. If full tariff rates are not prescribed, the State may still require approval of, or set a maximum level of, charges that an insurance company may impose, in order to protect consumers.

All these features restrict a free market and limit the number of participants in the market to those that can meet the State requirements. State intervention potentially damages innovation and new developments.

The role of the State in the provision of benefits is covered in more detail later in the course.

8.3 Large market participants

Large companies operating within a market can allow smaller participants to find niche markets and can help to stabilise premium rates. However, there may also be negative impacts.

In some markets there is a risk that very large participants could distort the market, potentially to the detriment of consumers in that market. In most developed markets, there will be regulations in place to avoid monopolies and anti-competitive practices in that market.

Regulation or legislation may aim to reduce the power of large market participants. This is in order to ensure that the market is sufficiently competitive and that the main participants do not act or collude in order to set prices and make it difficult for other companies to enter the market. This is often known as competition legislation.

There is also a risk that certain participants in a market could take up a significant share of the available resource that the regulator has. This could mean that the regulator has limited resource available to monitor the smaller market participants. This could be to the detriment of consumers in that market.

9 Core Reading example

We will now look at a Core Reading example question on treating the customer fairly.



Core Reading Question

A general insurance company writes unemployment insurance in connection with a finance house. The finance house offers loans for the purchase of motor vehicles, typically over three years. The unemployment insurance is paid by a single premium which is added to the amount borrowed. If the policyholder is unemployed for a period of eight weeks, the insurance policy will pay an amount equal to the remaining sum outstanding on the loan (but not any arrears of repayments).

If the borrower repays the loan early, the unemployment cover will cease and the insurance company will pay a surrender value of the policy to the finance house, which will be credited to the loan account in determining the final repayment balance due. If the policyholder cancels the unemployment cover without repaying the loan, no surrender value is paid.

When a surrender value is paid it is calculated as:

$$P \times 0.55 \times t / n$$

where:

- P is the single premium paid
- n is the original term of the policy in months
- t is the number of complete months left to run.

Discuss whether the surrender value calculation and the terms under which a surrender value is paid are fair to the policyholder.

In order to answer this question, we need to consider the fairness of both the calculation *and* the terms.

Consider:

- whether it is reasonable for the surrender value not to start at 100%
- the need to be practical
- the fairness of not paying a surrender value when the loan isn't repaid but the policyholder wants to cease cover.

Solution

The surrender value formula is a straight line run-off, starting at 55% of the original premium. The insurance company will have incurred initial expenses in setting the policy up and in paying commission to the intermediary – in this case the finance house. Thus it is reasonable for the scale not to start at 100%.

The amount outstanding under the loan will reduce as repayments are made. Thus more of the net single premium (after expenses and commission) is required for the early months of cover than the later months, when the outstanding loan will be small. Theoretically the surrender value formula should be a concave curve. But a straight line of best fit through the curve is easy to understand. It will pay surrender values that are too low at early durations and too high at later durations.

Overall the surrender value basis is not unreasonable.

It is also reasonable that the surrender value is paid to the finance house, provided that it is clearly credited to the policyholder's account. This is likely to save the insurer administrative costs, thus keeping the premium rates down.

What is unreasonable is that there is no surrender value if the policyholder decides that he or she does not want the unemployment cover without repaying the loan. The policyholder has a contract with the insurer, with the finance house only being an intermediary. The policyholder's circumstances may have changed, and the cover may not be required. If the insurer was prepared to pay a surrender value when its risk terminated for one reason, the same value should be available for any cause of termination. This contract term is unfair to the policyholder.

The chapter summary starts on the next page so that you can keep all the chapter summaries together for revision purposes.

Chapter 3 Summary

Aims of regulation

The principal aims of the regulation of financial services are to:

- correct market inefficiencies and to promote efficient and orderly markets
- protect consumers of financial products
- maintain confidence in the financial system
- help reduce financial crime.

As well as having benefits, financial services regulation will normally also impose costs, both direct and indirect, upon the various participants involved. Often, these will ultimately be borne by the investor in the form of increased charges.

Direct costs

- administering the regulation
- compliance for the regulated firms

Indirect costs

- alteration in consumer behaviour
- undermining of the sense of professional responsibility amongst intermediaries and advisors
- reduction in self-regulation by the market
- reduced product innovation
- reduced competition

Need for regulation

The need for regulation is greater in the financial world than in other markets in order to:

- maintain confidence in the sector
- deal with information asymmetries.

Functions of a regulator

The main functions of a regulator are typically:

- influencing and reviewing government policy
- vetting and registering firms and individuals authorised to conduct certain types of business
- supervising the prudential management of financial organisations and the way in which they conduct their business
- enforcing regulations, investigating suspected breaches and imposing sanctions
- providing information to consumers and the public.

Areas addressed by regulation: information asymmetries

- Asymmetries occur when one party has relevant information or expertise or negotiating strength not shared by another party.
- They can lead to anti-selection.
- The asymmetries are exacerbated by the complex and long-term nature of financial contracts.
- Mitigation tools include:
 - disclosure of information in plain language
 - Chinese walls
 - cooling off periods
 - customer legislation on unfair contract terms and TCF
 - ‘whistle-blowing’ by actuaries if they believe the client is treating customers unfairly.

Areas addressed by regulation: maintaining confidence

- There is a danger that problems in one area of the financial system spread, leading to the collapse of the whole system.
- Mitigation tools include:
 - checks on capital adequacy of providers
 - ensuring practitioners are competent and act with integrity
 - industry compensation schemes
 - ensuring orderly and transparent markets
 - stock exchange requirements.

Regulatory regimes

The main types of regulatory regime are:

- *unregulated markets* – where no financial services specific regulations apply; market participants are instead subject to normal legislation
- *voluntary codes of conduct* – drawn up by the financial services industry itself
- *self-regulation* – organised and operated by the participants in a particular market without government intervention
- *statutory regulation* – in which a government body sets out the rules and polices them
- *mixed* – a combination of the above (many countries adopt such a mixture).

Each of these regimes can adopt any of the following forms:

- *prescriptive regimes* – with detailed rules as to what may or may not be done
- *freedom of action* – with rules only on publicity of information
- *outcome-based regimes* – with prescribed tolerated outcomes.

Role of major financial institutions

Major financial institutions support the regulatory and wider business environment:

- central bank – controlling or influencing economic variables, acting as lender of last resort
- State intervention – provision of products (*eg* through State monopoly companies), control of premium rates
- large market participants – influencing premium rates, allowing smaller participants to find niche markets; however, may distort the market and use up too much of the regulator's limited resources.

The practice questions start on the next page so that you can keep the chapter summaries together for revision purposes.



Chapter 3 Practice Questions

3.1 (i) State the four principal aims of regulation of financial services. [2]

Exam style

(ii) Suggest ways in which each of these aims might typically be met in practice. [6]

[Total 8]

3.2 Outline the basic regulatory requirements that a stock exchange ought to satisfy in order to obtain authorisation to act as an exchange. [5]

Exam style

3.3 Give four examples of possible prescriptive rules that might be imposed on a financial institution by the regulator.

3.4 List the advantages and disadvantages of self-regulation.

3.5 (i) Outline the main benefits and costs associated with the regulation of financial services. [8]

Exam style

(ii) Explain why the regulations that apply in the retail investment market (*ie* for individuals) might differ from those that apply in the wholesale investment market (*ie* where customers are institutions). [2]

[Total 10]

The solutions start on the next page so that you can
separate the questions and solutions.



Chapter 3 Solutions

3.1 (i) ***Principal aims of regulation of financial services***

- to correct perceived market inefficiencies and to promote efficient and orderly markets
- to protect consumers of financial products
- to maintain confidence in the financial system
- to help reduce financial crime.

[½ each, total 2]

(ii) ***Meeting these aims***

Market efficiency

- ensuring sufficient liquidity in the market place, *eg* by having market makers
- the provision of settlement systems (to ensure that trades are carried out in an efficient and orderly way)
- imposing stock exchange requirements on listed companies

Consumer protection

- disclosure of information and product literature (to ensure that customers understand what they are buying)
- cooling off periods
- the initial authorisation of the main players in a particular market
- schemes to compensate investors for breaches of the regulations
- legislation preventing the use of unfair contract terms
- legislation on treating customers fairly

Confidence

- checking ongoing solvency (capital adequacy) of authorised providers
- enforcing strict accounting information requirements
- ensuring the competence and integrity of financial practitioners

Financial crime reduction

- vetting (investigating and approving) the firms authorised to conduct certain activities
- vetting the individuals authorised to conduct certain activities
- enforcing regulations
- investigating suspected breaches of regulation
- imposing sanctions if regulations have not been met.

[½ each, maximum 6]

3.2 An investment exchange ought to be required to demonstrate to the regulator that:

- it has adequate financial resources to provide the requisite exchange services [1]
- traders and brokers dealing on the exchange also have adequate capital [½]
- proper conduct of business rules exist, in particular ... [½]
- ... all parties (traders and issuers of securities) should be aware of the rules and understand them [½]
- these rules are monitored to ensure they are enforced ... [½]
- ... to prevent insider trading and fraud [½]
- it operates proper, transparent and sufficiently liquid markets in the securities traded [1]
- appropriate procedures for recording transactions exist, *eg* time, price and volume of each trade, and the parties involved [1]
- appropriate procedures exist for admitting new listings, ... [½]
- ... including obliging the companies to fulfil certain financial and accounting requirements in order to both secure and subsequently maintain the listing [1]
- proper arrangements exist for the clearing of transactions ... [½]
- ... including recording the time, price and volume of each trade in order to prevent fraud and insider dealing. [1]

[Maximum 5]

3.3 Examples of prescriptive rules might include rules on:

- the types of investment or contract that are offered by the institution
- the types of service provided
- the charges or premiums that may be levied for a particular investment, contract or service
- the types of investment that may be included within a collective investment vehicle or a pooled investment vehicle, such as a life contract
- the types of investment in which a financial institution may itself invest
- the required levels of capital adequacy
- who may control the institution or advise on products – *ie* only fit and proper persons.

3.4 ***Advantages of self-regulation***

- The regulatory system is implemented by the people with the greatest knowledge of the market, who also have the greatest incentive to achieve a soundly-run financial services industry in which consumers can have confidence.
- Self-regulation should be able to respond rapidly to changes in market needs.
- It may be easier to persuade firms and individuals to co-operate with a self-regulatory organisation than with a government bureaucracy.

Disadvantages of self-regulation

- The closeness of the regulator to the industry it is regulating may lead to a lack of public confidence in the regulator.
- Self-regulatory organisations may inhibit new entrants to a market.

3.5 (i) ***Benefits and costs of regulation***

The main benefits produced by regulation arise from the successful achievement of its aims, which are primarily to:

- correct perceived market inefficiencies and promote efficient and orderly markets, in which investors can trade confidently and fairly ... [1]
... for example, by ensuring investors have adequate information [½]
- protect consumers of financial products ... [½]
... against losses due to fraud or mismanagement ... [½]
... but not against losses arising purely from market movements [½]
- maintain confidence in the financial system ... [½]
... so that it continues to operate effectively for the greater good of society [½]
- help reduce financial crime ... [½]
... by vetting firms and individuals authorised to conduct certain activities ... [½]
... and by enforcing regulations, investigating suspected breaches and imposing sanctions. [1]

Regulation may also aim to limit the likelihood of failure of major financial institutions and to reduce the likelihood of the government or central bank having to step in as lender of last resort.

[1]

The main costs involved are:

- the direct costs that arise from:
 - administering the regulation [½]
 - complying with it. [½]

These will normally be passed on ultimately to the end investor in the form of higher charges / dealing costs. [½]
- the indirect costs, such as:
 - an alteration in the behaviour of consumers, who may be given a false sense of security and a reduced sense of responsibility for their own actions [1]
 - an undermining of the sense of professional responsibility amongst intermediaries and advisors – who again may have less incentive to provide the best advice for the investor [1]
 - a reduction in consumer protection mechanisms developed by the market itself, as the providers of financial services know that consumers are protected by regulation against mismanagement or insolvency [1]
 - reduced product innovation – due to the additional costs of complying with the regulatory requirements [1]
 - reduced competition – again due to the additional constraints imposed by the regulations on the providers of financial services. [1]

The optimal level of regulation is that at which the marginal costs and benefits of regulation are equal. [1]
[Maximum 8]

(ii) ***Why different regulations might apply in the retail and wholesale markets***

- Institutional investors (who invest in the wholesale markets) will typically have access to a much greater level of information than personal investors (retail markets) ... [½]
- ...and will in any case normally have more investment expertise. [½]
- There is a greater level of risk of information asymmetries for individuals. [½]
- Consequently, there is usually a much greater regulatory requirement to ensure the provision of appropriate information in the retail market. [1]
[Maximum 2]

4

Introduction to financial products and customer needs

Syllabus objectives

- 2.2 Describe the main types of social security benefits and financial products and explain how they can provide benefits on contingent events which meet the needs of clients and stakeholders.
- 2.3 Explain the main principles of insurance and pensions that impact on these benefits and products.
- 2.4 Describe the ways of analysing the needs of clients and stakeholders to determine the appropriate benefits on contingent events to be provided by financial products.

0 Introduction

As a financially aware individual, if someone asks you what your financial needs are, you should be able to have a good attempt at providing an answer. For example, you might come up with the following financial needs:

- to pay off any debts owing
- to save for retirement
- to save for a house purchase or to pay off a mortgage
- to protect yourself / any dependants against sickness, death, unemployment *etc*
- to protect your household contents against theft.

It comes as no surprise that, for each of the needs identified above, financial providers have developed just the products to meet these needs!

A whole range of benefits is available, which can be categorised into:

- **benefits on events that are unpredictable – both whether and when they might occur**
- **benefits on events certain to occur, but unpredictable in time**
- **benefits for immediate consumption**
- **benefits on events predictable in time**
- **benefits from the accumulation of disposable income and capital.**

This chapter, along with the next three chapters, give an overview of the different types of financial products that can be used to meet customer needs. This is mainly background reading. However, since most exam questions are based around one or other of these financial products, it is very important that you can grasp now the benefits / cover each product provides.

This chapter also covers the main principles of insurance and pensions that impact on the design of such financial products and benefit schemes.

If you don't feel comfortable with any of the financial products as you come across them, we recommend that you do one or more of the following:

- Get some basic information on the financial products from the internet. For example:
 - investments: <http://www.investopedia.com>
 - insurance products and pensions: <http://www.thisismoney.co.uk> and <http://www.moneyadviceservice.org.uk>
- Have a look at any pension scheme and insurance documents that you have in respect of yourself or your property.
- Read the money section in a quality weekend newspaper.
- Speak to other students or colleagues, or look at the ActEd discussion forum (see <http://www.acted.co.uk/forums>).

1 Types of provision

In some countries, the State provides certain benefits directly to its citizens ('social security'). Where these are at a low level, or not offered at all, individuals and organisations are often prepared to pay another party to protect themselves against the risk of certain events happening. The main types of:

- social security
- financial products
- contracts
- schemes
- transactions

fall into the categories described in the following sections.

These financial products are the basis for much of the remainder of the course. A general definition and very brief overview of these main categories is given in the rest of this chapter.

Exam Tip

Details of insurance and reinsurance products are given in an appendix. This provides a general indication and example of the types of product that the examiners may describe in examination questions. The examiners will not be testing detailed knowledge of the products but will expect candidates to be able to apply their understanding of principles to both these basic product types and to other products that may exist independently or where two or more of these basic contract types are combined as a package.

The 'appendix' mentioned in the Core Reading above is rather long and so has been included as the Core Reading in the next three chapters of the Course Notes, *ie*:

- the chapter on Benefits overview and providers of benefits
- the chapter on Life insurance overview and life products
- the chapter on General insurance overview and GI products.

2 Social security benefits

States vary considerably in terms of the type of benefits they offer to citizens, the amount of benefits offered, and whether or not the benefits are means tested.

A means test is an assessment to determine eligibility for benefits, for example, an individual may only be eligible for a specific benefit if they earn less than a certain level of income per year.

Alternatively the means test may be based on the level of an individual's assets or perhaps a combination of both income and assets.

Where means testing applies, there may be a financial disincentive to individuals to make alternative private provision. Citizens may or may not be required to contribute towards the costs of social security benefits. These benefits are subject to the political risk that the State may change or withdraw benefits in the future.

The main possible types of benefits offered are:

- **retirement pensions including survivor benefits**
- **medical care, for example, the National Health Service in the UK**
- **income support due to unemployment, illness, or disability**
- **housing support due to low income**
- **long-term care support.**

3 Financial products and contracts

3.1 Insurance contracts

Under insurance contracts, in return for a single payment (or a series of payments) the provider will pay an individual or any heirs an agreed amount (or series of amounts) that start or end on the occurrence of a pre-specified event. This event may happen to the individual, the individual's property or a third party.

The flexibility of the terms in this (admittedly rather long!) definition make it very general, incorporating a full range of insurance contracts. For example:

- Many long-term insurances (*eg* life, health) may have a series of premium payments. Shorter-term insurances (*eg* motor insurance, travel insurance) are more likely to have a single payment.
- Most insurances that are not contingent on life are paid to the insured individuals, whilst those contingent on life would normally be paid to the heirs.
- The 'series of amounts' widens the definition to include, for example, income benefits paid on the death of the insured life and long-term sickness or income protection benefits.
- Inclusion of the event happening to 'a third party' ensures that various liability insurances, *eg* employers' liability are encompassed by this definition.

We'll learn more about these specific types of insurance contracts in later chapters.

3.2 Reinsurance contracts

A provider of insurance may not want to retain all of the risks that it has accepted from individuals or companies. Instead the provider can pass (cede) some of this risk to a reinsurer in return for paying an appropriate reinsurance premium.

Providers of insurance products can pass some of the risks that they take on to third parties through reinsurance contracts. Risk transfer is covered in detail later in the course.

4 Pension schemes

A pension scheme involves the accumulation of funds, which are paid out on a later event; usually retirement, but the event may also be death or early withdrawal from the pension scheme.



Question

Outline the needs of customers that may be met by pension schemes.

Solution

Pension schemes meet the need:

- to accumulate assets to provide an income in retirement
 - to increase this income in real terms in order to maintain standard of living
 - to protect against the financial impact of the death of the member, both before retirement (*eg* lump sum death benefits) and after retirement (*eg* spouse's pension)
 - to accumulate assets for other reasons (*eg* lump sum at retirement to contribute to paying off mortgage loans).
-

5 Investment schemes

Investment schemes involve an individual paying a single payment or a series of payments to a provider with the expectation that a higher amount will be paid back at a later date.

Again, the generality of the definition enables it to incorporate a wide range of investment schemes. It therefore embraces:

- savings products offered by insurance companies, *eg* a unit-linked savings plan
- collective investment schemes such as investment trust companies and unit trusts.

These products will be covered later in later chapters.

6 Derivatives

A derivative is a financial instrument whose value depends on the value of other investments (eg shares, bonds) or variables (eg interest rates, exchange rates).

Providers of financial products, schemes, contracts and transactions can pass some of the risks that they take on to third parties through reinsurance contracts.

As with reinsurance, derivatives can also be used to pass risk to a third party. Derivatives are discussed in more detail in a later chapter.



Question

An investor holds shares in a big supermarket chain. Describe how the investor can protect himself against the risk of a fall in the value of these shares, using derivatives.

Solution

The investor could:

- sell a futures contract on the supermarket shares, *ie* enter into an agreement to sell the shares on a specified future date at a price agreed now
 - buy a put option on the supermarket shares, *ie* give himself the right, but not the obligation to sell the shares on a specified future date at a price agreed now.
-

7 Insurance principles

There are three main principles of insurance and pensions that impact on the design of financial products and the benefits that can be provided from such products.

These are:

- the existence of an insurable interest
- pre-funding of the risk
- pooling of risk.

7.1 Insurable interest

In most countries, an insurance contract is only valid if the person taking out the contract has a financial interest in the insured event. This is primarily to prevent moral hazard, fraud, and other crime.

In other words the policyholder has an interest in the claim event not happening and will not (in theory) encourage it to happen. Moral hazard is the idea that the policyholder behaves differently (in a way that may increase the likelihood or size of a claim) because they have insurance in place.

For example, if an individual could insure a building in which they had no interest against fire, then they could raise money from the insurance company by setting fire to the building.

Individuals are generally assumed to have unlimited financial interest in their own lives, and the lives of spouses and dependent children, but other financial interests are limited in amount to prevent overinsurance.

7.2 Pre-funding

The key principle of insurance and pensions is that individuals or corporate bodies put money aside in advance of the occurrence of an uncertain risk event. The uncertainty might relate to:

- whether the event will happen at all, such as the risk of fire or flood
- the timing of a certain risk event, such as life expectancy
- the cost of an event that is certainly going to occur.

The key issue for the individual or corporation is how much money is needed to provide a given level of benefit with the desired probability. This will depend on:

- the probability of the risk event occurring
- the amount that the risk event will cost, and
- the return that can be earned on the pre-funded money before the risk event occurs.

We will learn about pricing insurance contracts later in the course. The premium charged will reflect the 3 points in the bullet point list above.

The individual will also have a risk tolerance – how comfortable they are with the probability of their desired outcome not being achieved.

7.3 Pooling of Risk

As an alternative to financing benefits directly for themselves, individuals may group together and pool their finances. This approach will help to protect the individuals against some of the uncertainties that may exist in the cost of financing the benefits. It may also lead to more cost-effective provision than if each individual made their own financial provision.



Question

Explain why such group provision may be more cost-effective.

Solution

It may be more effective as there can be benefits of economies of scale in:

- provision (*eg* sharing of fixed costs)
 - administration costs
 - investment (as there is a larger pool of assets to invest).
-

Retirement communities

A trade union, an employee association, or a community or religious organisation may be a way in which individuals can group together to form such a pool. An approach that is common in the USA is the establishment of retirement communities. These originated as religious organisations into which members would contribute their available assets in return for lifetime care.

More recently the idea has developed to provide different levels of continuing care (including housing) according to the levels of initial and annual contributions. Continuing Care Retirement Communities (CCRCs) have also started to be established outside the USA.



Question

Explain why the provision of such long-term care is less of a concern in many less developed countries.

Solution

Life expectancy may be shorter than in developed countries. If this is the case then a smaller proportion of the population will reach old age and therefore fewer will require long-term care, or at least require it for a shorter period of time. In addition, family structures are often strong with higher fertility rates. This results in a greater burden of care being placed on the family.

Microinsurance

Various microinsurance examples exist, for example basic life and health insurance in deprived communities in developing countries.

These policies offer basic benefits at a low premium, the insurer can benefit from pooling large volumes of such business.

8 Analysing stakeholders' needs

8.1 Logical or emotional needs

This section refers to two possible approaches to establishing a customer's needs:

- a logical approach of systematically and carefully working out what needs a customer has and fitting products to these needs
- an emotional approach, which plays more on what an individual feels is needed.

Note that these two approaches can lead to identification of some of the same needs.

It is important to differentiate between the emotional needs and the logical needs of the customer. If the customer's emotional needs are met, they may get what they want rather than what they really need.



Question

Give four examples of emotional needs.

Solution

Examples of emotional needs include:

- **an individual may believe they have a need to generate additional income in retirement from investment capital. However, this may be an emotional need. On analysis, it may be that the customer's expenditure levels will fall on retirement and that the level of additional income required may be very much lower than perceived.**
- spending money today on enjoying oneself (in preference to protection or savings), *eg* on gambling or going on a spending spree
- providing overly generous death benefits for dependants
- emotional needs also include wanting more benefit than is needed.

The logical needs approach involves establishing the customer's needs, analysing them, prioritising them and fitting the benefits or products provided to those needs. Thus there is reconciliation between the products and the needs.

The process of analysing and prioritising financial needs is called a *fact find* and is often carried out by a financial adviser.

A customer's logical needs can be analysed as follows:

- maintaining a current lifestyle
- protection, eg against death, loss, illness or accident
- accumulation for a known purpose, eg an income in retirement, repayment of a mortgage
- accumulation for a purpose as yet unknown out of any remaining disposable income or capital.

This may involve taking advantage of any tax-efficient arrangements available.

8.2 Current or future needs

It is also necessary to determine whether the customer's needs are current or will arise in the future.

A *current* need is one that has an immediate effect on the customer's circumstances. For example, what would happen if they developed a condition that meant they were unlikely to work again?

A *future* need may be one that relates to a customer's future aspirations, for example, to retire at age 55 or to pay off a mortgage at a particular date.

Some needs may be both current and future. For example, for someone in retirement, the need to maximise returns earned on capital to provide income while at the same time protecting the value of the capital from the effects of inflation over time is both a current and future need.



Question

You are dining out with friends one evening and the conversation turns to a discussion of your financial needs. Outline your financial needs and whether they are current or future.

Solution

Clearly financial needs will vary from person to person. Typical needs for a young professional include:

- day-to-day living costs – current
 - paying off student debts – current
 - saving towards future needs, such as the deposit to buy a home or to repay the capital under a home loan – future
 - repayment of loans to meet cost of buying home – current
 - protection for any dependants should earner(s) become sick or die – current
 - starting to save for retirement – future
 - spending money being sociable – current.
-

8.3 Attitude to risk

In many cases stakeholders' needs will be greater than the money available to both fulfil those needs and to provide finance for the desired current lifestyle. These are the most difficult circumstances where the individual needs to make hard decisions.

A key feature of the individual's decision will be their attitude to risk:

- A risk-averse individual will prefer protection against future events even at the expense of a worse immediate lifestyle.
- A high-risk individual will prefer to work on the assumption that rare events will not happen to them, and will prefer to address such events when they occur. In the meantime they will use the money saved by not making provision to enhance their immediate lifestyle.

It is important that the options and consequences of each possible course of action are clearly set out so that the individual can consider them in detail.

Chapter 4 Summary

Benefits

Benefits can be categorised as:

- benefits on events that are unpredictable – both whether and when they might occur
- benefits on events certain to occur, but unpredictable in time
- benefits for immediate consumption
- benefits on events predictable in time
- benefits from the accumulation of disposable income and capital.

Types of provision

The main types of provision fall into the following categories:

- social security
- financial products
- contracts
- schemes
- transactions.

Social security benefits

The benefits offered by the State vary significantly by country. Such benefits may be means tested. The population is at risk from the State changing or withdrawing future benefits.

Insurance contracts

Under insurance contracts, in return for a single payment (or a series of payments) the provider will pay an individual or any heirs an agreed amount (or series of amounts) that start or end on the occurrence of a pre-specified event. This event may happen to the individual, the individual's property or a third party.

Reinsurance contracts

These are used by providers to pass on some of the risk they take on.

Pension schemes

A pension scheme involves the accumulation of funds paid out on a later event, for example retirement, death or withdrawal from the scheme.

Investment schemes

Investment schemes involve an individual paying a single payment or a series of payments to a provider with the expectation that a higher amount will be paid back at a later date.

Derivatives

A derivative is a financial instrument whose value depends on the value of other investments (eg shares, bonds) or variables (eg interest rates, exchange rates).

Insurance principles

There are three main principles of insurance:

- insurable interest
- pre-funding
- pooling of risk.

Continuing care retirement communities and microinsurance are examples of pooling of risk.

Customer needs

It is important to differentiate between a customer's:

- logical and emotional needs
- current and future needs.

A customer's logical needs can be analysed as follows:

- maintaining a current lifestyle
- protection
- accumulation for a purpose
- accumulation for a purpose as yet unknown.

Emotional needs are not identified in such a methodical way but are the result of what a customer thinks is needed or wants (rather than needs).

A current need is one triggered by an event that has an immediate effect on a customer's circumstances, eg protection against sickness.

A future need may be one that relates to a customer's future aspirations, eg to retire at a certain age.



Chapter 4 Practice Questions

- 4.1 Jenny was a bright student who obtained her degree at the age of 20 and who left university with no debts. She was lucky enough to be able to afford her first house by the age of 25 and married Jim on her 29th birthday. They had no children. The couple retired at age 60 and they are now living in Dorset, retaining their healthy dispositions at the ripe old age of 80.

By completing the following table:

- (i) describe Jenny's most important financial need at each age range indicated
- (ii) categorise the needs you have described into current or future
- (iii) state the broad type of financial product / scheme / contract that might best meet each of the needs you have identified.

An example is given in the table for Jenny's teenage years.

	Financial need	Current or future need	Meeting the need
Teenager	Purchasing a bike	Current need. Immediate consumption.	Bank savings account.
18–21			
21–30			
31–60			
61+			

4.2 As the marketing manager of a well-established insurance company, you have been invited to consider developing a tailored product to meet the needs of the membership of a large trade union.

Exam style

Describe how you would ensure the needs of the union's members are met by the benefits of any proposed product range. (You do not need to state the possible outcomes, but you should justify the need for each step in the process.) [7]



Chapter 4 Solutions

4.1

	Financial need	Current or future need	Meeting the need
18–21	Saving for the future.	Future need. Accumulation for a purpose as yet unknown.	Savings account.
21–30	Saving for deposit and then repayment of mortgage.	Future need. Accumulation for a known purpose. Protection against death <i>etc.</i>	Interest only loan together with endowment to repay capital at maturity or on earlier death ...Or ... repayment loan together with decreasing term assurance.
31–60	Saving for retirement.	Future need. Accumulation for a known purpose.	Membership of an occupational pension scheme or purchase of a personal pension policy.
61+	Paying for health and care needs.	Current need. Protection.	Health insurance and/or long-term care insurance (if available, affordable) or liquid savings and investments.

4.2 The process would be as follows:

Identify the stakeholders

- Develop a list of the distinct stakeholder groups where the members of each group have similar needs. [½]
It may be the case that the union covers a number of different industries or sectors, each with differing needs and requirements. [½]
- Consider the position of each group and identify their particular needs. [½]
The products proposed will need to target the needs of the customers in order to be attractive and successful. [½]
Each product will need to be simple in terms of meeting a small number of the identified needs. [½]

Classify the needs

- Differentiate between the logical and emotional needs approach to analysing needs. [½]
The logical needs approach determines needs as the result of analysis and prioritisation. [½]

Logical needs can be analysed in terms of:
 – maintaining current lifestyle [½]
 – protection [½]
 – accumulation for a known purpose and [½]
 – accumulation for a purpose as yet unknown. [½]
 The emotional needs approach may result in members getting what they want rather than what they really need. [½]
 This might be an irrational approach. However it may be important to consider it in order that members feel their feelings are being considered. [½]
- Current and future needs should be distinguished. [½]
Current needs are those that could have an immediate impact on a member's life, *eg* illness, death. [½]
Future needs relate to future aspirations, *eg* saving for retirement. [½]
This is necessary to ensure that *all* needs are identified and that, for example, the focus is not only on highly apparent immediate needs. [½]

Prioritise the needs

- For each group, prioritise the needs that have been identified, perhaps using the hierarchy of logical needs (above). [½]
This ensures that the products address the most important needs in preference to meeting subsidiary needs, thus providing value for money. [½]

- In particular, prioritise the needs identified using the logical needs approach over the emotional needs approach. [½]
[Maximum 7]

End of Part 1

What next?

1. Briefly **review** the key areas of Part 1 and/or re-read the **summaries** at the end of Chapters 1 to 4.
2. Ensure you have attempted some of the **Practice Questions** at the end of each chapter in Part 1. If you don't have time to do them all, you could save the remainder for use as part of your revision.

Time to consider ...

... 'learning and revision' products

The first X1 Assignment can be attempted once you have studied parts 1 and 2 of the course. You may want to consider marking for your assignments.

Marking – Recall that you can buy *Series Marking* or more flexible *Marking Vouchers* to have your assignments marked by ActEd. Results of surveys suggest that attempting the assignments and having them marked improves your chances of passing the exam. Students have said:

'The marking was extremely useful. It gave detailed comments on where I lost marks, how to improve exam technique and how to get the balance of breadth and depth right. This was exactly what I was looking for - thank you!'

'The feedback on individual questions was excellent, and acknowledged the areas I did well on and made very good suggestions on where I went wrong and what I could do to improve. It was tremendously helpful to go through the marked script and know the areas which required further work and those where I was doing very well.'

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5

Benefits overview and providers of benefits

Syllabus objectives

- 2.1 Describe the main providers of benefits on contingent events.
- 14 Have an understanding of the principal terms used in financial services, investments, asset management and risk management.

(Covered in part in this chapter.)

0 Introduction

This chapter starts with an introduction to the world of pensions in Section 1. If you work in pensions you should be able to speed through this early material. If you work in another actuarial area you should spend more time familiarising yourself with the concepts.

In Sections 2 to 6 we look at the roles and objectives of the key providers of benefits for individuals. A provider of benefits may *sponsor* the benefit or simply provide the *vehicle* for the benefit (eg a pension scheme, savings scheme or insurance contract).

The key providers are:

- the State
- employers
- individuals
- financial institutions
- other organisations.

Exam Tip

Sections 2 to 6 of this chapter are excellent for idea generation in the Subject CP1 exam. Most exam questions involve one of the five providers above.

For example, when you see the words 'the State' or 'the Government' in an exam question you should be linking these words with certain ideas – namely the roles and objectives of the State / Government, which are introduced in this chapter.

1 An introduction to benefit schemes

The idea of this section is to give you a taste of the key concepts in the world of benefits. The comments are framed around a pension scheme, although similar concepts would apply for other types of benefit scheme.

1.1 Key features of pension contracts

The key features of pension contracts are they:

- are primarily used as a means of providing income in retirement for individuals and possibly their dependants
- may provide other benefits, for example a lump sum payment to dependants if an individual dies before retirement
- may have options to change the form or timing of the benefit, for example an option at retirement to exchange a proportion of the pension payments for a cash payment
- are long-term arrangements.

1.2 Who provides pensions?

Pensions may be provided by a range of providers (more on this later in the chapter). In particular they can be provided by the State or through the private sector, via:

- occupational schemes – schemes offered by employers to their employees, where the employer usually pays a substantial percentage of the cost of providing the benefits
- personal pension plans or arrangements – usually purchased from an insurance company by an individual.

1.3 Types of pension scheme member

Scheme members can be divided into three types:

- actives – members still earning future pension benefits over time, *eg* a current employee of the sponsoring company
- deferred members – members who have stopped earning any future benefits but who have an existing benefit entitlement that will come into payment in the future, *eg* an employee who used to work for the sponsoring company but has now left to work for another company
- current pensioners – members who are receiving their benefit entitlement.

1.4 The main types of pension scheme

The three types of pension schemes that are discussed in Subject CP1 are:

- defined benefit schemes
- defined contribution schemes
- defined ambition schemes.

Key information

The type of scheme drives the type of benefit provided and where the risks lie, *ie* primarily with the member or primarily with the scheme sponsor.

State-sponsored and occupational pension schemes can be defined benefit, defined contribution or defined ambition in nature.

Personal pensions are almost always defined contribution in nature.

In the next three sections we'll look at these types of arrangement in turn.

1.5 Defined benefit schemes

A defined benefits scheme is one where the scheme rules define the benefits independently of the contributions payable, and benefits are not directly related to the investments of the scheme.

The scheme may be funded or unfunded.

Benefits will be defined by a set formula, and might be linked to, for example:

- how long the member works for the sponsoring company
- the member's salary at retirement.

A final salary scheme is a common example of a defined benefit scheme.



Question

A member of a defined benefit scheme is entitled to a pension from retirement of 1.5% of final salary for each year of service with the company.

The member is about to retire on a salary of £25,000 having worked for the company for 20 years, calculate the annual pension entitlement.

Solution

The annual pension at retirement is:

$$1.5\% \times 20 \times 25,000 = \text{£}7,500$$

The pension will:

- remain at this level throughout retirement if the scheme does not offer pension increases
- increase over time if the scheme offers pension increases that may be fixed, index-linked or discretionary.

Note that 1.5% or $\frac{15}{1000}$ is known as the *accrual rate* of the scheme.

1.6 Defined contribution schemes

A defined contribution scheme is one providing benefits where the amount of an individual member's benefits depends on the contributions paid into the scheme in respect of that member, increased by the investment return earned on those contributions.

The member may have some choice as to which asset classes their contributions are invested in. Note that the pension is not defined and will depend, for example, on the investment returns achieved by these assets.

The member will need to use the accumulated fund at retirement to meet their post-retirement needs. The member may have a choice at retirement (dependent on regulation) as to how to use the fund. For example, the member might choose:

- to secure a pension with a life insurance company by purchasing an immediate annuity. (Alternatively, for an occupational scheme, the pension may be provided directly by the employer.)
- to move the accumulated fund to an income drawdown product, where the fund remains invested and the member draws a regular income. We will learn more about this life insurance product in a later chapter.
- to take the money as a lump sum cash amount (although there may be tax implications associated with this approach).

In the UK, as of April 2015 new pension freedoms were introduced meaning that individuals retiring from a defined contribution arrangement are no longer required to purchase an annuity, but can take as much of their accumulated fund (subject to tax) as they wish as a lump sum.



Question

An individual aged 60 exactly is making savings of £5,000 each year on his birthday into a defined contribution scheme. Pre-age 60 he has already saved £100,000 and will retire at age 65 at which point he plans to purchase an annuity. His investments earn a return of 5.5% *pa*.

Calculate:

- (i) his accumulated fund at age 65 (note that he won't make a contribution on his 65th birthday, the day he retires!)
- (ii) the annual pension he can buy if the annuity rate is 16 (in other words if it costs £16 to buy a pension of £1 *pa* for the rest of life).

Solution

- (i) **Accumulated fund**

$$\begin{aligned}
 &100,000 \times (1.055)^5 + 5,000 \times (1.055)^5 + 5,000 \times (1.055)^4 + \\
 &5,000 \times (1.055)^3 + 5,000 \times (1.055)^2 + 5,000 \times (1.055) \\
 &= £160,136.
 \end{aligned}$$

- (ii) **Annual pension**

$$\frac{160,136}{16} = £10,009 \text{ pa.}$$

1.7 Defined ambition schemes

A defined ambition scheme is one where risks are shared between the different parties involved, for example scheme members, employers, insurers and investment businesses.

The range of alternative types of such schemes is very wide.

Examples of defined ambition schemes that are more defined benefit in nature include:

- Cash balance schemes, where a defined lump sum is provided at retirement as opposed to a defined pension through retirement.
- Schemes where the retirement age is increased for future service in light of increasing longevity.

In this case, the variable retirement age means that the post-retirement longevity risk is transferred from the employer to the member.

- The greater use of risk management options such as investments that transfer longevity risk (longevity swaps & bonds) and insurance company investments.

In this way the risk is shared between the employer and the provider of the investment (usually an investment business or insurance company).

Examples of defined ambition schemes that are more defined contribution in nature include DC schemes that offer minimum investment guarantees or minimum retirement income guarantees.

Defined ambition schemes aim to offer the best of both worlds to members, although administration may be complex and members may not fully understand their operation.

1.8 Who bears the risks?

The type of pension scheme is the main determinant of who primarily bears the risks.

These risks inevitably result in either the benefits received being less than expected, or the cost of providing these benefits being greater than expected.

The key risks relate to investment, increasing longevity after retirement and expenses.



Question

Explain who the investment, longevity and expenses risks predominantly lie with in the following scenarios. (Each arrangement is an occupational scheme and the cost is met solely by the employer.)

- (i) a defined benefit scheme
- (ii) a defined contribution scheme
- (iii) a defined ambition scheme, where the main benefit is defined contribution in nature but there is a promise that the pension won't be less than 1% of final salary per year of service at retirement.

Solution

- (i) In a defined benefit scheme, the members' benefits are promised and independent of investment return, longevity and administration expenses. The risks therefore lie primarily with the employer. For example, if investment returns are poor or members are living longer than expected, then the employer needs to pay more money into the scheme in order to be able to provide the benefits.
- (ii) In a defined contribution scheme, the risks lie primarily with the members. For example, if investment performance is poor then each member's accumulated fund will be smaller than expected and hence the annual pension lower than expected.

If an annuity is purchased at retirement then longevity risk passes to the annuity provider at this time (although annuity rates will reflect the annuity provider's views of future life expectancy). If an annuity is not purchased then longevity risk remains with the member.

Expenses risk may lie with the employer or the members depending upon whether the expenses are met separately by the employer or are met from charges taken from the accumulated fund.

- (iii) Investment, longevity and expense risk will be shared between the members and the employer:
- to the extent that experience is poor but the pension would still be greater than 1% of final salary for each year of service, then the risk lies with the members
 - once experience sinks to a level where the defined contribution pension is less than 1% of final salary for each year of service, then the risk is also taken by the employer.
-

Other key risks include:

- credit risk, *eg* failure of a counterparty such as an insurer
- operational risk, *eg* fraud, systems failure, regulatory changes.

1.9 Investment strategy

The pension scheme will need to consider the characteristics of its liabilities, in particular the nature and term, when determining the investment strategy. The term of the liabilities could be very long.

For example, a *defined benefit* scheme may need a mixture of:

- fixed-interest bonds to match benefits guaranteed in monetary terms
- index-linked bonds and equities to match benefits guaranteed in real terms (for example linked to price inflation or salary growth) and expenses
- some cash, for liquidity to meet immediate pensions and expense outgo and uncertain outgo, for example any death benefits.

For a *defined contribution* scheme, the member may have investment choices.

It may be more difficult to determine an appropriate strategy for a *defined ambition* scheme dependent on the benefits offered by the scheme.

Pension schemes often receive generous tax breaks relative to other investors, which can influence investment choice.

The investment strategy of a pension scheme is also constrained by regulation, which can restrict or prescribe what the scheme invests in.

1.10 Paying for the pension scheme

Defined benefit schemes

The cost of providing all of the benefits is not known with certainty until all the benefit payments have been made. There may be some flexibility as to when the money is set aside to pay for members' benefits.

At one end of the scale, no money may be set aside in advance and the money found just as each benefit payment is made – this means the scheme is unfunded and the benefits are being financed on a *pay-as-you-go* basis. This is how the Basic State pension works in the UK.

Alternatively, the scheme may be funded – this means money is set aside before the benefit payments are made and investment returns can be earned on this money. Most occupational schemes are funded. We'll examine the different ways of funding a pension scheme later in the course.

Defined contribution schemes

Money is almost always set aside gradually over the member's working lifetime. The timing of when money is paid into the scheme is key, since the money needs to be invested at the right time to earn the investment returns that will provide an adequate pension.

1.11 Provisioning

Defined benefit schemes

For defined benefit schemes it is a regulatory requirement to check that the scheme has enough assets to meet its liabilities on a regular basis.

The financial position of the scheme is expressed by the *funding level* of the scheme. This is defined as the value of the assets divided by the value of the liabilities.

Defined contribution schemes

Defined contribution schemes are not subject to the same regulatory valuation requirements. This is primarily because the value of the liabilities of the scheme (*ie* the fund value) is directly related to the value of the assets that the fund is invested in.

1.12 Setting contributions

Defined benefit schemes

The contributions need to be sufficient to meet:

- the cost of the future benefits being earned by scheme members
- any shortfall / surplus that has to be cleared because the funding level has fallen below / risen above an acceptable level.

Defined contribution schemes

The contribution rate will be defined in the scheme design. It may be age and/or service related and members may have some choice as to the amount they contribute.

2 Benefits providers

Benefits for individuals can be provided by:

- **the State**
- **employers or groups of employers**
- **individuals**
- **financial institutions**
- **other organisations.**

Financial institutions include insurance companies, banks and investment companies.

Other organisations include trade unions, employee associations and religious organisations.

An individual's need for any one particular benefit may be met by more than one party. Often employer-sponsored schemes and personal provision are designed to complement State provision or compensate for deficiencies in it.

For example, in the UK, the State provides universal emergency healthcare. As a result, employer-sponsored healthcare schemes typically provide for non-emergency care only. Individuals may supplement their needs from their savings or via purchasing private medical policies.

3 The State

3.1 Introduction to the roles of the State

The State has a major role in the provision of benefits. This may be through direct provision, through encouragement of provision, or through the regulation of provision from other providers.

The State is often the primary provider (sponsor) of:

- retirement benefits
- medical care
- unemployment benefits
- other welfare benefits, *eg* incapacity benefits.

The political, economic and fiscal viewpoints of the State will determine the precise roles that it will play.

However, the roles are likely to fall within the following categories:

- provide benefits to some or all of the population
- sponsor the provision of such benefits, perhaps by providing appropriate financial instruments
- provide financial incentives, usually through the tax system, either for other providers to establish appropriate provision, or to subsidise the cost of such provision to consumers
- educate or require education about the importance of providing for the future
- regulate to encourage or compel benefit provision by or on behalf of some of the population
- regulate bodies providing benefits, and bodies with custody of funds, in an attempt to ensure security for promises made, or expectations created.

In performing each of these roles, the State should also consider the whole picture to ensure consistency between the roles.

The next subsection looks at how each of these roles might be fulfilled by the State in relation to retirement benefits.

3.2 The roles of the State in relation to retirement benefits

Direct provision

In countries where life expectancy extends well beyond working age, retirement benefits are likely to be of high financial significance. Often they are not recognised as such by the potential recipients. The State is likely to play a large role in ensuring the population receives, or has the opportunity to receive, income after retirement.

The State may be unable to pass on the responsibility for the provision of retirement benefits completely to individuals. After all, many people will simply not earn enough money during their working lifetime to accumulate the capital required to provide an appropriate level of income in retirement. Passing on the responsibility to employers may help low-paid employees, but it will not alleviate the problems for the self-employed or the unemployed.

In developed countries, the State is often seen to have a responsibility for ensuring that all citizens receive a minimum level of income in retirement, *ie* the State acts as a 'safety net'. This might be achieved by means-testing the benefit, based on the individual's other sources of retirement income.

The State needs to bear in mind that the higher the level of direct provision that is made the higher the cost. This cost will need to be met in the long term by high taxation or may be met in the short term by government borrowing.

Sponsor the provision of benefits

For example, in the UK, all employers are required to provide a pension arrangement for their employees and to enrol employees earning more than a minimum amount into the scheme automatically, giving them an option to opt out rather than a requirement to opt in to the arrangement. To help small employers, perhaps with only one or two employees, the State has sponsored a pension arrangement 'NEST' (National Employments Savings Trust), which can be set up at no direct cost to the employer.

NEST is a defined contribution arrangement.

Provide financial incentives

In the UK, individuals making savings in most pensions schemes receive full tax relief on contributions and tax relief on most pension scheme investments. Some benefits are tax-free too.

Education

The State may undertake educational initiatives itself. Alternatively, it may impose regulations as to the minimum levels of information to be disclosed by pension providers (*eg* employers and insurance companies) to inform and educate pension scheme members.

Regulation to encourage or compel benefit provision

The State can choose either to encourage the population to make provision, *eg* via tax breaks for retirement or it can take stronger action and compel the population to make such provision.

The State could make provision compulsory by requiring:

1. that each individual joins an employer or individual scheme
2. a minimum level of contributions to be made or a minimum level of benefits to be provided by this employer or individual scheme.

For example, in 1981, the Government of Chile undertook radical reforms of its social security policy and introduced compulsory private-sector pension provision. It introduced a mandatory requirement for individuals to contribute at a minimum level to commercially run pension funds.



Question

Describe the advantages of the State legislating for compulsory pension arrangements.

Solution

Compulsory pension provision can:

- assist adequate pension provision if set at the correct level
- remove or reduce the burden on the State to provide pension provision
- lead to larger schemes with economies of scale in investment and administration
- avoid the need for financial incentives, thereby reducing the cost.

In many countries, certain classes of insurance are compulsory. These usually cover risks with low probability and potentially high payouts. In the UK and most developed countries, motor third party liability and employer's liability insurance are compulsory.

Regulation of other benefit providers

The State needs to strike a balance between:

- the degree of flexibility and freedom of action that they give to other providers (in order to encourage provision), and
- the need for regulation and supervision (to protect benefits and to ensure that any incentives are not abused).

Regulation may relate to marketing rules, benefit limits, reporting requirements, investment restrictions, security of benefits and rights of beneficiaries.



Question

Outline some possible ways in which the State might regulate personal pensions purchased by individuals from insurance companies.

Solution

The State might regulate the following areas of personal pensions provision:

- setting minimum and/or maximum contribution rates
- setting or limiting commission terms directly
- requiring those providing advice to be appropriately qualified
- limiting investment options
- setting a minimum and/or maximum amount of benefit
- setting terms for contracting out of the State provision (if that is allowed)
- preventing monopolies and encouraging competition
- setting maximum charges
- providing tax incentives or taxing contributions, investments and benefits
- setting a minimum and/or maximum retirement age
- limiting the form of any annuity that is purchased
- determining the method and assumptions to use in valuing / projecting the pension benefits.

Having discussed the roles of the State in relation to retirement benefits, Section 3 concludes by looking at some of the other benefits that the State might provide.

3.3 The roles of the State in relation to non-retirement benefits

The extent to which the State makes direct provision, educates the public, compels provision or encourages provision of non-retirement benefits depends on the perceived significance and importance to the individuals of the benefits. Benefits to protect individuals against loss or costs due to long-term ill health or to protect dependants on the death of an individual are often also considered important. The role of the State in relation to these benefits may, therefore, be very similar to that adopted for retirement benefits.

Many social security schemes provide benefits on death or disability. The benefits are often very low and only intended to cover essential outgo (eg funeral costs or basic living expenses) rather than to maintain living standards. If the State provides a small or a means-tested benefit, the individual or employer can often take out insurance to increase the benefits payable.

Governments may use education or financial incentives to encourage provision of other benefits.

For example, in the UK employers may operate life assurance schemes that provide life cover to their employees. Subject to certain requirements, the Government allows contributions and benefits to be paid tax-free.



Question

Outline some possible ways in which the State might regulate the cost and level of life assurance benefits.

Solution

The State might regulate the cost and level of life assurance benefits by:

- limiting the premiums that can be charged
- restricting distribution channels and commission payable
- setting a minimum and/or maximum amount of cover
- restrictions on the information that can be used for underwriting
- requiring that certain information is disclosed to the policyholder on sale
- restricting investments held
- requiring life insurers to demonstrate solvency on a regular basis
- preventing monopolies and encouraging competition
- requiring that staff and sales people are 'fit and proper'
- taxing benefits
- requiring life insurers to pay levies into a compensation scheme (which compensates the policyholder should a particular insurer fail).

3.4 The State as a provider of financial instruments

The State can also be the provider of financial instruments through which individuals can make their own provision for future benefits. For example:

- **direct investment in the National Debt (government securities)**
- **State-sponsored savings plans (National Savings in the UK)**
- **deposits with the State bank, or with local authorities.**

4 Employers

4.1 Introduction to the roles of the employer

Like the State, employers can play a role in educating and either encouraging or compelling their employees to plan benefit provision. However, perhaps the most significant role that can be played by employers is the orderly financing of benefits for their employees.

Another role that an employer may play is to provide a facility for the provision of benefits, *ie* a scheme. This may enable the employer to have greater control over the benefits being provided and the costs involved. Employer-sponsored pension schemes are common in many countries.

4.2 The roles of the employer in relation to the financing of benefits

Such financing may result from:

- **compulsion or encouragement from the State**
The State may offer tax incentives to employers to encourage provision.
- **a desire to attract and retain the services of good quality employees**
Employers may attract and retain good quality employees by:
 - providing benefits that employees *perceive* to be attractive
 - providing benefits that are at least in line with those offered by competing employers
 - rewarding certain classes of employees, *eg* loyal staff.
- **a desire to look after employees and their dependants financially beyond the level provided by the State**
- **pooling of expenses and expertise.**



Question

List the main criteria an employer should consider when introducing a scheme that covers ill-health, death and retirement benefits.

Solution

An employer's main criteria when introducing a benefit scheme should be:

- target level of benefits
 - type(s) of benefit (*eg* cash or pension)
 - who should be eligible to receive benefits
 - affordability of benefits
 - consistency between benefits
 - integration with the State benefits
 - definition of ill-health
 - financial incentives available
 - method of financing benefits
 - comparison with competitor schemes
 - relative popularity of the different benefits, and the needs of members.
-

Flexible benefit systems

In some countries employers provide a 'flexible benefit' system.

Flexible benefit systems are useful when it is inappropriate to provide all employees in an organisation with the same benefit package.

Employees have a choice between, for example, additional salary, additional pension benefits, additional holiday, enhanced death-in-service benefits and long-term sickness benefits. Each benefit is valued, and the employee has a notional sum of money to purchase benefits.

For example, an employer may offer a flexible benefit system in which employees will have a standard of 20 days holiday available, but have the opportunity to forego salary to 'buy' extra days of holiday or can 'sell' holiday back to the company for additional salary.

4.3 The role of the employer in relation to scheme provision

Single-employer schemes

The financing of a scheme could, subject to legislation, be shared between the employer and the employees who will receive the benefits.

A scheme where employees contribute as well as the employer is called a contributory scheme. If only the employer contributes towards the costs then the scheme is said to be non-contributory.

Multi-employer schemes

In some cases, these schemes are set up jointly with other employers, often from the same industry, as a means of making provision more cost effective.

In the UK industry-wide schemes are rare. (An example of an industry-wide scheme is the Merchant Navy Officers' Pension Fund.)

Industry-wide schemes are more prevalent and successful in Australia, where pension provision is largely compulsory, and in France.



Question

List the advantages of running industry-wide schemes.

Solution

Industry-wide schemes can provide:

- economies of scale and cost savings in investment and administration
 - increased mobility of the workforce between participating employers
 - a wider choice of benefits arising from larger schemes
 - a sense of identity for employees within the industry.
-

This use of multi-employer schemes leads to a need for greater care in allocating the liability for funding defined benefits, particularly in the event of the insolvency of one of the sponsors. Fund segregation is usually important in reducing such problems.

Fund segregation means holding the pension scheme's investments separate from the company, usually overseen by trustees.

5 Individuals

5.1 The role of individuals

Like employers, the main role that individuals can play in the provision of benefits is in financing the benefits. This may result from compulsion or encouragement from either the State or an employer or a personal desire for larger benefits for themselves or their dependants than are provided by either the State or an employer.

The financing may be through a formal benefit based scheme, which may be operated by the State, an employer, an insurer or another financial organisation. Alternatively it may be by way of non-specific individual savings, through the accumulation of property, or by way of financial support from families or local community schemes.

The method most appropriate for individuals to use depends on their specific needs, the resources they have available, and external factors such as the taxation regime that applies to them.

In many cases the State can steer individuals toward a preferred method of making provision for themselves through tax legislation. Tax relief can be given on contributions to certain types of financial product and different tax treatments can be applied to the benefits resulting from financial products. Employers may also incentivise employees to contribute more by matching employee contributions up to certain limits.

For example, a defined contribution scheme may offer matched contributions, *ie* up to a limit of 5% of salary. Matching contributions encourages employees to make contributions, with the cap of contributions protecting the employer from unacceptably high costs.

5.2 Domestic property as an investment

In countries such as the UK, where domestic property tends to be owner-occupied rather than leased, both the capital value of the home, and also the accumulated equity in it are important sources of finance for future benefits. To provide finance, loans can be secured on the accumulated equity in the home.

An anticipated capital sum through inheritance of a domestic property can form a major part in financial planning. However increasing longevity is a significant risk as it may result in funds not being available at the expected time or not available at all if care costs need to be met.

6 Financial institutions and other organisations

6.1 Financial institutions

Where an employer and/or an individual is looking to provide benefits of some form they often do this through products sold by financial institutions such as life insurers, general insurers, banks, investment houses etc.

In some cases the individual is aware of their future needs and can make plans appropriately. In other cases the institution is proactive in drawing the individuals' attention to their needs and the consequences of not making adequate plans.

6.2 Other organisations

Other organisations such as trade unions, credit unions and charities can also advise individuals of the need to make provision for their financial future. Many of these can act as financial intermediaries or as introducers to providers of financial benefits.

Increasingly, 'microinsurance' approaches are being used to provide benefits to lower-income individuals otherwise ignored by mainstream commercial and social insurance schemes, as well as persons who have not previously had access to appropriate insurance products.

Microinsurance involves the insurer selling very simple products, with a lower expected premium than traditional insurance business. The distribution model may also differ, and the insurer could distribute products making greater use of digital technology to reach a broad market at low cost.

Chapter 5 Summary

Type of scheme

Defined benefit – the scheme rules define the benefits independently of the contributions payable, and benefits are not directly related to the investments of the scheme. The scheme may be funded or unfunded.

Defined contribution – the scheme provides benefits where the amount of an individual member's benefits depends on the contributions paid into the scheme in respect of that member, increased by the investment return earned on those contributions.

Defined ambition – a scheme where risks are shared between the different parties involved, for example scheme members, employers, insurers and investment businesses.

Benefit providers

Benefits may be provided by:

- the State
- employers
- individuals
- financial institutions
- other organisations.

State

The major roles played by the State are:

- direct provision of benefits, *eg* on retirement, death, ill health
- sponsoring of the provision of benefits
- provision of financial incentives
- education
- regulation to encourage or compel benefit provision
- regulation of benefit providers.

The State can also provide financial instruments, *eg* the issue of bills and bonds, savings plans, deposits with the State Bank.

Employers

Employers have a variety of reasons for sponsoring benefit provision:

- compulsion or encouragement from the State
- the attraction and retention of good quality staff
- a desire to look after employees and their dependants
- to pool expenses and expertise.

Benefits can be provided through a formal employer-sponsored scheme. This can ensure a consistent approach across employees or help the employer target certain groups, *eg* long servers or high fliers. Such schemes could be set up to offer members a choice of benefits.

Organisations can tailor the benefits offered to employees using a flexible benefits system. Under a flexible benefits system, employees can trade in some of their existing benefits for other financially equivalent benefits.

Employer-sponsored schemes do not have to be backed by a single employer but can be sponsored jointly by many employers, *eg* industry-wide schemes.

Individuals

Apart from being beneficiaries, individuals also finance benefit provision. The motive for this can be:

- compulsion or encouragement by the State or employers
- the individual's personal preferences.

The provision can be formally structured savings plans, generated by the State, employers or other financial organisations. Alternatively, individuals can make informal unstructured arrangements.

Individuals may use domestic property as an investment to meet retirement needs or they may benefit from property through inheriting it.

Financial institutions and other corporations

The vehicle for providing benefits is often provided by financial institutions either via employer-run schemes or directly to individuals.

Institutions are also proactive in highlighting the need to individuals to make provision.

Other organisations such as trade unions, credit unions and charities can also advise individuals on provision.



Chapter 5 Practice Questions

- 5.1 Describe the key characteristics of defined benefit pension schemes and defined contribution pension schemes.
- 5.2 List the ideas that you should be associating with each of the following words, if they were to appear in an exam question:
- (i) the State / Government
 - (ii) an employer
 - (iii) an individual.
- 5.3 Describe the roles that may be played by the State in the provision of retirement benefits.
- 5.4 Identify reasons why an employer may provide benefits for its employees.
- 5.5 In a particular developed country, it has been proposed that State pension provision should be eliminated. Instead, pensions would have to be provided for all by individuals and employers through compulsory saving in the private sector.
- Discuss this proposal.
- 5.6 Explain how flexible benefit systems can meet the needs of:
- (i) employees
 - (ii) employers.
- 5.7 (i) Explain the demographic factors that have led to the cost of State retirement benefit provision increasing in many developed countries. [4]
- (ii) Suggest ways in which the State may respond to these increasing costs. [5]
- [Total 9]
- 5.8 A government has offered a flat-rate pension increasing in payment with national average earnings, payable to all citizens who have paid contributions to the social security system for at least 20 years of their working lifetime.
- Exam style
- In order to control costs, the government is considering amending the pension as follows:
- pension to be means-tested dependent upon an individual's level of other income
 - pension payable based on contributions being made for at least 30 years of an individual's working lifetime
 - the pension to increase with consumer price inflation.
- Discuss the merits of this proposal. [10]

5.9

Exam style

A country has a long-established State pension system. The main element of the system is a flat-rate pension payable in full from age 60 to all citizens who have contributed to the State social security arrangements for at least 20 years of their working lifetime.

The current amount of the full pension is €10,000 *pa*, and the pension has historically been increased in line with the increase in the national average earnings index for the country. The country also has a well-developed occupational pensions sector.

The State pension is funded from contributions from employers and employees on a pay-as-you-go basis (*ie* the current generation of workers' pay for the pensions of the retired population through taxes). The Government is concerned that the State pension is becoming increasingly difficult to finance and is unsustainable in the long term in its current form.

- (i) Explain how recent demographic trends may have led to the Government's concerns on financing the costs of the State pension. [4]
- (ii) Describe ways in which the total level of State pension outgo can be reduced and comment on other issues that the Government should consider. [8]

[Total 12]



Chapter 5 Solutions

5.1 A defined benefit pension scheme is one where:

- the scheme rules define the benefits independently of the contributions payable
- the benefits are not directly related to the investments of the scheme
- the scheme may be funded or unfunded.

A defined contribution scheme is one providing benefits where the amount of an individual member's benefits depends on:

- the contributions paid into the scheme in respect of that member
- the investment return earned on those contributions.

A defined contribution scheme will be funded.

5.2 Word association ideas:

- (i) *The State / Government* – provides (sponsors), provides (investment vehicles), educates, encourages, compels, regulates, economic and fiscal objectives, provide minimum standard of living, target needy, political popularity, means testing, control costs, economies of scale, simple administration, prevent fraud.
- (ii) *An employer* – provides (sponsors), provides (eg pension schemes), control costs, paternalism, attract and retain good staff, reward loyalty / high flyers, competition, comply with regulation, tax efficiency, simple administration, economies of scale, pool expenses, multi-employer schemes, flexible benefit systems.
- (iii) *An individual* – provides (sponsors), tax efficiency, simplicity, pooling of resources with other individuals, top up State / employer benefits, spend vs save.

5.3 The State has a role in:

- directly providing retirement benefits
- sponsoring the provision of benefits, eg by providing appropriate financial instruments
- providing financial incentives for other providers to establish provision or to subsidise the cost of provision to consumers
- educating the public about retirement provision
- encouraging or compelling private provision
- regulating private providers of retirement benefits.

The State can also be the provider of financial instruments through which individuals can make their own provision for future benefits. For example:

- government securities
- State-sponsored savings plans
- deposits with the State bank, or with local authorities.

5.4 Reasons include:

- It is compelled, or at least encouraged, to do so by regulation imposed by the State.
- The employer wants to act in a paternalistic way towards its employees ...
- ... in particular it may want to reward loyal or key staff, and care for those in need.
- It wants to attract and retain good employees ...
... and so offer benefits at least as good as key competitors.
- In order to benefit from economies of scale, *ie* it may be cheaper to provide benefits to employees through a pooled arrangement than for employees to make their own individual arrangements.
- The employer may be part of a multi-employer scheme that provides benefits.

5.5 The advantages of the proposal include:

- + It may result in an increased level of pension provision ...
... and a reduction in the level of poverty in retirement.
- + Coverage is universal.
- + It reduces the reliance on State benefits ...
- + ... freeing up funds to target other, possibly more urgent, causes.
- + Private provision may be more efficient / competitive, resulting in lower costs.
- + Compelling people to provide may be cheaper than encouraging as, for example, it will not be necessary to offer incentives.
- + It may generate demand for investments, stimulating financial markets.
- + Compelling people to provide for their own pensions can work in practice.
- + It may result in a reduction in the taxes that were traditionally used to finance the State pension benefits.

The disadvantages of the proposal include:

- Political unpopularity ...
- ... as the compulsion may be perceived as an extra tax.
- Some individuals may not be able to afford the contributions, *eg* the unemployed, carers or the low paid.

- Some employers may not be able to afford the contributions, *eg* small companies, forcing them to go out of business.
- The self-employed will also need special consideration.
- There will be difficulties in the transitional period and private provision will need to be phased in.
- There will be communication issues and a need to educate individuals and employers, which could be costly.
- The State will need to regulate the private provision.

5.6 (i) ***Meeting the needs of employees***

- allows employees to select from a menu of different benefit options
- different groups within the workforce (*eg* single, married, with dependants, without dependants, young, old *etc*) can select benefits appropriate to them
- benefit packages can be changed over time as personal circumstances change

(ii) ***Meeting the needs of employers***

- aids recruitment and retention of good quality staff
- the rewards package can be made attractive to different groups
- improves employee satisfaction as employees only get benefits that they value
- provides benefits to staff in a cost effective manner, *ie* there is less wastage as the employer does not have to pay for benefits that employees don't value
- introducing benefits can be done at little or no cost
- annual enrolment in the scheme which reminds employees of the value of the benefits they receive, hence improving employee appreciation

5.7 (i) ***Demographic factors that increase the cost of State retirement provision***

Changes in birth rates – periods of boom in the past, for example following the Second World War, and falling birth rates in more recent times. [1]

This means there will be an increased number of pensioners relative to the number of people in the working population. [½]

Increased life expectancy – people are living for longer in retirement, so the retirement pension has to be paid for longer. [1]

Changes to employment patterns – people are starting to join the working population later (as an increased number of people choose to pursue higher education) ... [½]

... and leave the working population earlier through early retirement. [½]

Both reduce the amount of contributions that are paid towards the pension. [½]

Earlier retirement can also lead to the benefit being paid sooner. [½]
[Maximum 4]

(ii) ***Dealing with the increasing costs of State retirement provision***

The State may decide simply to accept the fact that benefit costs are increasing, and just increase the level of contributions (taxes) collected from the working population to meet the cost. [1]

However, there may come a level of contributions at which it is no longer acceptable to the working population to increase the rate further. [½]

The State can look at reducing the cost of the benefits paid out by:

- increasing the retirement age so that benefits are paid for a shorter time [½]
- reducing the number of people who are eligible to receive the benefit, for example: [½]
 - only pay the benefit to those who have contributed for a certain number of years [½]
 - only pay the benefit to those still resident in the country in retirement [½]
- reducing the starting level of the benefit ... [½]
 - ... or a more politically acceptable solution may be to freeze the starting level of the pension (if normally it would increase year to year) [½]
- changing the benefit to be means-tested or increase the stringency of any means-testing carried out [½]
- reducing the level of pension increases awarded ... [½]
 - ... for example, if salary-linked increases are currently provided then reduce to price-inflation linked increases. [½]

Alongside any move to reduce the level of State provision, there will need to be steps to encourage or compel additional private provision ... [½]

... this might be achieved via tax incentives and regulation. [½]
[Maximum 5]

5.8 ***Exam Tip***

Try and break up big mark questions into subsections. In this question, it's a good idea to deal with each of the bulleted proposals separately.

Means-testing of benefits

This change will reduce the cost of State benefit provision – since some people (higher income) will no longer be eligible for the benefits. [1]

How large a proportion of the workforce is affected will depend upon the stringency of the means-testing. [½]

Such a change may be viewed as fair, *ie* it helps redistribute wealth ... [½]

... however some members of the population will be aggrieved if they have paid contributions but receive little or no benefit payment. [½]

In addition, people who have been prudent and set aside private pension income will be penalised and it may therefore discourage people from making their own provision. [1]

Means testing involves more complicated administration and increases costs. [½]

It also puts some people off applying for the means-tested benefits. [½]

Means testing can be seen as degrading (as it is an indicator of low income), which again discourages people from applying. [½]

The change will lead to inconsistent treatment across generations, *ie* current wealthy pensioners will receive higher benefits than future retirees who are affected by means-testing. [1]

Longer contribution period

A longer contribution period means:

- individuals contribute for longer ... [½]
- ... and individuals may be more likely to retire later, and hence receive benefits for a shorter period of time. [½]

Such a change needs to be considered against the demographics of the country to ascertain whether it is reasonable to expect people to contribute for 30 years. [1]

Certain groups in the population may not be able to contribute for this period of time, for example: [½]

- people who pursue higher education [½]
- people who take career breaks (*eg* maternity leave, carers) [½]
- people in occupations that typically have a low retirement age (*eg* the armed forces). [½]

The government may consider regulation to allow individuals to 'buy' missing years of contributions in order to qualify for a full State pension. [½]

Such a change will need to be phased in over a period of time; in other words it is unreasonable to expect those currently close to retirement to meet such a requirement. [½]

Consumer price inflation increases

This should reduce the cost of pension provision. This is because we usually expect consumer price inflation to be lower than salary inflation. [1]

The reduction in costs will occur gradually over many years. How significant the effect is depends upon the gap between salary and price inflation. [½]

There is a rationale to increasing pensions with consumer prices, since such increases should maintain the pensioner's purchasing power ... [½]

... however, the standard of living provided by the pension will be eroded compared to that of the working population. [½]

[Maximum 10]

5.9 (i) **Recent demographic trends**

The demographic factors that will affect the cost of the State pension are:

- falling birth rates which reduce the size of the younger working population [1]
- previous 'baby booms' have led to an increase in the size of the retired population [½]
- people are living longer and so collecting retirement benefits for much longer [1]
- retirement patterns are changing with more people leaving the working population through early retirement [½]
- working patterns are changing with more people starting work later, eg following a longer education. [½]

The combination of these will affect the ratio of retired population (receiving the benefits) to those in work (that are financing benefits). [1]

Many countries anticipate a demographic 'timebomb' where this ratio is increasing significantly. [½]
[Maximum 4]

(ii) **Reducing the level of State provision**

The total level of State pension outgo can be reduced by:

- increasing the age at which benefits can be drawn perhaps from 60 to 65, or higher ... [1]
... this will reduce the ratio of retired to working populations and benefits will be paid for less time overall [½]
- reducing the level at which the benefits increase, for example to be in line with price inflation rather than earnings increases ... [1]
... or by reducing the starting level of the benefit [½]
- toughening the eligibility requirements for the benefit to reduce the number of people who receive the benefit, for example by increasing the number of years required to qualify for a full pension ... [1]
... or by excluding people who do not meet the citizenship requirements of the country [½]
- introducing means-testing where the benefit is only paid to those who need it / who have other income below some threshold – this will reduce the number of people receiving the benefit [½]

- encouraging or compelling employers to provide more of the benefits to reduce the burden on the State – this may require certain incentives, *eg* tax incentives. [½]

Comments on the other issues that the Government should consider

The Government will need to think carefully about the political acceptability of any of the changes above and the consequences on its popularity. [½]

Any reduction in benefits will make people worse off and this is likely to be unpopular. [½]

Means-testing can act as a disincentive to save. [½]

Means-testing increases the costs of administering the scheme and makes it more susceptible to fraud. [½]

Means-testing may result in individuals failing to claim entitlements. This is because people may feel it is demeaning to claim benefits or may not understand the process. [½]

Changing benefits or eligibility may be expensive / complex to administer. [½]

The population will need educating as to the changes. [½]

Deferring retirement might increase other social security costs if people are not in employment. [½]

There may be an impact on employers if people stay in work longer because they cannot afford to retire until the State pension is paid. [½]

Consider the macroeconomic impact of any changes. [½]

[Maximum 8]

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6

Life insurance products

Syllabus objectives

- 2.2 Describe the main types of social security benefits and financial products and explain how they can provide benefits on contingent events which meet the needs of clients and stakeholders.

(Covered in part in this chapter.)

- 14 Have an understanding of the principal terms used in financial services and risk management.

(Covered in part in this chapter.)

0 Introduction

This chapter starts with an introduction to the world of life insurance. If you work in life insurance then you should be able to skim through this first section. If you work in other actuarial areas you should spend more time on it, familiarising yourself with the concepts.

The rest of the chapter introduces the different life insurance products. The Core Reading in this chapter forms part of the Core Reading 'appendix' described in [Chapter 4](#). As such, the following introduction to the appendix applies to all the Core Reading in this chapter:

The sections below provide a general indication and example of the types of contract that the examiners may describe in examination questions. The examiners will not be testing detailed knowledge of such contracts but will expect candidates to be able to apply their understanding of principles to both these basic contract types and to other contracts that may exist independently or where two or more of these basic contract types are combined together as a package.

1 An overview of life insurance

This section is designed to give a broad overview of the ideas that will be covered in Subject CP1 surrounding life insurance, particularly for students who do not work in life insurance and who may be unfamiliar with some of the concepts involved.

1.1 Contracts sold by life insurance companies

The key features of life insurance contracts are:

- They are often long term (*eg* insurance cover may be provided for 20 years say).
- There is typically only one claim (as death only occurs once for most of us)!
- The claim amount (or sum assured) may be known with certainty.
- They are used for protection against death or ill health, and for savings.
- They may be sold to individuals or on a group basis, *eg* to an employer to cover several employees.

There are 15 life insurance products discussed in Subject CP1. More on these in Sections 2 to 14 of this chapter.

Another subdivision of life insurance contracts is by investment type:

- without-profit
- with-profit
- unit-linked
- index-linked.

If you have studied earlier subjects, you should be familiar with the workings of these investment types. However, don't worry if you feel a little rusty on this area, we'll recap in Section 15 of this chapter.

1.2 Contract design

In designing a life insurance contract, a key consideration, particularly for proprietary companies (companies owned by shareholders), is profitability.

For a life insurance contract, profits are made up of the following items:

	Premiums net of reinsurance premiums paid
+	Investment income and gains
–	Claims (<i>eg</i> death, sickness, maturity, withdrawal) net of reinsurance recoveries
–	Expenses and commission
–	Increase in provisions (reserves)
–	Increase in the cost of capital
–	Tax
=	Profit

One item on this list that merits a reminder is the ‘increase in provisions’. Provisions are the amounts of money that an insurer must set aside now to meet future liabilities. So an *increase* in provisions represents an *outgo* to the insurer. As and when the benefits under the policy are paid, or as the liability reduces, the provisions are released. A *reduction* in provisions represents an *income* to the insurer.



Question

- (i) By considering the above items that make up a life insurer’s profit, list the assumptions, *eg* mortality rates, needed to project forward profits in each future year for a life insurer.
- (ii) Suggest other factors that should be considered when designing a life insurance contract.

Solution

- (i) Assumptions needed include:
 - premium rates per policy
 - sales volumes and mix of business
 - investment returns, *eg* bond yields, dividend yields and growth
 - expense levels
 - expense inflation
 - commission rates
 - mortality rates
 - morbidity rates

- withdrawal rates
 - separate assumptions to calculate the provisions (these assumptions may be more prudent than those used above), for example a valuation interest rate, valuation mortality rates
 - solvency capital requirements (see [Section 1.5](#))
 - tax rates
 - reinsurance premium rates and recovery rates.
- (ii) There are many factors to consider in designing a life insurance contract. Some of the key considerations are:
- meeting customer needs
 - the type of benefit offered – level, form (*ie* income or lump sum), options, guarantees, when it is payable
 - marketability
 - competition
 - financing requirements
 - simple administration
 - consistency with other products.
-

There is a later chapter in the Subject CP1 Course Notes on contract design.

1.3 Underwriting

Underwriting is a process used by the life insurer to decide the level of risk posed by a potential policyholder. As a result of underwriting, the policyholder may be charged a higher than standard premium, given a lower than standard benefit, or even declined insurance.

The most common form of underwriting for life insurance is *medical* underwriting, which can be done by asking questions on the insurance application form, such as sex, age, smoker status, weight, height, existing health conditions, family medical history *etc.*

If any of the information leads the insurer to believe that the applicant is riskier than average, or if the policy is a large one, further medical evidence may be sought.



Question

Suggest where the insurer could obtain further medical evidence from.

Solution

Further medical evidence could be obtained from:

- a report filled in from an applicant's medical records
 - a routine medical exam
 - specialist medical tests.
-

Underwriting will be discussed further in [Chapter 30](#), Other risk controls.

1.4 Setting premiums

Premiums for life insurance can be set by using either a formula or a profit-testing model. You should be familiar with both of these approaches from earlier subjects.

1.5 Provisioning

Once cover commences on a life insurance policy, the insurer is required, by regulation, to establish provisions. Provisions are the amounts of money that need to be set aside now to meet the future liabilities, *ie* benefits promised and the insurer's expenses.

Provisions may be calculated using different assumptions to those used in the formula or profit-testing approach for setting premiums. For example, the basis used for provisioning may be more prudent, as prescribed by regulation.

In addition to these provisions, the regulator may require the insurer to hold a minimum level of solvency capital to provide greater security that the policyholder benefits will be paid. We will look at the calculation of this solvency capital in greater detail later in the course.

1.6 New business strain and capital

Usually, in the first month of a life insurance contract, the insurer receives a premium, but has to pay out commission, initial administration and underwriting expenses, set up provisions and any required solvency capital. If the outgo is more than the income, this is called *new business strain*.

Therefore, in order to write new business, a life insurer requires some capital (free assets) to make up this difference. Gradually, over the term of the contract, the loss is recouped as, in subsequent years, the premium received is generally greater than the expenses that need paying, and the provisions and solvency capital released may be greater than the claim that is paid. This is because the sum of the provisions plus required solvency capital will have been set at a prudently high level to increase the likelihood that the claims can be paid.



Question

Suggest any other reasons why a life insurance company may need capital.

Solution

Other reasons a life insurer needs capital include:

- to cover unexpected events – for example, to cover adverse claim experience, or a mis-selling fine
 - to give investment freedom – the more free assets, the greater the ability to mismatch in pursuit of higher returns
 - to demonstrate financial strength – capital helps the insurance company to look strong, which encourages brokers and policyholders to place business with the company, and credit rating agencies to award a favourable rating
 - for opportunities – capital can be used for ventures such as mergers and acquisitions
 - to smooth dividends / bonuses
 - for development expenses – *eg* product development, advertising, marketing costs
 - to cover guarantees – contracts with guarantees tend to have more onerous provisioning requirements than contracts without guarantees.
-

1.7 Investment strategy

The insurance company will need to consider the characteristics of its liabilities when determining the investment strategy.

For life insurance companies this generally means holding:

- fixed-interest bonds to meet liabilities that are guaranteed in money terms, *eg* a death benefit of £100,000
- real assets (index-linked bonds, equities and property) to meet benefits that are inflation linked, *eg* a stream of index-linked annuity payments, and expenses
- equities and property to maximise returns, *eg* to provide for discretionary benefits such as some types of with-profit bonuses
- assets to match the *term* of the liabilities, which are predominantly medium- to long-term, but some shorter-term assets will be needed to meet immediate cashflow requirements, *eg* benefits in payment
- assets predominantly denominated in the domestic currency
- some derivatives to hedge guarantees and options.

The investment strategy of a life insurer is constrained by factors such as regulation (which can restrict what the insurer invests in), the size of the free assets (and therefore ability to mismatch) and the need to be tax efficient.

1.8 Key risks under life insurance contracts

Key risks to the life insurer include:

- mortality (too many deaths), longevity (living too long) and morbidity (sickness)
- investment risks, *eg* poor or volatile returns, falls in asset values, default risk
- expenses, not met by premium loadings or charges
- early withdrawals, before the initial expenses have been recovered
- new business volumes too high and hence new business strain, or too low and not enough business over which to spread the overheads
- credit risk, *ie* failure of a counterparty such as a reinsurer or a broker
- operational risks, *eg* fraud, systems failure, regulatory changes.

A range of responses and tools can be used to manage these risks, for example reinsurance. Responses to risk are covered in more detail later in the Subject CP1 Course Notes.

1.9 Monitoring experience

Monitoring experience is a crucial element of the actuarial control cycle.

Given the long-term nature of life insurance contracts, it is important that *incorrect* assumptions as to future experience are corrected as soon as possible so as not to continue to write business on unprofitable terms.



Question

List the items of experience that a life insurer should be monitoring.

Solution

A life insurance company should monitor any item of experience related to profits, *eg*:

- claim rates – mortality rates, morbidity rates
 - withdrawal rates
 - reinsurance premiums and recoveries
 - competitors' premium rates
 - investment returns
 - expenses
 - sales volumes and mix.
-

A life insurance company will be keen to break down any profits / losses into component parts to help understand the causes of profit / loss. This process is called an *analysis of surplus*. This is discussed further in [Chapter 37](#), Surplus and surplus management.

2 Life insurance products – an overview

The actual products or contracts discussed in this chapter are:

- pure endowment and endowment assurance
- whole life assurance
- term assurance, both level and decreasing
- convertible and renewable term assurance
- immediate annuity
- deferred annuity
- income drawdown
- investment bond
- income protection insurance
- critical illness insurance
- keyperson cover
- long-term care insurance.

For each of these products we consider:

- *Definition of benefits*
For each of the products you should know whether a benefit is paid on death, maturity, surrender or some other event (*eg* becoming ill).
- *Use of the product to meet customers' needs*
As part of your active study of this chapter, having read the description of a contract, consider what customer needs it may be used to meet. Then read on and compare your thoughts with the needs described.
- *Whether a group version exists*
As the name suggests, a group version of a contract is a contract that covers a group of lives! The group is specified (*eg* all employees of a particular company) but not necessarily the individuals within it.

Exam Tip

Make sure by the time of the exam that you can explain the 3 bullet points above for each of the products in the list at the top of the page.

3 Pure endowment and endowment assurance

3.1 Definition

A pure endowment provides a benefit on survival to a known date and hence operates as a savings vehicle, providing a lump sum on retirement, or a means of repaying a loan.

An endowment assurance also provides a significant benefit on the death of the life insured before that date and, in this case, operates also as a vehicle for providing protection for dependants.

In addition to the maturity and death benefits described above, the policyholder may be allowed to surrender an endowment assurance contract before maturity and receive a lump sum (surrender value) at that time, on guaranteed or non-guaranteed terms.

If the policyholder wishes to keep the contract in force but without paying further premiums, a reduced sum assured (paid-up value) may be granted.

3.2 Use to meet customers' needs

Endowment assurances are often used as a means of transferring wealth from, say, parents to children.



Question

Explain how you think an endowment assurance could be a more attractive means of transferring wealth than a non-insured savings method.

Solution

If the sum assured on death is chosen to be the same as at maturity, then the endowment assurance provides the guarantee that a substantial wealth transfer will be made whether or not the policyholder survives the intended savings period.

A non-insured savings method would simply have accumulated the contributions paid in by the date of death, and this could be very small (*eg* if the policyholder died after only a short time).

An endowment assurance is sometimes used as a means of repaying the capital on a loan (*eg* an interest-only mortgage). Where this is done, the borrower pays interest (only) to the lender during the term of the loan. The borrower also takes out an endowment policy, the proceeds of which are hoped to be sufficient to repay the original loan amount at the end of the loan term or on earlier death.

Another use of endowments is to provide a vehicle for saving money for retirement. We describe this use in more detail later, under the heading of deferred annuities.

An endowment assurance could come in without-profit, with-profit or unit-linked forms.

3.3 Existence of a group version

A group endowment assurance would enable, for example, an employer to provide benefits at retirement, and maybe also on death in service, in respect of his or her employees.

Group contracts usually arise as a way for an employer to provide some form of insurance cover or savings benefit to employees as part of their overall remuneration package. Group contracts might also be sold to 'affinity groups' (clubs, societies etc).



Question

Suggest problems with group arrangements where the workforce is highly mobile.

Solution

By mobile, we mean "the ability to change jobs frequently".

With a highly mobile workforce, the administration of such an arrangement would become costly. It might also result in poor surrender values for employees who leave after a short time, if the individual contracts have to be surrendered on leaving.

4 Whole life assurance

4.1 Definition

A whole life assurance will provide a benefit on the death of the life insured whenever that might occur.

Note that, unlike an endowment assurance, this policy has no fixed term. As with endowment assurances, a benefit may be paid if the policyholder chooses to withdraw from the contract, although the payment may be at the life insurance company's discretion. Similarly, there may be a 'paid-up policy' option.

4.2 Use to meet customers' needs

It is useful as a means of providing for funeral expenses or for meeting any liability to tax, such as inheritance tax or death duties, arising on the death of the life insured. It is a general purpose contract for providing long-term protection to dependants.

In the last respect a whole life assurance is particularly useful as a means of protecting some of the expected transfer of wealth that a parent would be aiming to make to his or her children when he or she died. Without the contract, the wealth transfer would be likely to be very small if the parent died young. Such contracts can also be a tax-efficient way of transferring wealth, at any age, depending on legislation (often reducing the liability to death duties or inheritance tax).

Without-profit contracts offer a guaranteed sum assured on death. On with-profit whole life contracts, the initial benefits may be increased by bonuses. A unit-linked version of the contract is also possible.

Under a unit-linked whole life contract, there is considerable flexibility in the level of death cover included, *eg* the benefit could be the maximum of the unit fund and the sum assured (a guaranteed minimum death benefit) chosen at outset by the customer.

Example

A unit-linked, regular premium, whole life contract might have the following features:

- Premiums: £20 monthly, payable in advance. Reviewable by the insurer every ten years.
- Allocation rate of premiums to units: 25% for first 18 months, 97% thereafter.
- Range of unit investment funds to choose from: bonds, equities, property.
- Sum assured: policyholder may choose (up to a maximum of £140,000).
- Death benefit: the insurer guarantees to pay the bigger of the unit fund and the sum assured, provided that the required premiums are paid.
- The cost of life cover to be met by cancelling units monthly. Each month the insurer will cancel units to the value of $\frac{q_x}{12} \times (\text{sum assured} - \text{unit value})$.
- Annual fund management charge: 1% of value of unit fund.
- Withdrawal is allowed at any time. Surrender value is the value of the unit fund.

A key element of the flexibility in the contract illustrated is the choice of level of life cover for a given premium.

At the maximum level of life cover there may be little unit fund left by the time of the first premium review after ten years, as the amount cancelled monthly to cover the cost of the death benefit will be high. As the unit fund is small, the death benefit would be the chosen sum assured, as the unit fund would never get larger than this amount.

At a low level of life cover the fund would be larger, unit cancellations would be much lower, and so a larger savings element would build up.

The policyholder is able to select the desired mix of savings and protection, and possibly able to change this mix as his or her needs evolve.

4.3 Existence of a group version

There would not seem to be a consumer need for a group version of this contract.



Question

Explain why would there not seem to be a need for a group whole life assurance contract.

Solution

Group contracts are usually funded by employers for their employees. It is therefore natural to restrict life cover to the period of employment, rather than offer it on a whole life basis.

5 Term assurance

5.1 Definition

A term assurance provides a benefit on the death of the life assured provided it occurs within the term selected at outset. As the policy will not pay a benefit in every case (as with endowment and whole life assurances), the cost is usually considerably cheaper. Term assurances do not normally have any benefit paid on early termination.

Term assurances do not pay a benefit on maturity and so they are cheaper than endowment or whole life assurances for the same benefit levels.



Question

Explain why term assurances do not normally have any benefit paid on early termination (*ie* withdrawal).

Solution

Term assurances do not usually pay benefits on withdrawal because this would increase the risk of selective withdrawals, *ie* policyholders who believe they are “healthy” and so unlikely to receive the death benefit during the term may be more likely to surrender if they would receive a benefit on surrender. This would leave the insurer with a pool of lives with a higher than acceptable proportion in poor health.

Also, term assurances have low premiums and low reserves as they do not pay a benefit in every case. Therefore, there is little scope to pay a worthwhile surrender value.

5.2 Use to meet customers’ needs

If an individual takes out the contract, it provides protection against financial loss for the assured’s dependants.

If the contract is a decreasing term assurance contract then it may provide a lump sum on death, a lower amount being paid the later the death occurs in the contract term, or the contract may provide an income for the rest of the contract term.

A decreasing term assurance can be used to meet two specific needs. First, it can be used to repay the balance outstanding under a repayment loan and, secondly, it can be used to provide an income for a family with children following the death of the income provider until such time as the latter can fend for themselves.

5.3 Existence of a group version

The group equivalent of the term assurance contract can be used by an employer to provide a benefit to dependants on the death, whilst in employment, of an employee.

There are also other uses for a group contract. For example it can also be used by a credit card company to provide a benefit on death equal to the balance outstanding on a credit card.

Thus the insurance company in effect indemnifies the credit card company against the loss when a credit card balance is not repaid because of the death of the credit card holder. The benefit could be defined, for example, as the full amount outstanding on death, or as the average monthly balance over a period prior to death.

Any supplier of goods with payment in instalments could use a term assurance to cover the risk that recovered goods are less valuable than the outstanding loan balances due on death.

6 Convertible or renewable term assurance

6.1 Definition

A renewable term assurance is a term assurance with the option to renew (*ie* take out a further term assurance) at the end of the original contract. The appeal of this option lies in the fact that the renewal can be made without further medical underwriting. (Although in South Africa, renewable contracts sometimes allow for a test to detect for HIV at renewal.)

A convertible term assurance allows the policyholder to convert the term assurance into another type of contract, such as a whole life or endowment assurance. The point(s) at which conversion is allowed will vary depending on the particular policy conditions. Conversion may be allowed on only one date, on any of several dates, or at any time during the original term assurance contract.

A particular contract may offer only the renewal option, only the conversion option, or both.

6.2 Use to meet customers' needs

For individuals, these contracts combine the attractions of a term assurance, in terms of obtaining cheap death cover, with the certainty of being able either to convert to a permanent form of contract, ie an endowment or whole life assurance, when it can be afforded, or to renew the original contract for a further period of years, all without health evidence being provided (unless the benefit level is increased).

The Core Reading comment 'when it can be afforded' reflects the fact that for a given sum assured the premiums for an endowment or whole life contract will be considerably more than for a term assurance.

6.3 Existence of a group version

A comparable group arrangement would be the option for an individual in a scheme covered by a group life policy to convert to some form of individual arrangement on leaving the scheme.

For example, an individual who has been a member of a group term assurance scheme during employment may, at retirement, be given a 'continuation option' to continue the policy as an individual term assurance arrangement. If the individual takes up this option then the individual pays the future premiums.

7 Immediate annuity

7.1 Definition

A single premium (or consideration) purchases the income, which commences immediately after purchase.

The income is purchased with a single premium at outset. This single premium could come from the maturity proceeds of an endowment or some other savings or another source (*eg* an inheritance).

In many markets annuity contracts are predominantly without-profit or index-linked.

With-profit and unit-linked annuities are also possible. For a with-profit annuity the income paid to the policyholder will be a guaranteed amount plus a bonus added by the insurer. For a unit-linked annuity, the insurer guarantees paying a number of units. However, the policyholder's income is not guaranteed (in monetary terms), because the income is equal to the number of units multiplied by the unit price, which will vary on a daily basis.

Impaired life annuities are a more recent innovation, where higher annuities are available for those in poor health.



Question

Explain why higher annuities may be available to those in poor health.

Solution

Higher annuity rates may be available as these individuals would be expected to have a shorter life expectancy than those in good health. Therefore, the insurer will have to make the annuity payments for a shorter period of time and can offer a higher amount for each payment in return for the same single premium.

Lower life expectancy is obviously not guaranteed for someone in poor health though and the insurer will need to consider the risk that this individuals lives for longer than expected when setting its rates.

7.2 Use to meet customers' needs

Immediate annuities meet a financial need for an income for the remainder of the life of the insured, for example after his or her retirement, or for an income during a limited period, for example to pay the school fees of the insured's children.

Contracts for a limited period are called temporary annuities.

7.3 Existence of a group version

A group version of the contract can be used by an employer to fund for pensions for his or her employees at or after retirement.

Essentially, such contracts are just collections of individual annuities.

8 Deferred annuity (including personal pensions)

8.1 Definition

Deferred annuities can be used when there is time between the date of purchase and the date when the income stream is required to start. The contract can thus be paid for either by a single or regular premium during the deferred period.

The usual structure for these contracts is that the policyholder pays regular premiums for a period up to the specified 'vesting date'. These premiums buy amounts of regular income, payable to the policyholder from the vesting date. A single premium at the start of the contract is a possible alternative to regular premiums.

8.2 Use to meet customers' needs

The contract enables individuals to build up a pension that becomes payable on retirement from gainful employment. At the vesting date of the annuity, an alternative lump sum may be offered in lieu of part or all of the pension, thereby meeting any need for a cash sum at that point, for example to pay off a house purchase loan. This is commonly referred to as a 'cash option'. In practice, the same aims can be achieved, in potentially a more flexible way, by combining an endowment assurance with an immediate annuity starting at the maturity date.

The endowment assurance (be it with-profit, without-profit or unit-linked) would be used as a savings vehicle, and the proceeds used to buy an annuity at maturity (or possibly earlier, if reasonable surrender values are given on the endowment). Alternatively, but *only* if legislation allows, the policyholder could blow the lot on a huge party and a world cruise!



Question

Despite the flexibility, suggest two disadvantages from the policyholder's perspective of the endowment plus immediate annuity structure.

Solution

If the proceeds from the endowment must be converted to income at rates unknown until the annuity is purchased, this may introduce considerable uncertainty for the policyholder.

It may also mean higher expenses, for example two lots of commission.

The rate at which the proceeds of the policy in the deferment phase can be converted into an annuity might be guaranteed at outset, or current market rates might be used.

8.3 Existence of a group version

The group equivalent of a deferred annuity can be used by an employer to fund for pensions for his or her employees.

In particular, a group contract may be used when an employer closes an occupational pension scheme to buy out the benefits with an insurer.

9 Income drawdown

9.1 Definition

Some defined contribution arrangements allow for ‘income drawdown’. Under such an arrangement instead of buying an annuity the fund remains invested and the member withdraws an amount of the fund each year. This may be just the income earned on the fund or may also include some of the fund capital.

It is usual for this income drawdown product to be offered by an insurance company. At retirement the member (*ie* individual) will transfer their accumulated fund from their defined contribution arrangement to the income drawdown product.

Income drawdown is unlikely to be suitable for individuals with small accumulated funds, as the charges imposed by the insurance company to manage the income drawdown product can be significant.

There may be legislative restrictions on the:

- **amount of the fund that can be withdrawn each year**
- **age at which drawdown must cease and a pension (*ie* an annuity) must be purchased.**

9.2 Use to meet customers’ needs

One of the main drivers behind the ‘income drawdown’ approach is that, should the member die before having to secure an annuity, the member’s heirs can inherit the balance of the fund.

If instead an annuity were to be purchased then the insurer would profit from the early death of the member.



Question

Set out other advantages to the member of the income drawdown approach compared to instead purchasing an annuity at retirement.

Solution

Advantages of income drawdown include:

- the member may be able to earn a return on their invested funds (after tax and charges) in excess of that underlying annuity rates.
 - the member has flexibility within the legislative requirements in terms of how much to take each year as an income.
 - annuity rates may currently be poor but improve in the future (at which time the member may be required by legislation, or chooses, to buy an annuity).
-

However, income drawdown carries several risks for the member:

- **if only the income earned on the fund is taken each year the member's income could be volatile**
- **if too high a level of income is taken, the capital could potentially reduce to zero before the member dies leaving the member dependent on the state at the end of his or her life**
- **the charges taken in relation to administering the arrangement may be high**
- **the remaining fund on the member's death may be insufficient to provide adequate benefits for a dependant**
- **there may be a tax charge on the residual fund on the member's death.**

9.3 Existence of a group version

The income drawdown product will be sold to individuals as a way of meeting their retirement needs.

10 Investment bonds

10.1 Definition and use to meet customer's needs

These are single premium contracts, normally whole life, designed to enable policyholders to invest for the medium to long term.

A policyholder can usually make withdrawals from an investment bond, however these may incur a penalty in the first few years of the bond. There may also be restrictions on the frequency with which withdrawals can be made later in the term.

On death, the bond will pay a lump sum. There may be a guarantee that this lump sum will not be less than the original single premium investment. However, the amount paid is likely to depend on the return earned on the investment chosen by the policyholder / their advisor.

They are typically written on a unit-linked or investment-linked basis.



Question

Explain why an individual might purchase an investment bond.

Solution

An investor could purchase an investment bond to earn a higher return on funds that are not currently required to meet their needs.

The life insurance element ensures a minimum payout on death which could be passed on to the policyholder's family or used to meet costs such as funeral costs or inheritance tax liabilities.

As the policyholder needs additional funds, they can withdraw money from the bond.

Investment bonds could be used in a similar way to investment drawdown products.

It is also possible to take out a fixed term investment bond. There may be an enhanced or minimum guaranteed amount payable on death within the term.

10.2 Existence of a group version

Investment bonds are purchased by individuals.

11 Income protection insurance

11.1 Definition and use to meet customers' needs

The contract enables individuals to provide an income for themselves and their dependants in the event of the insured risk occurring.

The most common insured risk is long-term sickness or incapacity due to accident or illness.

The policy literature must define what constitutes sufficient *incapacity* to be able to claim. This usually means 'unable to work' in some sense, although there is scope for considerable variation here.

For example, if a brain surgeon is no longer capable of brain surgery but could do light manual work, is he or she 'unable to work' and hence able to claim? The policy must make it clear whether the claim is dependent on being unable to follow any occupation, or the individual's own occupation, or some other definition.

These contracts typically terminate at retirement age, and do not provide benefits for the first period of any claim. In the first period of a claim it is assumed that the insured will have other resources, for example a company sick pay scheme or State benefit provision.

Benefits might be payable until normal retirement age or for some specified shorter period. Individual contracts are usually regular premium.

11.2 Existence of a group version

The group equivalent can be used by an employer to provide a sick-pay scheme for employees.

12 Critical illness insurance

12.1 Definition and use to meet customers' needs

The contract provides a cash sum on the diagnosis of a 'critical' illness, such as heart attacks, strokes or many forms of cancer, which could be used for nursing and other care. It therefore meets an important need for financial security in the event of contracting such illnesses.

Normally the specific critical illnesses covered will be explicitly listed in the policy documentation.

The policy wording is critical (pun intended) in defining precisely which diseases are covered, which could potentially have a huge effect on the claim experience.

In some jurisdictions the definition of illnesses may be standardised across all contracts of that type.

Policies are normally without-profit or unit-linked.

The benefit may be offered in 'stand-alone' form, where the contract covers only critical illness.

In the stand-alone contract, no benefit is paid on death.

Alternatively, the benefit may be offered as a 'rider' (*ie* additional) benefit on another contract. Such a rider benefit may operate in one of the following two ways:

- **Where the benefit is attached to another contract, typically an endowment, whole life or term assurance, it usually constitutes an acceleration of the death benefit.**

This means that the contract will pay out on the first to occur out of death or diagnosis of a critical illness. One appeal of the acceleration contract is that it allows the holder of, say, a whole life assurance to 'enjoy' the benefit under certain (unenjoyable) circumstances.

- The rider benefit may act as an additional benefit. Under this second version there is the potential for two separate sums assured to be paid out: once on critical illness and again on death (within the policy term). The maximum possible payment under this version would be the total of the two sums assured.

12.2 Existence of a group version

A group version of the stand-alone contract could be used by an employer to provide financial security for employees in the event of contracting a critical illness.

13 Keyperson cover

13.1 Definition and use to meet customers' needs

A life and / or critical illness policy taken out to cover the life of a key person within a business.

Within a business, particularly a small business such as a doctor's practice or law firm, there may be key individuals without whom the business may struggle. If the business is a 'partnership' these individuals (or partners) may each have made a financial contribution to the business.

If one of these individuals dies, suffers a critical illness or long-term incapacity, keyperson insurance pays a lump sum benefit to the business.

This lump sum can be used to:

- buy out the individual from the partnership
- cover any loss of profits as a result of the loss of the keyperson
- meet the costs of finding a replacement.

The benefit payable may be based on loss of profits to the business, or related to the salary of the key person (to facilitate recruitment of a successor).

13.2 Existence of a group version

Keyperson insurance is purchased by a company for its own benefit, covering particular employees. It is unlikely to be purchased as a 'group' version covering many employees.

14 Long-term care insurance

14.1 Definition and use to meet customers' needs

The contract can be used to help provide financial security against the risk of needing either home or nursing-home care as an elderly person, ie post-retirement. The contract could pay for all the costs of care throughout the remainder of life (an indemnity contract), or could provide a cash lump sum, or an annuity, to contribute towards the costs of care.

A claim is payable on this contract when the policyholder is deemed to have reached a specified level of disability, for example the policyholder may be unable to perform a specified number of 'activities of daily living' (ADLs).

The different levels of care will differ between one contract and another, but typically may include:

- cost of care in own home
- cost of being cared for in a residential (but non-nursing) home
- cost of being cared for in a residential nursing home.

These involve increasing costs as you move down the list.

The contract can be paid for by single or regular premiums, and all types of benefit structures (without-profit, with-profit, unit-linked and investment-linked) are possible. Obviously any regular premiums would cease from the point at which claims begin to be paid (if not at some earlier date).

14.2 Existence of a group version

A group version of the contract would enable an employer to provide long-term care cover to employees and their spouses and parents.

Another example of a group version of long-term care is the CCRCs (Continuing Care Retirement Communities), which were discussed in an earlier chapter.

15 Investment types

Each contract type described in the previous sections is likely to be available in one or more of the following investment types:

- without-profit
- with-profit
- unit-linked
- index-linked.

15.1 Without-profit (non-participating) contracts

A life insurance contract is without profit if the life insurance company has no discretion over the amount of benefit payable, ie the policy document will specify at outset either the amount of the benefits under the contract or how they will be calculated.

So, the key feature of without-profit business is its guaranteed, non-discretionary nature. A customer knows, at outset, what both their premiums and benefits will be. Strictly, only the main benefits may be fixed, for example the death and maturity benefits may be fixed but the surrender value may be at the discretion of the life insurance company.

Without-profit contracts tend to be most appropriate when the primary customer need is protection.

Broadly, this certainty means less risk for the policyholder than on a with-profit or unit-linked contract.



Question

If without-profit contracts are less risky for policyholders, explain why might an individual nevertheless decide to take out a with-profit or unit-linked contract.

Solution

The *expected* returns from a with-profit or unit-linked contract will be higher. However, because they are more risky the *actual* returns may or may not be higher than those from a without-profit contract.

15.2 With-profit (participating) contracts

A life insurance contract is with profit if the policyholder is entitled to receive part of the surplus of the company or of a sub-fund within the company. The extent of the entitlement is usually at the discretion of the company. Without profits contracts do not have this profit participation feature.

Under a with-profit contract, the insurer and the policyholder share the profits (and hence the risks).

A wide range of with-profit contracts is available. They tend to be most appropriate when the customer need that the contract is addressing is saving. Savings contracts will tend to have premiums invested in riskier assets than do without-profit contracts, with higher expected returns that are used to form the basis of the discretionary benefit entitlement.

It is typical for a with-profit contract to involve some guaranteed benefits and some discretionary. There are a variety of ways of applying the discretionary benefit including the additions to benefit approach illustrated by the next question.



Question

A 20-year conventional with-profit endowment assurance has a benefit comprising:

- a guaranteed sum assured of £20,000
- regular bonuses of 3% compound per year
- a terminal bonus of 25% of the guaranteed sum assured plus regular bonuses.

Calculate the total maturity benefit for a policyholder who survives to maturity.

Solution

The maturity benefit is given by:

$$£20,000 \times 1.03^{20} \times 1.25 = £45,153$$

In the above question, the insurance company would decide on the level of regular bonuses each year. (They may not necessarily always be 3%!) Once the regular bonuses are declared, they become part of the guaranteed element of the policy.

In the above question, at the end of year 1, the guaranteed benefit increases to:

$$£20,000 \times 1.03 = £20,600$$

This doesn't mean that the policyholder receives £600 at the end of year 1, rather that the benefit to which he/she is entitled on maturity has risen to £20,600.

The factors that come into play, when setting levels of bonus include:

- the wish to smooth benefits from year to year, so keeping back some of the profit from the good years, to help in the bad years
- policyholder expectations, *eg* based on past bonus distributions by the company
- looking at what competitors are doing
- adhering to regulatory limits on payouts.

Exam Tip

The above four bullet points represent good word association ideas to have for the word 'with-profit' in the exam.

15.3 Unit-linked contracts

Unit-linked contracts are unitised contracts whose value of units is directly attributable to the underlying value of the invested assets.

Unit-linked contracts operate by paying policyholder premiums into pooled investment funds. Often the policyholder has a choice of funds. The policyholder's share of the fund is represented by units.

Any of the types of contract can be written in a unit-linked form, although normally only contracts with a significant investment element are written in this way.

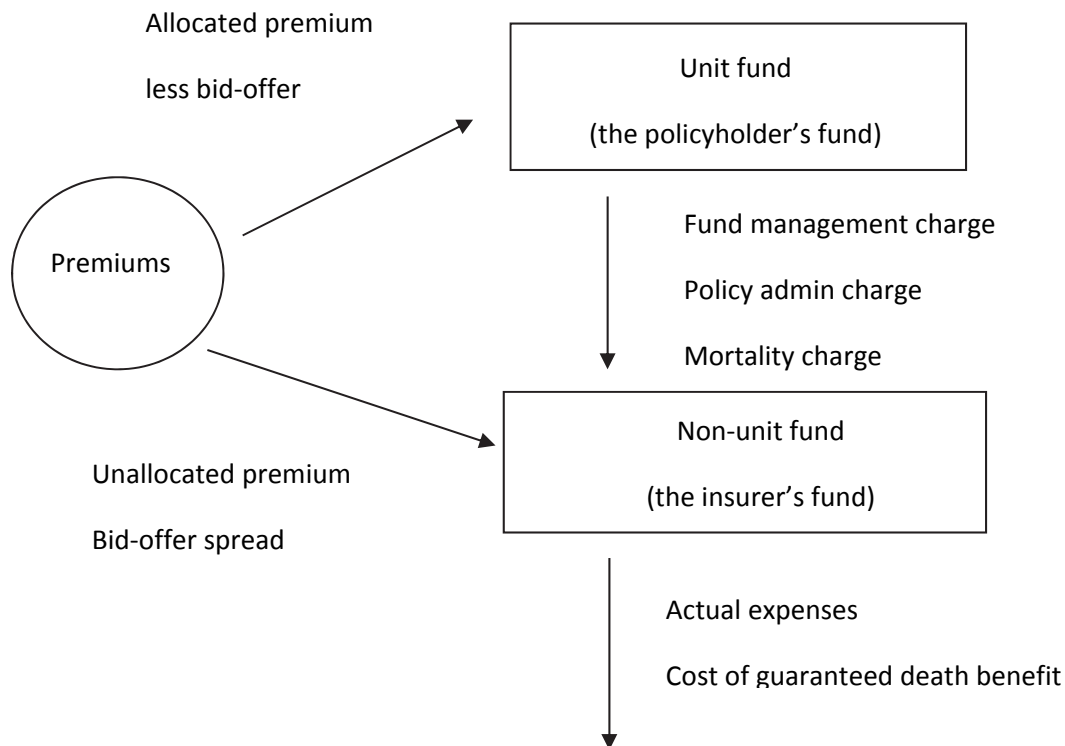
The benefit payable at maturity depends on the performance of the underlying assets and the level of charges levied by the insurance company. This is the investment, or savings, element of the contract.

A protection element of the contract may also exist. For example, the benefit on death might be:

- a fixed sum (*eg* £50,000), or
- the value of units, or
- some percentage (*eg* 120%) of the value of units.

This makes unit-linked policies very versatile: if the first option is chosen, with a very high sum assured (relative to the premium), then the contract can be almost entirely protection in nature. The policyholder will typically be charged for this protection cover via regular charge deductions (*eg* a monthly mortality charge) from his/her unit fund.

The main cashflows on a unit-linked policy, which offers a guaranteed death benefit, may look like this:



From the insurer's perspective, the profit comes from the expense charges less the actual expenses, and the mortality charge less the cost of providing any guaranteed death benefit. Therefore, the key risk to the life insurer is that the charges do not match the expenses / cost of guarantee in terms of nature, timing and amount.

A unit-linked contract enables consumers either to obtain a higher expected level of benefit for a given premium or to pay a lower expected level of premium for a given level of benefit, than under a comparable non-linked version of the contract. This occurs because the consumer accepts a significant element of risk, mostly investment risk. By accepting greater risk, the consumer gains a higher expected return, at the expense of a possibility that the return will be lower than might have been achieved from a non-linked contract.

However, note the word 'expected'. While the *expected* maturity value might be higher under a unit-linked contract, the *actual* maturity value *could* be lower. This is what is meant by the policyholder taking more risk.



Question

Explain how the consumer accepts a greater element of the risk under unit-linked contracts than under with-profit contracts?

Solution

Under a typical unit-linked contract, all the investment risk lies with the consumer, as investment performance *directly* affects the value of the unit fund and hence the main benefit.

Under a typical with-profit contract, less investment risk lies with the consumer because:

- There is still a guaranteed element to the benefit that the insurance company must meet.
 - Policyholder expectations may limit the scope and speed of bonus reductions. These are at the discretion of the company rather than being “automatic” as with the value of the unit-linked contract.
 - It is possible that shareholders (where there are any) share in the investment losses (as well as profits) of the company.
-

In addition, a unit-linked contract can offer flexibility in the types and levels of cover included and the ability to vary premiums according to need.

15.4 Index-linked contracts

An index-linked contract enables the consumer to obtain a benefit that is guaranteed to move in line with the performance of an index specified in the contract. Normally the index will be an investment or economic one. Premiums may move in line with the same index, or may be fixed in monetary terms.

Suitable investment indices might be the major domestic equity market indices of any country, or more broadly based international equity indices. Also links might be made to other asset classes such as fixed interest.

Typical economic indices that might be used include retail or other appropriate price indices.

The chapter summary starts on the next page so that you can keep all the chapter summaries together for revision purposes.

Chapter 6 Summary

Pure endowment and endowment assurance

A pure endowment assurance provides a benefit on survival to a known date and hence operates as a savings vehicle, for example to provide a lump sum on retirement, or a means of repaying a loan.

An endowment assurance also provides a significant benefit on the death of the life insured before that date and therefore operates also as a vehicle for providing protection for dependants.

Whole life assurance

A whole life assurance will provide a benefit on the death of the life insured whenever that might occur.

Term assurance

A term assurance provides a benefit on the death of the life assured provided it occurs within the term selected at outset. Term assurances do not normally have any benefit paid on withdrawal.

Convertible or renewable term assurance

These contracts combine a term assurance with the certainty of being able either to convert to a permanent form of contract (*ie* an endowment or whole life assurance) or to renew the original contract for a further period, all without further evidence of health being provided (unless the benefit level is increased).

Immediate annuity

An immediate annuity involves a single premium purchasing an income stream, which commences immediately after purchase.

Deferred annuity

A deferred annuity can be used when there is time between the date of purchase and the date when the income is required to start (the vesting date). The contract can be paid for either by a single premium or by regular premiums during the deferred period.

Income drawdown

The contract allows an individual to leave their accumulated pension fund at retirement invested and draw an income from it each year. There may be limits on how much can be drawn down each year and an age limit at which point an annuity must be purchased.

Investment bond

Single premium invested for the whole of life (or a fixed term). The benefit depends on investment returns during the period of investment. Funds can be withdrawn but this may incur surrender penalties, particularly at early durations. There may be a guaranteed offered on death.

Income protection insurance

The contract enables individuals to provide an income for themselves and their dependants during periods of long-term sickness or incapacity due to accident or illness. Such contracts typically terminate at retirement age.

Critical illness insurance

The contract provides a cash sum on the diagnosis of a 'critical' illness as defined by the policy documents.

Keyperson cover

Pays a lump sum on death or critical illness of a key individual within a business. The benefit may be linked to loss of profits or the salary of the individual and used to buy out the individual from the business or find a replacement.

Long-term care insurance

The contract can be used to help provide financial security against the risk of needing either home or nursing home care as an elderly person, *ie* post-retirement.

Investment types

The main life insurance policy investment types are:

- without-profit (benefit amount or method of calculation specified)
- with-profit (benefit involves a share in the surplus of the company)
- unit-linked (benefit depends on the value of a unit fund)
- index-linked (benefit moves in line with a specified investment or economic index).



Chapter 6 Practice Questions

6.1 Describe the customer needs met by the following contracts:

- (i) income protection insurance
- (ii) critical illness insurance
- (iii) long-term care insurance.

6.2 Comment on the following quote. "Buying a without-profit annuity to provide income in retirement is foolish. The insurer will only take the money and invest it in fixed-interest securities, and so the policyholder would do better to buy these directly and cut out the insurer's expenses and profit."

6.3 Compare the extent to which a unit-linked design (versus a without-profit design) meets the needs of:

Exam style

- (i) a consumer seeking income protection at low cost [4]
- (ii) a consumer seeking a regular premium savings vehicle. [4]

[Total 8]

The solutions start on the next page so that you can
separate the questions and solutions.



Chapter 6 Solutions

6.1 (i) ***Income protection insurance***

This contract provides an income to individuals (and any covered dependants) while they are unable to work because of long-term sickness or incapacity due to accident or injury (within the terms of the contract).

Its function is to replace (part of) the income lost as a result of the incapacity.

(ii) ***Critical illness insurance***

This contract provides a cash lump sum on the diagnosis of a “critical” illness, as defined by the policy.

It may be sold as a stand-alone product or as a rider benefit to, for example term assurance.

The cash sum could be used for nursing and other care, to pay off the mortgage and other family debts, to help support dependants in future, or even to pay for a world cruise!

(iii) ***Long-term care insurance***

The contract can be used to cover, or help to cover, the cost of care in old age when individuals are no longer able to look after themselves.

This might be home-based care or care in a nursing or residential home.

Group versions

Group versions of any of the contracts above are available, and could be used by an employer to provide the stated benefits as part of an employee benefits package.

For example, in the USA, CCRCs (Continuing Care Retirement Communities) may be used.

6.2 The principal objection to this comment concerns the absence of insurance if someone took this advice.

An annuity may be thought of as insurance against the financial consequences of living too long (*ie* beyond the point at which your money runs out).

Without an annuity the ‘longevity risk’ remains with the individual.

Other points that might be mentioned:

- The expenses of buying fixed-interest securities directly may be higher for the individual ...
... but it is true that the insurer’s administrative expenses and profit would be cut out.
- The individual might not know which securities are the best to buy.

- The contract might not be backed entirely with fixed-interest securities. If the company has sufficient investment freedom to invest a proportion of the funds in equities, it may be able to offer better rates to policyholders.
- If the individual were in relatively poor health but unable to get an impaired-life annuity then the advice might be reasonable.
- If the policyholder purchases corporate fixed-interest securities, then he/she is exposed to the risk of default.
- The policyholder might want an annuity that is index-linked in nature, eg that increases in line with price inflation, but may not be able to find securities to replicate these cashflows.
- There may be regulation in the country that requires the purchase of annuities after a certain age.
- There may be tax advantages associated with annuity purchase relative to the direct purchase of the underlying securities.

6.3 (i) ***Unit-linked design – income protection insurance***

Assuming that the policy conditions for the two designs are similar, and will pay out in similar circumstances, both contracts should meet the consumer's need for income protection. This is the fundamental aim of both contracts. [1]

A without-profit contract provides this cover with greater certainty about the cost... [½]

... on a unit-linked version, charges are often variable. This may discourage some prospective consumers. [½]

However, it is also possible that premiums may be reviewable under a without-profit version. [½]

On the other hand, a unit-linked contract may have a lower initial premium because of less need for margins in the assumptions. Provided experience turns out no worse than expected the consumer may get the required cover at lower cost than under the without-profit contract. [1]

Under a unit-linked contract, it is even conceivable that premiums or charges will fall if experience turns out better than expected, particularly if competitive pressures give the life insurance company an incentive for such reductions. [½]

A unit-linked contract is more complex to administer and so administration costs are likely to be higher. [½]

[Maximum 4]

(ii) ***Unit-linked design – regular premium savings vehicle***

Both contracts provide a mechanism for regular savings. [½]

A unit-linked design is likely to provide a higher level of benefits for a given premium than a without-profit version. [½]

This occurs because the consumer accepts a significant level of the investment risk under a unit-linked design ... [½]

... whereas this risk lies with the provider for a without-profit design, resulting in a more cautious investment strategy and pricing basis. [1]

A unit-linked design caters better for consumers with a range of risk appetites ... [½]

... by offering a range of investment funds. [½]

For example, risk-averse investors can select more cautious investments, and speculators more risky investments. [½]

Unit-linked designs are often more flexible in terms of being able to choose benefits, vary premiums, change investment funds *etc.* [½]

[Maximum 4]

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7

General insurance products

Syllabus objectives

- 2.2 Describe the main types of social security benefits and financial products and explain how they can provide benefits on contingent events which meet the needs of clients and stakeholders.

(Covered in part in this chapter.)

- 14 Have an understanding of the principal terms used in financial services, investments, asset management and risk management.

(Covered in part in this chapter.)

0 Introduction

This chapter starts with an introduction to the world of general insurance. If you work in general insurance then you should be able to skim through this first section. If you work in other actuarial areas you should spend more time on it, familiarising yourself with the concepts.

The rest of the chapter introduces the different general insurance products. The entire Core Reading in this chapter forms part of the Core Reading 'appendix' described in [Chapter 4](#). As such, the following introduction to the appendix applies to all the Core Reading in this chapter:

The sections below provide a general indication and example of the types of contract that the examiners may describe in examination questions. The examiners will not be testing detailed knowledge of such contracts but will expect candidates to be able to apply their understanding of principles to both these basic contract types and to other contracts that may exist independently or where two or more of these basic contract types are combined together as a package.

1 An overview of general insurance

This introduction is designed to give a broad overview of the ideas that will be covered in Subject CP1 surrounding general insurance, particularly for students who do not work in general insurance and who may be unfamiliar with some of the concepts involved.

1.1 Contracts sold by general insurance companies

In simple terms, general insurance is any type of insurance that is not life insurance.

General insurance therefore encompasses a wide range of types of insurance. In most cases a general insurance policy is a contract of indemnity, *ie* it aims to reimburse any losses occurring. Other policies might pay pre-specified amounts on particular contingencies only (*eg* £10,000 if you lose the use of an eye) or if the loss is unclear, the amount might be determined by a court of law.

The key features of general insurance contracts are:

- they are short term (*ie* insurance cover is typically provided for a single year)
- there can be multiple claims
- claim amounts are generally unknown and can be very volatile
- there can be delays in reporting and settling claims.



Question

List as many different general insurance products as you can think of (or can remember from studying previous exams).

Solution

The common general insurance products include:

- *Liability classes*
 - employers' liability
 - product liability
 - public liability
 - motor third party
 - professional indemnity

- *Property damage classes*
 - land vehicles
 - marine
 - aircraft
 - residential buildings
 - commercial buildings
 - moveable contents
 - *Financial loss classes*
 - pecuniary loss (including mortgage indemnity guarantee)
 - fidelity guarantee
 - business interruption (or consequential loss)
 - *Fixed benefit classes*
 - personal accident
 - health (medical expenses)
 - unemployment
-

The common general insurance products are discussed in more detail later in this chapter.

General insurance contracts can also be split into:

- *personal lines* – contracts sold to individuals, such as residential buildings and contents insurance
- *commercial lines* – contracts sold to businesses, such as commercial property, employers' liability and business interruption insurance.

1.2 Short- vs long-tailed business

Different classes of business are referred to as 'short-tailed' or 'long-tailed', where:

- short-tailed means that claims are generally reported quickly and settled quickly by the insurer, and
- long-tailed means that there is a sizeable proportion of total claim payments that take a long time to be reported and/or a long time for the insurer to settle.

When looking at an individual class of business, or type of claim, you should make a point of noting whether it is short-tailed or long-tailed (or in-between!). This can affect, for example, the level of risk that the contract represents and the investment strategy used to match the liabilities.



Question

Why do reporting and settlement delays occur?

Solution

The reporting delay is the time from the event occurrence through to the time that the insurance company is notified of the event. There may be delays due to:

- the time between an event occurring and the condition emerging, *eg* for an industrial disease such as asbestosis
- the time taken for the policyholder to advise the insurer – possibly because the amount involved is quite small – or because they do not realise that there is cause for claiming.

The settlement delay is the period between notification to the company and the payment of the claim. These delays are due to:

- initial administrative processing
 - establishing whether the insurer is liable
 - waiting for a condition to stabilise (*eg* will the injured party recover, or is the disability permanent?)
 - establishing how much should be paid
 - possible disputes and court settlements.
-

1.3 Underwriting

As with life insurance, underwriting is a process used by the general insurer to decide how risky an applicant for insurance is, and what premium should be charged. The work involved in the underwriting of risks varies greatly from one class of general insurance business to another.

For personal lines business such as motor and household, risks are underwritten almost entirely by reference to the answers to questions on proposal forms, with reference to an underwriter only in exceptional cases. These questions gather information called 'rating factors' to use in assessing the risk posed by a particular potential policyholder.



Key information

A rating factor is a factor used to determine the premium rate for a policy, which is measurable in an objective way and relates to the likelihood and/or severity of the risk. It must, therefore, be a risk factor or a proxy for a risk factor or risk factors.

For example, if you have insured a car, you may be familiar with some of the underwriting questions, such as:

- What is the make and model of your car?
- Where is your car parked overnight?
- How many miles do you expect to drive?

For commercial lines, underwriting will be a skilled job based on detailed reports from brokers, surveyors, fire officers *etc.* So the underwriting will be based on much more than a set of objective questions.



Question

Why is a greater level of underwriting needed for commercial lines than personal lines?

Solution

The level of underwriting tends to be greater for commercial lines, relative to personal lines due to:

- the nature of the risks being more heterogeneous and therefore the greater level of uncertainty involved
 - the larger sums at risk involved, which justify a greater degree of underwriting expense.
-

Claims management will be carried out at the claims stage, to check the validity of claims and to check that claims have not been over-inflated.

1.4 Contract design

As with the life insurance contract, the key contract design consideration to a general insurance company is profitability.

For a general insurance contract, profits are made up of the following items:

+	Premiums net of reinsurance premiums paid
+	Investment income and gains
–	Claims incurred net of reinsurance recoveries
–	Expenses and commission
–	Tax
=	Profit

You may be wondering where the 'increase in provisions / reserves' item (which was in the life insurance list in the previous chapter) has gone. In general insurance accounts, it is common to include this in the claims incurred figure, *ie* claims incurred = claims paid + increase in provisions.

The other contract design factors that should be considered when designing a general insurance contract are similar to those mentioned in the section on contract design for life insurance policies in the previous chapter.

1.5 Setting premiums

The starting point for determining a general insurance premium is the *risk premium*, also known as the *theoretical cost*. At a very basic level, this is calculated as:

$$\text{Risk premium} = \text{expected claim frequency} \times \text{expected cost per claim}$$

If the insurance company has a reasonable quantity of past data, it can fit a distribution to the claim frequency and claim amount data. From this, expected values can be estimated. It is important that any distorting features are removed from the past data, for example trends, one-off events or changes in cover provided. It is also necessary to project the claims data, *ie* to allow for future trends and claim inflation, to the period when the future claims are likely to occur.

The risk premium would be determined for a base case (*eg* for car insurance, the base case may consist of a male, age 40–45, driving car type X).

You may remember the concept of *generalised linear modelling* from your previous studies. Such models can be used to determine which rating factors to use, and percentage adjustments to apply to the base case risk premium for other categories of policyholder.

Key rating factors for car insurance would be the policyholder's age and car type.



Question

Give examples of other rating factors that could be used for pricing car insurance.

Solution

Examples of other rating factors include:

- postcode
- use of car – business or leisure?
- number of years driving licence held
- where the car is parked overnight – *eg* in a garage, on the roadside
- age of the vehicle
- modifications to the car and security devices
- details of any accidents / claims in the past X years
- details of criminal convictions relating to the drivers.

The above list is just a sample, you may well be able to think of others.

Once the risk premiums have been determined, these are then adjusted into *office premiums* or *gross premiums* by allowing for loadings for commission and other expenses, profit, contingencies, investment income and the cost of reinsurance.

As with life insurance, the actual premium charged may be different to the office premium calculated above. In particular, for general insurance business, premium rates may vary between new business and renewals. If the theoretically correct premium was charged for new business, it may be uncompetitive as most insurers subsidise new business premiums to some extent with renewal premiums. As a result, the renewal rate assumption (also known as the persistency rate) is a critical assumption in pricing a general insurance contract.

Account will be taken of competitors' premiums and the position in the insurance cycle. This is discussed further in [Chapter 23](#), Pricing and financing strategies.

1.6 Provisioning

Once cover commences on a general insurance policy, the insurer is required, by regulation, to establish provisions. Provisions are the amounts of money that need to be set aside now to meet the future liabilities, *ie* benefits promised and the insurer's expenses.

In general insurance, there are many different types of provisions, commonly referred to as reserves, that must be established. These include:

- an outstanding reported claims reserve (for claims that the insurer knows about, but have not yet been settled)
- an incurred but not reported (IBNR) reserve (for claim events that have occurred but which the insurer does not yet know about)
- an unexpired risk reserve (for claims that have not yet happened in a future period of cover)
- a catastrophe reserve (for, strangely enough, catastrophes)
- a claims handling expense reserve.

You may remember calculating outstanding claims reserves using run-off triangle (chain ladder) techniques from studying previous exams.

1.7 New business strain and capital

As with life insurance, writing general insurance requires capital to cover the effects of *new business strain*. The amount of capital needed will vary by class depending on the volumes of business written and the risk attached.



Question

What features of a class of general insurance business contribute to its riskiness?

Solution

The riskiness of a class of business will be affected by factors such as:

- whether the class is long-tailed or short-tailed
 - sum insured or likely claim amount
 - likely claim frequency
 - claims volatility (*ie* the heterogeneity of the risks written)
 - exposure to accumulations of risk (geographical or portfolio) or catastrophes
 - volume of contracts sold and hence availability of data and predictability of future assumptions
 - availability of and take up of reinsurance for that class of business.
-

1.8 Investment strategy

The insurance company will need to consider the characteristics of its liabilities when determining the investment strategy.

Some general insurance liabilities are fixed, *eg* a personal accident contract may offer a fixed amount of £50,000 for loss of a leg.

However, most general insurance liabilities will be settled in prices applicable at the time of settlement. This means that there is an element of inflation underlying most of the liabilities. The type of inflation the liabilities are exposed to varies by class and peril. For example, property damage claims tend to be affected by inflation of repair costs and replacement parts (similar to price inflation), whereas bodily injury claims tend to be associated with loss of earnings (similar to wage inflation).

For general insurance companies, this generally means holding:

- plenty of cash for liquidity (for uncertain outgo and short-term outgo)
- some fixed-interest bonds to meet fixed liabilities
- assets to match the *term* of the liabilities, which are predominantly short to medium term
- assets denominated in both the domestic and overseas currency (as contracts such as marine and aviation are often written abroad)
- real assets (index-linked bonds, equities and property) to meet inflation-linked liabilities and expenses (however, the volatile nature of a general insurer's business and its need for liquidity will limit its appetite for property and equity to some extent).

The investment strategy of a general insurer is constrained by factors such as regulation (which can restrict or prescribe what the insurer invests in), the size of the free assets (and ability to mismatch) and the need to be tax efficient.

1.9 Key risks under general insurance contracts

Key risks to the general insurer include:

- claim frequency, amount, volatility and delays
- accumulations of risk (geographical and by class of business) and catastrophes
- investment risks, *eg* poor or volatile returns, falls in asset values, default risk
- expenses being higher than expected
- poor persistency, *ie* high lapses and low renewals
- new business volumes too high and hence new business strain, or too low and not enough business over which to spread the overheads
- credit risk, *ie* failure of a counterparty such as a reinsurer or a broker
- operational risks, *eg* fraud, systems failure, regulatory changes.



Question

Suggest some tools that a general insurer could use to mitigate the above risks.

Solution

Risk management tools used by a general insurer include:

- reinsurance
- underwriting
- diversification across classes of business or geographically
- monitoring experience (*eg* claims and expenses).

We will learn more about these tools in a later chapter of the course.

1.10 Monitoring experience

Monitoring experience is a crucial element of the actuarial control cycle. A general insurer will typically monitor claims, expenses, lapses and renewals, new business volumes and mix, investment returns, reinsurance performance and profitability.



Question

List reasons for monitoring experience. Try to think of several ideas.

Solution

A general insurer will monitor experience for the following reasons:

- to set assumptions for premium rating
 - to set assumptions for provisioning and to monitor the run-off of claims against expectations
 - to assess the profitability of its business and the key components of profitability
 - to assess reinsurance requirements and to monitor the adequacy of reinsurance
 - to determine an appropriate investment strategy
 - to determine capital requirements
 - to assist with financial planning and strategy
 - to provide management information
 - to help with marketing new contracts.
-

2 An introduction to general insurance products

The types of insurance cover provided by general insurance products can be classified under the main headings of:

- liability
- property damage
- financial loss
- fixed benefits.

Policies may comprise elements of one or more of these types of cover.

For example, a typical motor insurance policy may provide cover for compensation for personal injury to third parties and damage to their property, compensation for loss or damage to the insured's vehicle, and fixed benefits in the event of defined categories of personal accident to the insured. Therefore, a typical motor policy may comprise elements of liability, property and fixed benefit cover.

For each product type, the main features discussed in this chapter will be the benefits provided and the perils insured.



Key information

Typically, the intention of the benefits is to *indemnify* the insured, *ie* compensate the insured for the financial loss as a result of the insured event. The *principle of indemnity* is to restore the insured to the same financial position after a loss as before the loss.

For example, if your two-year old bicycle is stolen then you receive an amount that reflects the value of your two-year old bicycle not the amount needed to purchase a brand new one.

Liability, property damage and financial loss insurance are typically written on an indemnity basis. Fixed benefit insurance is not written on an indemnity basis, but instead provides a fixed amount.

For example, personal accident insurance provides a fixed amount per limb lost.

A *peril* is a type of event that may cause losses, whether manmade (*eg* theft) or due to natural disaster (*eg* flood). In virtually all types of insurance, it would be impossible to list all possible perils against which a policyholder might wish to be protected.



Question

A household buildings policy indemnifies the policyholder against loss or damage to their house. List the perils you think might be covered under this type of policy.

Solution

Insured perils may include:

- fire
 - adverse weather conditions – storm, hurricane, lightning, flood
 - earthquake
 - subsidence
 - impact from vehicles, falling trees
 - explosion (*eg* as a result of gas leaks)
 - damage caused by burst pipes
 - criminal damage
 - other perils (*eg* war damage) depending on where the house is situated.
-

3 Liability insurance

Liability insurance provides indemnity where the insured, owing to some form of negligence, is legally liable to pay compensation to a third party. Any legal expenses relating to such liability are usually also covered. An illegal act of negligence will often invalidate the cover.

For example, an insurer is unlikely to pay out compensation if the insured caused a crash whilst drink driving. However, the insurer would pay out if the crash was due to a punctured tyre or just a complete accident.

The extent of any legal liability may depend on the prevailing legislation. For marine and aviation liability, international law is likely to prevail. For classes such as motor and employers' liability, national laws are likely to apply.

For example, in the UK there is a legal minimum level of private motor insurance of third party liability cover.

The basic benefit provided by liability insurance is an amount to indemnify the policyholder fully against a financial loss. However, subject to any statutory requirements, this benefit may be restricted by:

- a maximum specified amount per claim or per event (this may involve more than one claim)
- an aggregate maximum per year
- an excess, when the first part of any claim is not paid.



Question

List the main reasons for having an excess.

Solution

An excess:

- reduces the amount of each claim (by the amount of the excess)
- reduces the number of claims (because all claims less than the excess are eliminated)
- eliminates the small claims and so results in expense savings (especially as the expenses of claim settlement are largely fixed and an excess removes those costs)
- arguably encourages policyholders to be more careful and so helps prevent claims.

Subject to the details of any reinstatement clause, payment of any benefits may result in a cancellation of cover or the need for a further premium.

Without such a reinstatement clause, after a claim under a policy, the level of cover available for the remainder of the policy year would be reduced by the amount of the claim payment made. An additional premium would be needed in order to reinstate the cover to its former level for the remainder of the policy year.

The main types of liability insurance are:

- **employers' liability**
- **motor third party liability**
- **public liability – often linked to other types of insurance such as property, marine etc**
- **product liability**
- **professional indemnity.**

(Motor third party liability is a particular type of public liability insurance, but is usually treated separately because of the large volumes of cover written in most territories.)

3.1 Employers' liability

This insurance indemnifies the insured against the legal liability to compensate an employee or their estate for accidental bodily injury, disease or death suffered, owing to negligence of the employer, in the course of employment.

Employers are liable if they are negligent in providing their employees with safe working conditions.

As well as accidents, perils covered include exposure to harmful substances or harmful working conditions.

At any given time there is often a particular cause that gives rise to a large number of claims, eg asbestosis, industrial deafness, repetitive strain injury (RSI) and stress have each been common.

3.2 Motor third party liability

This insurance indemnifies the owner of a motor vehicle against compensation payable to third parties for death, personal injury or damage to their property. In most countries such cover is compulsory, with or without an upper limit on the amount of compensation. The cover provided may or may not be limited to that required by legislation.

3.3 Public liability

The insured is indemnified against legal liability for the death of, or bodily injury to, a third party or for damage to property belonging to a third party, other than those liabilities covered by other liability insurance.

As this type of insurance forms part of many types of insurance policy, the insured perils will relate to the type of policy. For example, compensation for a dog bite may be covered by a household policy, while compensation for injury from a falling object may be covered by a commercial policy held by a builder.

3.4 Product liability

This insurance indemnifies the insured against legal liability for the death of, or bodily injury to, a third party or for damage to property belonging to a third party, which results from a product fault.

Here the perils depend greatly on the nature of the product being produced, but include faulty design, faulty manufacture, faulty packaging and incorrect or misleading instructions.

Examples could include unwanted side effects from a drug or faulty wiring on an electrical appliance.

As with all types of liability insurances, the policy would also cover legal expenses incurred by the insured in respect of claims against them.



Question

An insurance company is considering the information it will require from potential customers (product manufacturers) in deciding whether to offer them product liability cover and, if so, what price to charge.

List the information you would advise the company to obtain.

Solution

Information the company should obtain includes:

- the nature of the particular product (and any product specific information such as the results of clinical trials or health and safety tests)
 - the general trade of the company (is this a new development or an area in which they have experience?)
 - how the product is used
 - any potentially dangerous components within the product, and how quickly they deteriorate
 - the material used for packaging
 - where the product is sold, as some countries are more litigious than others.
-

3.5 Professional indemnity

The insured is indemnified against legal liability resulting from negligence in the provision of a service, eg unsatisfactory medical treatment or incorrect advice from an actuary, solicitor etc.

In a company takeover for example, considerable weight may be given to professional reports from accountants, merchant bankers and, where relevant, actuaries. Negligence by one of the advisors could cause their client to suffer large losses.

Similarly, auditors may be the subject of negligence claims if companies for which they audit financial statements subsequently become the subject of some financial mismanagement scandal.

The perils here depend on the profession of the insured. Examples include wrong medical diagnosis, error in medical operation and error in an actuarial report.

4 Property damage insurance

The main characteristic is to indemnify the policyholder. However, here the indemnity is against loss of, or damage to, material property.

The main types of property that are subject to such damage are:

- residential building (eg house)
- moveable property (eg contents of house)
- commercial building (eg office)
- land vehicles (eg car)
- marine craft
- aircraft.

Insurance contracts that combine more than one of these are possible. For example, a combined household policy offering both buildings and contents insurance is likely to be available in addition to the two separate policies.

The benefit is often the amount to indemnify the insured against the value of the loss or damage, at the time the incident occurs, subject to any limits or excesses. Household contents cover is frequently written on a 'new for old' basis, where new goods are provided to replace lost or damaged goods, whatever their age and condition.

4.1 Household and commercial buildings property

In respect of household and commercial buildings, fire is the principal peril insured against but policies can cover many other perils such as explosion, lightning, theft, storm and flood.

Damage to the insured property caused by measures taken to put out a fire is also covered.



Question

Explain why theft is listed as an insured peril on a buildings policy despite it being very unlikely that someone will steal your house!

Solution

It refers to the damage done to buildings in the course of forced entry by thieves, eg if windows are broken.

4.2 Moveable property

The policy will define precisely what moveable property is covered by the insurance. For example, under a household contents policy, the definition may include the insured's household goods and personal possessions plus visitors' personal effects.

Theft is the major peril for moveable property.

As with buildings insurance, the policy will set out the perils covered. The same type of perils will be covered (*eg* theft, fire, storm, flood).

4.3 Motor property

The perils include accidental or malicious damage to the insured vehicle, and fire or theft of that vehicle. In many countries, including the UK, this cover is typically provided together with motor third party cover within a single policy, whilst in other countries it may be provided in a separate policy.

4.4 Marine property and aviation

The following perils relate specifically to marine hull cover, but similar perils are covered for marine cargo, marine freight and aviation insurance:

- perils of the seas (or other navigable waters)
- fire
- explosion
- jettison
- piracy *etc.*

‘Marine hull cover’ refers to loss of or damage to the craft. ‘Marine cargo’ refers to the actual contents of the craft, whereas ‘marine freight’ refers to the money payable for shipment of the cargo.

5 Financial loss insurance

Financial loss insurance can be categorised as follows:

- **pecuniary loss**
- **fidelity guarantee**
- **business interruption cover, also known as consequential loss.**

The benefit provided is indemnity against financial losses arising from a peril covered by the policy.

5.1 Pecuniary loss

Pecuniary loss, which includes mortgage indemnity guarantee insurance, protects the insured against bad debts or other failure of a third party.

When a lender (*eg* a building society) provides a mortgage to an individual for house purchase, the lender will be worried that:

- the borrower may default on the interest payments
- on taking possession of the property, the proceeds from the sale of the property may be insufficient to cover the amount of the mortgage and outstanding interest.

Mortgage indemnity insurance protects the mortgage lender against the risk that the borrower (who pays the insurance premium) defaults on the loan and a loss is made by the lender due to the sale of the property not covering the outstanding liability.

5.2 Fidelity guarantee insurance

Fidelity guarantee covers the insured against financial losses caused by dishonest actions by its employees (fraud or embezzlement). These will include loss of money or goods owned by the insured or for which the insured is responsible and reasonable fees incurred in establishing the size of the loss (paid to auditors or accountants, for example).

5.3 Business interruption cover

Business interruption cover indemnifies the insured against losses made as a result of not being able to conduct business for various reasons specified in the policy, for example fire at the insured's or a neighbouring property.

The financial consequences of a fire to a company can be much more significant than the cost of repairs to premises. If the company's production lines are hit, income from customers will be much reduced until alternative production arrangements can be made. If this income stream was being used to pay off loans from a bank, the accumulating interest charges can put further financial strain on the company.

5.4 Cyber insurance

Cyber insurance is available to protect against cyber risks. Cyber insurance can cover pecuniary, fidelity guarantee and business interruption cover losses for a business.

Cyber risks include a wide variety of threats such as hacking, phishing, worm attacks, viruses, *etc.*

Criminals can use these attacks to steal company data, carry out fraudulent transactions, eavesdrop, extort money (*eg* by 'freezing' the company's IT system until the victim pays a ransom demand) *etc.*

Traditional risk management techniques such as antivirus software and firewalls can reduce the likelihood of these threats, but the pace of technological developments makes it impossible to eliminate the risk entirely.

Cyber attacks are often excluded from traditional insurance policies, so cyber insurance has evolved to meet this risk. It is a fast-evolving and growing area for general insurers.



Question

Describe the sorts of cover that might be provided under a cyber insurance policy.

Solution

Cyber insurance can provide cover against financial loss arising from an IT security breach.

Examples include:

- the cost of identifying and repairing any breaches
 - the cost of buying new computers / hardware
 - business interruption losses, while the insured's systems are down, *eg* lost revenue from internet sales
 - consequential losses / compensation payments to customers
 - fines imposed by the regulator as a consequence of the attack
 - costs associated with the loss of client information
 - costs associated with damage to the insured's reputation
 - costs arising from the onwards transmission of a virus, *ie* to third parties
 - loss of intellectual property.
-

Cyber insurance may *broadly* be considered a type of financial loss insurance. You can see from the question above though that in practice these policies can also include:

- property damage cover, *eg* covering the replacement value of affected computers
- liability cover, *ie* compensation payable to third parties.

6 Fixed benefits

6.1 Personal accident insurance

Benefits are usually specified fixed amounts in the event that an insured party (this may include the policyholder's family as well as the policyholder) suffers the loss of one or more limbs or other specified injury. This is not indemnity insurance because it is not possible to quantify the value of the loss, for instance, of an arm.

Cover may be offered on a group basis by an employer to all employees.

The perils are any form of accident that results in the loss of limbs or other specified injury.



Question

What do you think are the key differences in cover between group personal accident insurance and employers' liability insurance?

Solution

Group personal accident (GPA) claims are of fixed amounts (*eg* for loss of limb). The size of employers' liability (EL) claims will vary from claim to claim.

EL is often subject to legal minimum levels of cover and is compulsory in many countries. GPA cover is nearly always optional with the level of cover chosen by the employer.

Claims under EL will be due to the employers' negligence or negligence due to other employees. GPA claims are for any accident, regardless of fault.

EL will only pay out for incidents arising from employment. GPA will (generally) pay out for any accidents regardless of whether they arose from employment.

Accidents during employment could therefore give rise to claims on either EL or GPA.

6.2 Health insurance

Health insurance, in its narrowest sense, provides money for medical treatment. As such, it is an indemnity insurance. However, only part of the cost may be provided. Or benefits may be a fixed amount regardless of the actual cost of treatment, and this type of health insurance can then be included with fixed benefit insurances. Hospital expense plans also exist which pay a fixed amount for each day the patient is treated in hospital as an in-patient.

Health insurance cover is subject to the primary peril of the need for treatment in a hospital.

Note that in practice, the term 'health insurance', or 'health and care' (H&C) is an umbrella term used to describe the four main types of cover:

- income protection
- critical illness
- long-term care
- private medical insurance.

However, the Core Reading for Subject CP1 uses the term 'health insurance' to mean only private medical insurance.

6.3 Unemployment insurance

This provides a lump sum or an income stream, usually of no more than a year's duration, in the event of the policyholder being made redundant. Its purpose is to provide additional funds to maintain the policyholder's lifestyle and service any debts for a short period while new employment is sought.

Chapter 7 Summary

Liability insurance

Liability insurance provides indemnity where the insured, owing to some form of negligence, is legally liable to pay compensation to a third party.

Whilst the cover is on an indemnity basis, there may be an excess (payable by the insured) and/or a maximum level of cover provided by the insured.

The main types of liability insurance (along with the major perils covered) are:

- *employers' liability* – perils include accidents in the workplace due to negligence of an employer or employee, exposure to harmful substances / working conditions
- *motor third party liability* – perils include motor accidents caused by the insured
- *public liability* – perils depend on the type of policy, eg dog bites, falling objects
- *product liability* – perils include faulty design, manufacture, packaging and misleading instructions
- *professional indemnity* – perils depend on the profession of the insured.

Property damage insurance

The main characteristic of property damage insurance is to indemnify the insured against loss of, or damage to, their own material property.

Whilst the cover is on an indemnity basis, there may be an excess (payable by the insured) and/or a maximum level of cover provided by the insured. Household contents insurance is frequently written on a *new for old* basis.

The main types of property damage insurance (along with the major perils covered) are:

- *residential building* – perils include fire, explosion, lightning, theft, storm, flood
- *moveable property (ie contents)* – major peril is theft, other perils as per buildings insurance
- *commercial building* – perils include fire, explosion, lightning, theft, storm, flood
- *land vehicles (eg car)* – perils include accidental damage, theft
- *marine craft* – perils include perils of the sea, fire, jettison, explosion, piracy
- *aircraft* – similar perils to marine craft but air based.

Financial loss insurance

The benefit provided by financial loss insurance is indemnity against financial losses arising from a peril covered by the policy.

Whilst the cover is on an indemnity basis, there may be an excess (payable by the insured) and/or a maximum level of cover provided by the insured.

The main types of financial loss insurance (along with the major perils covered) are:

- *pecuniary loss* – perils include bad debts or failure of third parties, includes mortgage indemnity guarantee insurance
- *fidelity guarantee* – perils include dishonest actions by employees, such as fraud and embezzlement
- *business interruption*, also known as *consequential loss* – perils include fire in the insured's own property or in a neighbouring property.

Fixed benefits insurance

Fixed benefits insurance does *not* operate on an indemnity basis.

The main types of fixed benefit insurance (along with the major perils covered) are:

- personal accident – perils include loss of limb or other specified injury from an accident
- health – perils include the need for treatment in a hospital
- unemployment – the peril is redundancy.



Chapter 7 Practice Questions

7.1 List the perils associated with each of the following forms of insurance:

- employers' liability
- public liability
- product liability
- professional indemnity
- marine hull cover
- pecuniary loss
- fidelity guarantee.

7.2 *Moral hazard* is the risk that an insured behaves differently from the way they would behave if they did not have insurance in place.

Identify four examples of possible moral hazard within household insurance.

7.3 A friend has recently established a pizza delivery company. He has asked you for some advice as to the types of general insurance products that he might need. Describe briefly the types that he might need, including your reasons for suggesting them.

7.4 State the cash inflows and outflows associated with a motor vehicle insurance policy (from the perspective of the insurer) and the uncertainty associated with the cashflows.

7.5 A *rating factor* is a factor relating to a specific policyholder that is a quantifiable measure of risk to help in determining the appropriate premium rates. For example, rating factors under a private motor policy would include: age of driver, sex of driver (if allowed by regulation), past claims history of driver, make and model of car.

Set out the key rating factors for the following insurance products:

- employers' liability
- residential buildings.

7.6 A large industrial company is seeking to expand its operations. The company wishes to ensure that it has appropriate insurance arrangements to adequately manage the risks involved in the existing business, and make any appropriate changes in respect of the expansion.

Exam style

Describe the various types of general insurance product that might be appropriate in helping to manage the industrial company's risks.

[6]

The solutions start on the next page so that you can
separate the questions and solutions.



Chapter 7 Solutions

7.1 Perils include:

- *employers' liability*
 - accidents due to negligence of the employer or other employees
 - illness due to exposure to harmful substances
 - injury or illness due to exposure to harmful working conditions
- *public liability*
 - perils relating to policy type
 - examples include dog bites, falling objects
- *product liability*
 - perils depend upon the nature of the product
 - examples include faulty design, faulty manufacture, faulty packaging, misleading or incorrect instructions
- *professional indemnity*
 - perils depend upon the profession
 - examples include incorrect medical diagnosis, inappropriate legal advice, error in actuarial report
- *marine hull cover*
 - perils of the seas and navigable waters
 - fire, explosion
 - jettison, piracy *etc*
- *pecuniary loss*
 - bad debts or failure of a third party
 - an example is default on mortgage payments (under mortgage indemnity guarantee insurance)
- *fidelity guarantee*
 - dishonest actions by employees
 - examples include fraud or embezzlement

7.2 Four possible moral hazards in household insurance:

- engineering “accidents” to old / broken items and claiming full replacement
- acting carelessly, *eg* leaving a window open or the house unlocked
- carrying more cash / valuable items around with you (*ie* if personal effects outside the home are included under the terms of the cover)
- arson.

7.3 Types of cover:

- building insurance to protect against fire, storm, flood and other hazards
- contents of the kitchen / shop to protect against theft, flood, storm damage and other hazards
- business interruption cover to protect against loss of profits after damage to contents or buildings
- theft and liability fleet cover for the delivery vehicles / mopeds
- employers' liability against claims from the staff
- possibly public and product liability against claims for negligence from the public and employees.

7.4 The inflow for the insurance company is the premium received at the start of the year or at regular intervals, *eg* monthly.

The amount and timing of the premium is known precisely ...

... unless endorsements are made to the policy or the policy is discontinued.

The outflows consist of claim payments to policyholders or to third parties, *eg* vehicle repairers.

Both the amount and timing of the claim payments are uncertain.

Other outflows include the expenses incurred by the office including administration, rent of offices, staff costs *etc.*

These outflows will be relatively fixed and hence certain in the short term, with the exception of claim-related expenses (which will depend on the timing and the amount of the claim).

7.5 Key rating factors:

Employers' liability

- Payroll
- Number of employees
- Type of industry
- Exposure to hazardous chemicals / products / processes
- Past claims experience
- Location
- Size of excess

Residential buildings insurance

- Sum assured
- Number of rooms / bedrooms
- Age and gender of policyholder
- Owner or tenant
- Age of building
- Construction of building
- Past claims experience

7.6 **Exam tip**

- Consider the different general insurance products that are outlined in this chapter. Pick out the ones that are relevant to this company and give a description of the cover that they provide and the risks (or perils) that they insure against.
- Note that you should be considering *commercial* covers only, not *personal* covers, as the question concerns an industrial company, not an individual.
- For six marks, you should aim to describe twelve products.

The following products might be appropriate in helping to manage the industrial company's risks:

Employers' liability – indemnifies the insured against legal liability to compensate an employee or their estate for accidental bodily injury, disease or death suffered, owing to negligence of the employer or other employees. [½]

Public liability – indemnifies the insured against legal liability for the death of or bodily injury to a third party or for damage to property belonging to a third party, other than where covered by other liability insurance. [½]

Fleet motor 3rd party liability – indemnifies the insured against compensation payable to third parties for personal injury or damage to their property. [½]

Product liability – indemnifies the insured against legal liability for the death of or bodily injury to a third party (eg a customer) or for damage to property belonging to a third party, that results from a product fault. [½]

Professional indemnity – indemnifies the insured against legal liability resulting from negligence in the provision of a service by professionals in the company. [½]

Property contents – indemnifies the insured against the value of loss or damage to the contents, subject to any limits or excesses, resulting from, for example theft, accident, flood, fire. [½]

Commercial buildings – indemnifies the insured against the value of loss or damage to the buildings, subject to any limits or excesses, resulting from, for example fire, storm, lightning, flood, theft, explosion. [½]

Fleet motor property – indemnifies the insured against value of loss or damage to the vehicles, subject to any limits or excesses, resulting from, for example accidental or malicious damage, fire, theft. [½]

Marine and aviation property – indemnifies the insured against the value of loss or damage to marine/aircraft, subject to any limits or excesses, resulting from, for example fire, explosion, jettison, piracy, perils of the sea or air. [½]

Pecuniary loss – protects the insured against bad debts or failures of a third party. [½]

Fidelity guarantee – covers the insured against financial losses caused by dishonest actions by its employees, for example fraud and embezzlement. [½]

Business interruption – indemnifies the insured against losses made as a result of not being able to conduct business, for example due to a fire in the property itself or in a neighbouring property. [½]

Personal accident – provides fixed benefits on loss of a limb or other specified injury from an accident. [½]

Medical benefits (health insurance) – provides benefits (often fixed) for medical treatment in hospitals. [½]

These last two products would need to be offered on a group basis, since we are considering commercial rather than personal lines cover. [½]

[Maximum 6]

End of Part 2

What next?

1. Briefly **review** the key areas of Part 2 and/or re-read the **summaries** at the end of Chapters **5** to **7**.
2. Ensure you have attempted some of the **Practice Questions** at the end of each chapter in Part 2. If you don't have time to do them all, you could save the remainder for use as part of your revision.
3. Attempt **Assignment X1**.

Time to consider ...

... 'learning and revision' products

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8

Bond and money markets

Syllabus objective

9.3.2 Demonstrate a knowledge and understanding of the characteristics of the principal investment assets and of the markets in such assets.

(Covered in part in this chapter.)

0 Introduction

In this chapter we introduce some common investment classes:

- cash on deposit
- money market instruments
- fixed-interest bonds
- index-linked bonds.

Each investment class has its own characteristics. If we understand the characteristics of an investment, we can make an informed decision as to whether an investment is appropriate to be held by a particular investor.

There is a useful acronym that can be used to help understand the characteristics of an investment, SYSTEM T:

Security (default risk)

Yield (real or nominal, expected return)

Spread (volatility of market values)

Term (short, medium or long)

Expenses or **E**xchange rate

Marketability

Tax

1 Cash on deposit

Cash on deposit covers call deposits, notice deposits and term deposits.

Cash can be placed on deposit:

- **with the depositor having ‘instant access’ to withdraw the capital deposited**
This is a call deposit.
- **with the depositor having to give a period of notice before withdrawal**
This is a notice deposit.
- **for a fixed term with no access to the capital sum earlier than the maturity of the deposit.**

This is known as a term deposit or fixed-term deposit.

Call deposits can be for as short a term as overnight. Term deposits are typically for terms of up to a year but can be for longer. Notice deposits form a subset of term deposits.



Question

Explain which of the three types of cash deposit above would be expected to offer the highest interest rate.

Solution

The term deposit would be expected to offer the highest interest rate, to compensate the investor for the lack of flexibility relative to the notice and call deposits.

The rate of interest paid by the borrower can be:

- **fixed for the term of the deposit**
- **fixed for an initial period**
- **variable from day to day.**

The borrower may have to give notice of any change in interest rates.

The above combinations may be familiar from looking at the types of account offered by high street banks.

At one extreme, a fixed term deposit at a fixed-interest rate throughout the term, all the cashflows are certain and known in advance. At the other extreme, an instant access or ‘call’ account with variable interest, the amounts and timing of cashflows will be completely unknown.

2 The money markets

2.1 Types of instrument

There are many different types of money market instrument. They are characterised by being highly liquid and being short term, usually with a term of one year or less. Examples of money market instruments are Treasury Bills, certificates of deposit, commercial paper and bills of exchange.

2.2 Key players in the money markets

Clearing banks

The money markets are dominated by the clearing banks, which use them to lend excess liquid funds and to borrow when they need short-term funds. These loans and deposits are usually very short term, often overnight. Interbank rates are usually taken as the benchmark for short-term interest rates.

Central banks

Central banks, as lenders of last resort, stand ready to provide liquidity to the banking system when required and also use their operations in the money markets to establish the level of short-term interest rates. Central bank money market operations involve the sale or purchase of Treasury and other eligible bills.

When it sells Treasury bills, a central bank will receive cash from the money market. This makes cash scarcer and tends to drive up interest rates. Similarly, when it buys back Treasury bills and other bills that are eligible to be sold to the central bank, the central bank will pay out cash. This tends to reduce interest rates, since interest rates represent the price of using money.

Other institutions

Other financial institutions and non-financial companies also lend and borrow short-term funds in the money market.

3 Characteristics of cash on deposit and money market instruments



Question

Set out the investment and risk characteristics of cash on deposit and money market instruments using SYSTEM T as headings.

Solution

Security

This depends on the issuer. For example, money lent to the US Government is more secure than a deposit with a small company in a developing country. In most cases, the security will be very good due to the short-term nature of the instruments, and default is very rare.

Yield – real vs nominal

The income from cash on deposit and money market investments will approximately equal the prevailing short-term interest rate set by the monetary authorities. This can vary considerably over time.

Some instruments are issued at a discount and redeemed at face value (these sometimes have the word *bill* in their name). However this increase in capital value should really be considered as income (as it often is for tax purposes). Such instruments provide a known nominal return.

In general, cash deposits and money market instruments tend to give a positive real return (where 'real return' means the return net of inflation). This is because short-term interest rates tend to be higher when inflation is higher. We would usually expect short-term interest rates to be, say, 2% *pa* or 3% *pa* above inflation, otherwise there is no incentive to save. However, this is not always the case, as has been seen in recent years in both the UK and the USA.

Yield – expected return relative to other assets

Cash on deposit and money market investments are generally close to being risk-free, in the sense that there is very little risk of default – although this does depend upon the issuer, as mentioned above. The expected returns from money market investments are therefore lower than from almost every other type of investment.

This does not mean that these investments will give a lower *actual* return than other investments.

Spread – volatility of capital values

The nominal values of cash on deposit and money market investments are fixed in cash terms and, as they are short-term, there is very little volatility in market value. For example, if three-month interest rates change by 1% *pa*, the present value of a 91-day bill would change by only about ¼%. For call (*ie* instant access or overnight) deposits with a bank, there is no volatility.

Term

The distinctive feature of cash on deposit and money market investments is that they are short-term. The term is generally less than one year and is often very much shorter, *eg* one week or even one day (*ie overnight* money).

Expenses

The expenses of dealing in and managing cash on deposit and money market instruments are minimal.

Exchange rate – currency risk

Cash on deposit and money market investments are available in a wide range of currencies. The main additional consideration with overseas cash deposits and money market instruments is the possible fluctuations in exchange rates. Movements in exchange rates would be expected to compensate for differences in interest rates between countries over the term.

For example, suppose Euro six-month interest rates are 5% *pa* and US rates are 4% *pa*. An investment in a six-month dollar bond would be justified if the investor expects the dollar to strengthen by more than ½% against the Euro over the next six months.

However, currency movements are very difficult to predict, so there would be a substantial risk of getting less than the expected return.

Marketability

With the exception of call and term deposits, most instruments are highly marketable. However, they are unquoted – they are traded through an *interbank* money market rather than through a stock exchange.

Tax

The total return from cash on deposit and money market instruments is normally treated as income for tax purposes.

4 Attractions of cash on deposit and money market instruments

4.1 Introduction

It would usually be inappropriate for long-term institutions such as life insurance companies and pension funds to hold a high proportion of their assets in the form of cash on deposit or money market instruments.



Question

Give two basic arguments to support the above statement.

Solution

Two basic arguments are that cash:

1. usually gives a lower expected return than other assets
2. may not match the liabilities (*eg* in terms of the impact of unexpected changes in the rate of inflation and in terms of the uncertainty resulting from the need for frequent reinvestment of cash).

Long-term institutional investors such as life insurance companies and pension funds generally hold cash only:

- as liquidity to meet expected outgoings or
- temporarily, when taking a view that values of other assets are likely to fall.

4.2 Holding cash and money market instruments for liquidity

Known short-term commitments

An investor may have a known major outgo within the very short term. A short-term money market investment therefore provides an ideal match by term for the liability.

Uncertain outgo

Institutions with a high degree of uncertainty in their liability outgo usually want to maintain a minimum level of liquidity to meet any immediate liabilities that may arise. General insurers are good examples of such institutions. Holding money market investments and cash protects the general insurer against the risk of being forced to sell assets at depressed prices should a natural disaster occur resulting in very many claims.

Opportunities

Institutions might like to maintain a strong liquid base in order to take part in attractive investment opportunities that may arise from time to time. If the opportunities are available for a very short period only, then it is essential that the investor has the necessary liquidity to take part.

Recent cashflow

From time to time, an institutional investor may receive large cash inflows and it will not necessarily purchase other assets immediately. Until all the funds have been reinvested, the institution will have a large cash balance.

Preservation of nominal value of capital and risk aversion

Investors who are highly risk-averse and investors who need to maintain the monetary value of their investments will probably hold a larger proportion of cash investments than others.

4.3 Economic circumstances in which cash and money market instruments are attractive

Economic conditions which might make cash temporarily attractive to long-term institutional investors or to other investors seeking to maximise returns include:

- **generally *rising interest rates* which will depress both bond and equity markets**
- **the *start of a recession* if it is thought that equity markets will suffer from lower growth and bonds might suffer from an increase in the government's deficit**
- **weakness of the *national currency* making cash investments in other currencies attractive.**

Rising interest rates

If interest rates are increasing then gross redemption yields on fixed-interest bonds will tend to increase and prices of fixed-interest bonds will therefore fall (this will be covered in more detail later in this chapter). The equity market might also suffer a fall in market values due to an increase in interest rates, as higher interest rates will generally depress economic activity and reduce companies' profits.

An investor who correctly anticipates an increase in interest rates (when other investors have not) would therefore choose to hold cash rather than suffer a capital loss from either fixed-interest bonds or equities. The higher nominal income from higher interest rates might also be attractive.

Start of an economic recession

If a country starts to move into a period of recession, then the domestic stock market is likely to perform badly. Share prices are unlikely to increase if companies are struggling to maintain profitability.

There might be some fears that government borrowing would increase during a recession, leading to a larger supply of government fixed-interest bonds and so to reductions in the prices of fixed-interest bonds. However, recessions are often followed by reductions in short-term interest rates, which could themselves lead to lower gross redemption yields and higher prices for fixed-interest stocks.

So, cash investments might be more attractive than bonds and equities at the start of a recession. Cash would give a reasonable income stream combined with no risk of capital loss, unlike equities and fixed-interest investments, which might fall in value.

Depreciation of domestic currency

If an investor expects the domestic currency to come under pressure, cash investments might be attractive for the following two reasons:

1. Short-term interest rates may be raised by the Government in an attempt to defend the domestic currency. This might make cash investments attractive because the value of other assets might be expected to fall in value.
2. A cash investment in a stronger currency (*eg* dollars) could prove attractive, even if the interest rates abroad were lower. As the domestic currency depreciated, the value in the domestic currency of overseas cash would increase.

General economic uncertainty

The stability of capital values will make cash investment attractive to risk-averse investors – this effect is enhanced in times of economic uncertainty. However, over the long term, cash would be expected to give a lower return than riskier or less liquid investments.



Question

Suggest why an institutional investor might hold a large share of its assets in cash investments.

Solution

Institutions may hold a large portion of their funds in money market investments for the following possible reasons:

- to reflect their liabilities and need for liquidity, *eg*:
 - lots of short-term commitments
 - to be ready to take advantage of other investment opportunities
 - highly uncertain outgo, so funds need to be kept liquid
 - need to protect the monetary value of assets
 - recent receipt of large cashflow
 - economic conditions, *eg*:
 - worried about the prospects for other asset categories
 - worried that the value of domestic currency will fall (so invest in money market instruments denominated in other currencies)
 - clients of the institution are risk averse and/or a period of economic uncertainty is expected.
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5 Bond markets – an introduction

‘Bond’ is an alternative term for a fixed-interest or index-linked security.

They are issued by national and local governments, government agencies, supranational organisations (*eg* the World Bank) and by a wide range of companies. Bonds issued by the government of a developed country in its domestic currency are typically the most secure long-term investment available. In most developed economies, government bonds form the largest, most important and most liquid part of the bond market in the domestic currency.

Bonds are described by:

- **the type of organisation issuing the security, such as government bonds, local authority bonds, corporate bonds and so on**
- **the nature of the bond – fixed-interest (also called conventional) or index-linked.**

UK government bonds are commonly referred to as ‘gilt-edged securities’ or ‘gilts’.

US government bonds are commonly referred to as ‘Treasury bonds’.

The most important distinct types of bond market are:

- **the markets in government bonds, listed in their country of origin**
- **the markets in corporate bonds, listed in their country of origin**
- **the markets in overseas government and corporate bonds, listed in any country other than the ‘home’ country.**

Overseas bonds may be denominated in the national currency, in which case there is an additional currency risk, or may be denominated in the currency of the country in which they are marketed.

We will look at the overseas investment markets, including bonds, in a later chapter.

6 Fixed-interest (or conventional) bonds

6.1 Introduction

A body such as an industrial company, a public body, or the government of a country may raise money by issuing a fixed-interest security, normally in bonds of a stated *nominal* amount.

Central governments issue bonds as part of an overall borrowing programme designed to fund part or all of the shortfall of income as compared to government expenditure. Government bonds typically constitute the majority of a domestic bond market.

Regional government bodies, *eg* local authorities, issue bonds as a means of raising finance on a local level (*eg* to pay for roads or schools).

Companies issue bonds as an alternative to raising money via equity finance.

The term *nominal* refers to an amount of bond stock. It is the amount specified on the stock certificate. Dealings in bonds and calculations for bonds are carried out in amounts of nominal. For example, an investor may purchase £100 nominal of a particular bond which has a *coupon* of 5% *pa*, and is redeemable at par. The purchase price for this amount of bonds might be £94.56. You would then expect to receive £5 *pa* in income and, ultimately, a repayment (or *redemption*) of £100.

6.2 Cashflows

The characteristics of such a security are that the holder of a bond receives a lump sum of specified amount at some specified future time together with a series of regular level interest payments until the payment of the lump sum.

The fixed lump sum payment is called the redemption of the bond; it is paid on the redemption date and is normally of the original nominal amount, *ie* 'at par'.

The lump sum payment at redemption is calculated by multiplying the nominal amount held N by the redemption price R per unit nominal (which is often quoted as a percentage in practice). As mentioned above R is usually = 100% (*ie* the bond is redeemable at par) but R can be > 100% (*ie* the bond is redeemable at a premium) or < 100% (*ie* the bond is redeemable at a discount).

The investor has an initial negative cashflow to buy the bond, a single known positive cashflow on the redemption date, and a series of smaller known positive cashflows on the interest payment dates. Although the amounts and timing of these positive cashflows are known, there is still uncertainty associated with them due to credit risk.

The initial negative cashflow in the paragraph above is the price paid for the bond.

6.3 Gross redemption yield

An important concept is the *gross redemption yield* of a bond. This is the return the investor would expect to get on a bond if they held it until redemption. This assumes that they could reinvest the coupons at exactly the same rate, and it ignores expenses, tax and default risk.

Equivalently, it can be defined as the yield that equates the price of the bond with the discounted value of the interest and capital proceeds on the bond.



Question

Give an expression for calculating the gross redemption yield on the following bonds (redeemed at par):

- (i) a 10-year zero-coupon bond
- (ii) a 10-year semi-annual coupon bond with an 8% coupon.

Solution

- (i) The gross redemption yield is the value of i that solves the following equation:

$$\text{Price} = 100v^{10} = \frac{100}{(1+i)^{10}}$$

- (ii) The gross redemption yield is the value of i that solves the following equation:

$$\text{Price} = 8a_{\overline{10}|}^{(2)} + 100v^{10}$$

In practice, the gross redemption yield that is quoted for a semi-annual-coupon bond is an interest rate which is *convertible half-yearly*. So, in this example, the gross redemption yield would be $i^{(2)}$ rather than i .

The price and gross redemption yield on a bond are inversely related. Therefore, for example, if the price of a bond increases, the gross redemption yield will fall. This can be seen from the formulae showing the relationships between price and gross redemption yield in the solution to the previous question.

6.4 Fixed-interest government bonds: investment and risk characteristics

The investment and risk characteristics of conventional government bonds should be familiar from earlier actuarial subjects.



Question

Set out the investment and risk characteristics of conventional government bonds using the SYSTEM T acronym.

Solution

Security

Bonds issued by a reputable government offer absolute monetary security of both income and capital. There is virtually no risk of default.

Yield – real vs nominal

If conventional government bonds are held until redemption, the monetary amounts of income and capital are known and fixed. To this extent, the expected nominal returns are known at outset. The *actual* return achieved might, however, be uncertain:

- If an investor bought an n -year bond to meet an n -year liability, the coupon payments would have to be reinvested on terms that are not known at the outset.
- If an investor plans to sell before redemption, the sale price is not known at the outset.
- The real return (*ie* the return in excess of inflation) is uncertain. If inflation turns out to be higher than expected at outset, the real returns from conventional bonds will be lower than originally anticipated.

Yield – expected return relative to other assets

Low risk / low return – as low risk investments, government bonds should have a low expected return. The historical evidence tends to support the idea that returns from government bonds are generally lower than returns from equities.

There are broadly two scenarios in which investors in conventional bonds do well:

1. Holding conventional bonds when redemption yields are falling. This produces a capital gain if the bond is sold, particularly for more volatile long-dated bonds.
2. Buying when gross redemption yields are high. Investors are effectively locking into a high nominal return. (However, the yields are probably high for a reason, *eg* investors expect very high inflation and/or other investments are also expected to produce a high return.)

Spread – volatility of capital values

Market values will fluctuate from day to day if there are changes in the supply and/or demand. Quite large shifts in market value are possible with less liquid, long-dated stocks.

The risk of falling market values may be a problem for:

- investors who need to prove financial strength by reference to the market value of assets (*eg* general insurers)
- investors who have to sell at the lower market prices (*eg* if an investor is required to meet a liability earlier than anticipated).

Term

Conventional government bonds can be classified as:

- shorts (< 5 years)
- medium-dated (5 – 15 years)
- long-dated (> 15 years)
- undated or irredeemable (no redemption date).

Expenses

Dealing costs are usually very low – the margins between buying and selling prices being narrower than for corporate bonds.

Exchange rate – currency risk

Government bonds are issued by many overseas countries. To this end, there will be a currency risk for an investor who is investing in bonds denominated in one currency but who has liabilities denominated in another. (We discuss the risks of overseas investments later in the course.)

Marketability

Excellent marketability. Investors can deal in large quantities with little (or no) impact on the price.

Tax

The taxation of the income and capital gains will depend on the tax regime of the country concerned. In the UK, individual investors are taxed on income but not on capital gains. Institutional investors pay a uniform rate of tax on the total return (income + capital gains).

The wide variety of conventional government bonds by term and coupon means that they are particularly useful for investors who need to match fixed monetary liabilities.

6.5 Fixed-interest corporate bonds: investment and risk characteristics

The basic features, *eg* the structure of the cashflows, of corporate bonds are similar to those of government bonds.



Question

Describe the major differences in investment and risk characteristics between government and corporate bonds.

Solution

The main differences between government and corporate bonds relate to:

- *Security* – corporate bonds are generally much less secure than government bonds. The level of security depends upon the type of debt security considered, the company that has issued the bond and the term of the bond.
- *Marketability* – corporate bonds are typically much less marketable than government bonds, primarily because the size of issue is smaller.
- *Liquidity* – the market values of corporate bonds tend to be more volatile / less predictable than the market values of government bonds.
- *Yields* – The gross redemption yields on corporate bonds are higher than for similar government bonds, compensating for the lower marketability and liquidity and the perceived additional default risk. The lowest yield margins will be for larger issues from companies with high credit ratings.

Government securities generally provide the most secure and marketable fixed-interest investment in a particular currency. Therefore, investors will require a higher yield on other forms of debt.

However, the degree of security offered by government bonds may vary between different governments and depends on economic conditions. For example, bonds issued by most western European governments have historically been perceived as being free of default risk, but this has not been true in the case of the governments of smaller or less developed countries.

In addition, during the economic turmoil following the ‘credit crunch’ even bonds issued by some western European governments such as Greece and Italy have been considered to carry significant default risk.

Hence in some instances, the debt issued by a large multinational firm might actually be considered less risky.

The size of this yield margin depends on both the security and the marketability of the debt. Relatively low security and marketability will mean a large margin whereas a large secure issue will trade at a small yield margin to the closest equivalent government bond.

The yield margin referred to in the previous paragraph is the excess of the yield available on corporate bonds over than on equivalent government bonds. Yield margins will vary time; they will tend to be lower when economic conditions are good and the risk of default is low. They will also tend to reflect any differences in tax treatment.

7 Index-linked bonds

7.1 Introduction

This is a security where the cash amount of the interest payments and the final capital repayment are linked to an 'index' which reflects the effects of inflation.

Such bonds therefore provide a return in *real* terms (*ie* the returns are protected against changes in inflation).

Compared to conventional bonds, index-linked bonds are a relatively new investment. For example, index-linked gilts were introduced in the UK in 1981, whilst index-linked, US Treasury bonds were introduced only in 1997. The sizes of individual issues of government index-linked bonds can vary greatly, leading to differences in marketability. Index-linked bond issues are generally much smaller and, hence, less marketable than their conventional equivalents.

Issues of index-linked bonds by non-government bodies are relatively infrequent. Our discussion below therefore relates primarily to government index-linked bonds. Corporate index-linked bonds have similar characteristics – as with conventional bonds, the main differences relate to marketability and security.

7.2 Cashflows

The initial negative cashflow is followed by a series of unknown positive cashflows and a single larger unknown positive cashflow, all on specified dates. However, it is known that the amounts of the future cashflows relate to the inflation index. Hence these cashflows are known in 'real' terms.

In practice the operation of an index-linked security is such that the cashflows do not relate to the inflation index at the time of payment, due to delays in calculating the index. It is also possible that the borrower (or perhaps the investors) may need to know the amounts of the payments in advance. This may lead to the use of an index from an earlier period so that the amount to be paid is known in advance of the payment date.

This is often referred to as a 'lag' in the indexation.

As a result of the lag, there is effectively no inflation protection during the last months before redemption (where the number of months equals the period of the lag). This means the investor is exposed to erosion of the real value of the investment if inflation is higher than expected during that period.

7.3 Yields

The actual payments from an index-linked bond are dependent on future inflation. Without knowing future inflation rates, we cannot calculate redemption yields from index-linked bonds.

The convention for quoting yields on index-linked bonds is to assume a fixed rate of future inflation and then to calculate the *real* yield in excess of this assumed inflation rate. For index-linked bonds, it is a fall in *real* yields not *nominal* yields that increases prices. This is an important point to remember.



Question

Outline the information and assumptions that are required in order to value an index-linked bond.

Solution

The following is required:

- the *assumed* future inflation rate – as measured by the price index used for indexing the coupon and redemption payments
 - the nominal values of the coupon and capital redemption payments
 - the outstanding term of the index-linked bond
 - the value of the price index used to calculate the actual amount of the next coupon payment
 - the time to the next coupon payment
 - a yield at which to discount the future cashflows in order to obtain a value.
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8 Comparison of fixed-interest and index-linked bonds

8.1 The relationship between real and nominal yields

The nominal yield on conventional government bonds can be expressed as:

$$\text{nominal yield} = \text{risk-free real yield} + \text{expected future inflation} \\ + \text{inflation risk premium}$$

The inflation risk premium reflects the additional yield required by investors with real liabilities for bearing the risk of uncertain future inflation. The size of the premium is therefore determined by the degree of uncertainty as well as the balance between the numbers of investors requiring a fixed return and those requiring a real return.

If investors require a certain real return, *eg* because they have real liabilities, then there will be an inflation risk premium on a fixed-interest bond. Investors will require a higher return from fixed-interest bonds (than index-linked bonds) to compensate them for the risk of inflation being higher than expected and eroding the real return on conventional bonds.

If investors require a certain nominal return, *eg* because they have fixed liabilities, then there will not be an inflation risk premium on fixed-interest bonds. In fact, investors will require a higher return from index-linked bonds (than fixed-interest bonds) to compensate them for the risk of inflation being lower than expected and the required nominal return not being achieved. We could express this as a 'monetary risk premium' on index-linked bonds.

In practice, in deriving yield equations such as the one above, we tend to assume that investors have real liabilities.

The inflation risk premium is unlikely to be large.

If the inflation risk premium is ignored, the difference between nominal and real yields gives an estimate of the market's expectations for inflation.

8.2 The relative attractiveness of fixed-interest and index-linked bonds

In general, investors' expectations for the relative performance of different asset classes will depend on their views of all the factors that affect supply and demand. However, there are particular economic circumstances when index-linked bonds will outperform conventional bonds and *vice versa*.

8.3 Increases in the values of fixed-interest bonds

As previously mentioned, the market values of fixed-interest bonds rise when nominal yields fall.

Conventional bond yields will fall if investors' expectations for future inflation fall or if the size of the inflation risk premium falls. Both could occur with minimal effects on the real yields on index-linked bonds and, consequently minimal change in the level of index-linked prices. Thus, an investor whose expectation for future inflation is lower than that implied by the difference between nominal and real yields in the market will find conventional bonds relatively more attractive than index-linked bonds. The converse will be true for an investor who is more pessimistic about inflation than the market.

If we want to enjoy the increase in the market values of conventional bonds, we need to be holding the bond *while* the market changes its views about future interest rates and inflation. It is too late rushing in and buying the bond *after* the market has realised that the economic circumstances are looking good for fixed-interest bonds. By then the prices will have already gone up. This is a fundamental principle of all investment decisions based on a particular market view.

8.4 Increases in the values of index-linked bonds

Index-linked securities may increase in value as markets become *more uncertain* about the prospects for future inflation. The best time therefore to buy index-linked bonds is just *before* the market gets worried about the prospects for future inflation.

Greater uncertainty may cause investors to increase their demand for index-linked securities as they offer protection against *unexpected* inflation. The extra demand for index-linked securities may push their prices up and real yields down.

The economic circumstances that tend to cause greater uncertainty over future expected inflation are:

- less government commitment to a low inflation environment
- loose monetary policy
- devaluation of the domestic currency
- rapid economic growth.

8.5 Conclusion

In practice it is very difficult to be sure whether fixed-interest or index-linked bonds, or even money market instruments, will give the best returns. Not only does the investor have to judge correctly how various economic factors will develop, but they have to make their judgement ahead of the rest of the market. (They might even end up making the right choice for the wrong reasons.)

Rarely can we look at a particular set of circumstances and know for sure which asset categories will produce the best returns. It is important to:

- avoid being dogmatic (there might be several potentially correct answers)
- recognise the relevant economic factors and try to identify the most important
- consider how the most important economic factors might affect the values of each asset category.

Chapter 8 Summary

Types of cash on deposit instruments

Cash on deposit instruments include:

- call deposits, where the depositor has 'instant access' to withdraw funds
- notice deposits, where the depositor has to give a period of notice before withdrawal
- term deposits, where the depositor has no access to the capital sum earlier than the maturity of the deposit.

Interest rates on bank deposits may be fixed or variable over the term of investment.

Types of money market instruments

Money market instruments can be issued by:

- Treasury bills (issued by governments)
- local authority bills (issued by regional government bodies)
- bills of exchange and commercial paper (issued by companies).

The main players in the money markets

The *main* players are:

- the clearing banks, who use money market instruments to lend excess liquid funds and to borrow when they need short-term funds
- central banks, who act as lenders of last resort, stand ready to provide liquidity to the banking system when required, and who buy and sell bills to establish the level of short-term interest rates
- other financial institutions and non-financial companies, who lend and borrow short-term funds.

Investment and risk characteristics of cash on deposit and money market instruments

- normally good security as term very short, but will depend on the borrower
- all return is through income (or capital gain that can be considered as income)
- level of income has a loose, indirect link with inflation
- lower expected returns than equities or bonds over the long term
- stable market values
- short-term
- low dealing expenses
- liquid
- normally highly marketable
- return normally taxed as income

Reasons for holding cash on deposit and money market instruments

Institutions may hold a portion of their funds in deposits and money market instruments for the following reasons:

- to meet short-term commitments
- because outgo is uncertain
- to be ready to take advantage of other investment opportunities
- because the institution has received funds which are awaiting investment in some other asset category
- because the institution needs to protect the monetary value of assets.

Institutions may also hold money market instruments temporarily if they are pessimistic about the outlook for other assets, *eg* if they expect:

- rising interest rates (which might cause other asset values to fall)
- economic recession (with a fear that equity and possibly bond prices will fall)
- the domestic currency to weaken (which makes *overseas* cash holdings attractive)
- general economic uncertainty.

Bonds

A bond is a fixed-interest or index-linked security that is traded on a bond market.

Bond markets

The most important distinct types of bond market are:

- the markets in *government bonds*, listed in their country of origin
- the markets in *corporate bonds*, listed in their country of origin
- the markets in *overseas* government and corporate bonds, listed in other than the 'home' country.

Fixed-interest bonds

A *fixed-interest* or *conventional* bond gives an income stream and final redemption proceeds that are fixed in monetary terms.

Investment and risk characteristics of fixed-interest government bonds:

- very good security (in politically stable countries)
- yield (gross redemption yield) is fixed in nominal terms
- lower expected returns than equities over the long term
- market values can be volatile especially for longer-term bonds
- mixture of terms: short, medium, long, undated
- low dealing expenses
- highly marketable.

Corporate bonds are generally less secure, less marketable and less liquid than government bonds – consequently, investors will generally require a higher yield in order to hold them.

Index-linked bonds

An index-linked bond gives an income stream and final redemption proceeds that are linked to an inflation index.

Nominal yield on a fixed-interest government bond

nominal yield = risk-free real yield + expected future inflation + inflation risk premium

Relative attractiveness of fixed-interest and index-linked bonds

An investor whose expectation for future inflation is lower than that implied by the difference between nominal and real yields in the market will find fixed-interest bonds more attractive than index-linked bonds and *vice versa*.

The practice questions start on the next page so that you can keep the chapter summaries together for revision purposes.



Chapter 8 Practice Questions

- 8.1 Suggest reasons why an investor might invest heavily in Treasury bills.
- 8.2 Explain the principal economic factors that might cause institutional investors to increase their holdings of money market instruments.
- 8.3 A 15-year bond has a gross redemption yield of 5.5% *pa*.

State reasons why a tax-exempt investor buying that bond may not make a return of 5.5% *pa* even if they hold it to redemption.

- 8.4 Describe the circumstances under which money market investments may be temporarily unattractive to investors. [4]

Exam style

- 8.5 (i) Discuss the features of corporate debt that would make it a suitable investment for a scheme providing benefits on retirement. [5]

Exam style

- (ii) Describe the possible features of a new corporate bond issue that would reduce the risks associated with it, and thus might make the bond more attractive to an investor. [4]

[Total 9]

The solutions start on the next page so that you can
separate the questions and solutions.



Chapter 8 Solutions

8.1 An investor may invest heavily in Treasury bills because he or she:

- is very risk-averse
- is worried about the risk of default on other securities
- wants stability of monetary values
- is worried that the values of other assets may fall
- needs liquidity, *eg* to meet short-term liabilities ...
- ... or to meet uncertain liabilities
- wants diversification from other asset categories, *eg* equities.

8.2 Expectations of rising interest rates, because of the higher nominal income from money market instruments and because both bond and equity markets are likely to fall.

The start of a recession, as the equity market would be expected to fall (as companies struggle) ...

... as would the bond market (as the government may issue more bonds to raise finance and interest rates may be higher).

An expected weakening of the domestic currency, which makes investment in overseas money market instruments attractive.

Additionally, a depreciation of the domestic currency may be followed by rising interest rates.

In each case, cash will be attractive to an investor if they anticipate the above events *before* the market as a whole allows for them in the price of investments.

8.3 Reasons why the investor may not make a return of 5.5% *pa*:

- reinvestment of coupons may not occur at 5.5% *pa*
- default by issuer
- sterling return on overseas bond affected by currency movements
- inflation means that *real* return is not 5.5% *pa*
- dealing costs
- issuer exercises a call option against the investor.

Note also that tax may sometimes even be payable by a tax-exempt investor (*eg* a withholding tax on an overseas bond, which it may not be possible to reclaim).

8.4 *This question is Subject CA1, September 2005, Paper 1, Question 1*

Circumstances under which money market instruments may be temporarily unattractive include:

- General economic certainty – since cash would be expected to give a lower return than on other assets ... [½]
 ... and investors would be less concerned with the stability of capital values. [½]
 - Expectations of falling interest rates – if interest rates are expected to fall, then gross redemption yields on fixed-interest bonds will be expected to decrease and bond prices rise. [½]
 A fall in interest rates will also generally stimulate economic activity and increase companies' profits, which should lead to a rise in the equity market. [½]
 - The end of a recession / start of a boom – it may be thought that equity markets will benefit from higher growth. [½]
 Government borrowing might be expected to decrease during a boom, potentially leading to a shortage of government bonds and therefore to an increase in government bond prices. [½]
 - Expectations of a strengthening domestic currency. [½]
 - If the investor is not risk averse or is *not* concerned with liquidity. [½]
- [Total 4]

8.5 *This question is Subject CA1, April 2005, Paper 1, Question 5*

(i) ***Corporate debt securities for benefits scheme***

Characteristics of liabilities

Most corporate debt is fixed interest. This provides a good match for any fixed monetary liabilities within a benefits scheme, eg level or fixed increase pensions in payment. [1]

In particular, corporate debt is likely to be useful for maturing benefit schemes, where a large proportion of the liabilities will constitute pensions in payment. [½]

Benefit scheme liabilities can be very long-tailed. Corporate debt may be available at longer durations than government debt, providing a better match. [1]

Characteristics of assets

Corporate debt tends to offer a higher expected return than government debt. This extra return may be deemed to outweigh the higher risks, for example of default and lower marketability. [½]

An ongoing benefits scheme may not be worried about lower marketability if it intends holding the debt until redemption. [½]

Most corporate debt securities provide a nominal return, which includes an allowance for expected future inflation and an inflation risk premium. [½]

If the benefits scheme believes that the market has overestimated either of these two components, then the debt may seem cheap. [½]

Corporate debt provides diversification from government debt and the equity markets. Such diversification reduces portfolio risk. [½]

Some types of corporate debt may include options, *eg* convertible debt, which further increases diversification. [½]

A relative lack of supply of alternative investments, *eg* government debt or equities, may have caused the price of such alternatives to seem high relative to corporate debt. [½]

Characteristics of the investor

Benefit schemes may enjoy favourable tax treatment relative to other investors, *eg* tax breaks may be available on income and/or capital gains. As the price of an asset is set based on the average investor and their tax treatment, the benefit scheme may view certain corporate debt securities as being cheap. [½]

Legislative / solvency requirements and/or the scheme's trust deed may require investment in corporate debt. [½]

[Maximum 5]

(ii) ***Features of a new corporate bond issue to reduce risk***

The bond would be less risky if it had lower default risk. This could be a result of:

- the type of debt, *ie* higher ranking debt (*eg* debentures) rather than lower ranking debt (*eg* unsecured debt or subordinated debt) [½]
- the existence of fixed or floating charges [½]
- higher levels of income / capital cover [½]
- restrictions on further corporate borrowing [½]
- a lack of prior ranking debt [½]
- parent company guarantees being in place where the loan has been issued by a subsidiary [½]
- third party guarantees, for example insurance provision [½]
- registering any security and ensuring that investors can enforce that security on default [½]
- a shorter-term issue. [½]

Marketability would be increased, and hence risk reduced, if the bond had the following features:

- a larger issue size [½]
- no options set against the investor, *eg* option for early redemption [½]
- options for the investor, *eg* convertible debt [½]
- a stock exchange listing (rather than a private placement). [½]

[Maximum 4]

9

Equity and property markets

Syllabus objective

9.3.2 Demonstrate a knowledge and understanding of the characteristics of the principal investment assets and of the markets in such assets.

(Covered in part in this chapter.)

0 Introduction

In this chapter we continue to discuss investment classes and markets by covering equity and property investment.

Equities

Ordinary shares, or equities, form a very important component of many institutional investors' portfolios. Historically, equities have proved to be a very successful investment for most investors, with average gross returns exceeding those of other asset classes for most long periods in the 20th and 21st centuries.

A thorough knowledge and understanding of equity investment and equity markets is therefore important if they are to be successfully incorporated into the asset management process. In the early sections of this chapter we describe the basic features of equities, some of which will be familiar from the earlier subjects, and discuss the categorisation of equities in order to analyse the equity market.

Property

The later sections of this chapter are concerned principally with direct and indirect property investment. Within investment terminology, *property* means a legal title to the use of land and buildings.

Direct property investment differs from investment in financial securities in that it involves the purchase and management of *tangible* assets. Direct property investments are usually large and indivisible, and the management of a property portfolio is generally both expensive and requires a high level of expertise.

Indirect property investment is possible, however, *via* shares in property companies or units in a pooled property fund.

1 Characteristics of ordinary shares (equities)

1.1 Introduction

Ordinary shares (also known as equities in the UK and as common stock in the USA) are securities held by the owners of an organisation. In a small company all the equity shares may be held by a few individuals or institutions; in a large organisation there may be many thousands of shareholders.

Ordinary shareholders have the right to receive all distributable profits of a company after debtholders and preference shareholders have been paid. They also have the right to attend and vote at general meetings of the company.

1.2 Cashflows

The distribution of profits to shareholders takes the form of regular payments of dividends. Since dividends are related to the company profits that are not known in advance, dividend rates are variable. It is expected that as company profits increase over time, dividends per share will also increase – though there are likely to be fluctuations. This means that in order to construct a cashflow schedule for an equity it is necessary first to make an assumption about the growth of future dividends; it also means that the entries in the cashflow schedule are uncertain – they are estimates rather than known quantities.

Share valuation using a discounted cashflow approach and allowing for an assumption about the growth of future dividends is considered in a later chapter.

In practice the relationship between dividends and profits is not a simple one. From time to time, companies hold back some profits to provide funds for new projects or expansion. Companies may also hold back profits in good years to subsidise dividends in years with worse profits.

The proportion of profits that a company decides to distribute as dividends is determined by the *payout ratio*, defined as:

$$\frac{\text{dividends per share}}{\text{earnings per share}}.$$

Companies may be able to distribute profits in a manner other than dividends, such as by buying back the shares issued to investors.



Question

Suggest reasons why a company might want to buy back some of its shares.

Solution

- The company may have excess cash that it cannot use profitably, so it decides to return it to shareholders.
 - The excess cash may only have been earning a deposit rate of interest, less than the return earned on the company's other assets. Disposing of the cash should therefore improve the earnings per share for the remaining shares.
 - It could be a tax-efficient means of returning capital to shareholders if the tax treatment of capital gains is more favourable than that of dividends.
 - The company may wish to change its capital structure from equity financing to debt financing.
-

Since equities do not have a fixed redemption date, they can be assumed to continue indefinitely (unless an investor sells the shares or the company buys them back), but it is important to bear in mind the risk that the company will fail. In this case, the dividend income will cease and the shareholders will only be entitled to any assets remaining after creditors are paid. The future positive cashflows for the investor are therefore uncertain in amount and may even be lower, in total, than the initial negative cashflow.

In summary, dividend income is highly uncertain.

However, in practice directors try to pay a steadily increasing stream of dividends. But companies do have to cut, or even *pass* (ie not pay) dividends from time to time. Equally, some companies are wound up which may result in the investor losing their initial capital investment.

1.3 Investment and risk characteristics

The investment and risk characteristics of equities should be familiar from earlier actuarial subjects. The following question should be largely a matter of revision.



Question

Set out the investment and risk characteristics of equities using the SYSTEM T acronym.

Solution

Security

The security of the dividend income will depend on the company issuing the shares. In particular, it will depend on the stability of the company's profits and the ratio of earnings to dividends (dividend cover).

If the company is wound up, the shareholders will receive the residual assets after all creditors have been paid.

Yield – real vs nominal

Historically, equities have provided a real yield over the long term. This is because company profits tend to rise with inflation and economic growth and hence so do dividends. However, the hedge is a loose one – there is no guarantee of inflation protection.

Yield – expected return relative to other assets

Equities are perceived to be more risky than bonds and would be expected to give a higher return to compensate. The margin will depend on the company issuing the shares / bonds.

Spread – volatility of capital values

Both equity prices and dividends can be volatile.

The price of individual equity shares is determined by the interaction of supply and demand.

Some investors in the market will buy or sell on the basis of short-term speculation, but the most important basis for buyers and sellers when deciding on the price for a share is an assessment of its value based on the present value of future dividends.

Term

Equities can generally be held in perpetuity.

Expenses

The costs of dealing in equities are closely linked to the marketability; *ie* for many shares, the largest element of expense in active trading is the spread between buying and selling prices.

Dealing expenses are generally greater than for bonds, but this depends on the relative marketability of the stocks being compared.

Exchange rate – currency risk

Equities are available in many overseas countries. To this end, there will be a currency risk for an investor who is investing in equities denominated in one currency but who has liabilities denominated in another.

Marketability

The marketability of equities varies enormously between companies. In general terms, the larger the company, the better the marketability. This relationship is not perfect, however. For example, where a few investors hold a large proportion of the shares in a particular company, the marketability could be low.

The extreme in poor marketability will be shares that are not listed on any recognised stock exchange. Such shares can be sold only on a 'matched bargain' basis, *ie* the investor will need to find another party who wishes to buy their shares.

Tax

Income and capital gains from quoted (and unquoted) shares may be taxed differently. In addition, different investors will often pay differing tax rates upon these two elements.

1.4 Quoted / listed shares

Most equity investment by financial institutions and individuals is in shares that are listed on a stock exchange. In order to obtain a listing companies have to comply with the stock exchange's regulations, which give investors a measure of protection.

The regulations generally relate to financial reporting and the disclosure of information.

Equities that are not listed on a stock exchange are not subject to the same degree of regulation and, consequently, may be considered less secure and a more risky investment.

Listed shares are also generally more marketable than unlisted ones and, hence, are easier to value because a meaningful market value can usually be ascertained.

Quoted shares can be bought and sold in easily divisible chunks. This feature is referred to as *divisibility*.

2 Equity categorisation

In analysing the equity market, it is often helpful to categorise shares in different ways. Shares may be classified by size of company, expected profits growth, or industrial sector.

2.1 Categorisation by industry

Equity analysts often specialise in an industry and confine their research and advice to the relative merits of companies within that industrial group for two main reasons:

- practicality
- correlation of investment performance.

Practicality

Suppose that you were working as an investment analyst and that you were interested in assessing the prospects for a well-known high street store. Their aim would be to compare the current share price with their own estimate of the value of the shares based on future profit prospects.

To determine the profit prospects for the shares, they would find out as much as they could about the company and the factors that might impact upon its future trading. They would certainly consider, for example:

- trends in shopping habits (high street vs retail parks vs mail-order)
- trends in consumer expenditure
- population projections (determines the market size)
- extent of competition in the stores sector (affects profit margins).

Having collected all of the necessary information and completed their analysis of the store, they wonder what to analyse next. Given that much of the data they have collected is relevant to almost every other company in the store sector, it would now seem appropriate to analyse another company in the store sector.

Investment analysts specialise within particular investment sectors because:

- the factors affecting one company within an industry are likely to be relevant to other companies in the same industry
- much of the information for companies in the same industry will come from a common source and will be presented in a similar way.
- no single analyst can expect to be an expert in all areas, so specialisation is appropriate.
- the grouping of equities according to a common factor gives structure to the decision-making process. It assists in portfolio classification and management.

Correlation of investment performance

After adjusting for overall market movements, the share price movements of companies within industrial groupings tend to correlate more closely with each other than with companies in other industries. The share price movements reflect the changes that have occurred in the operating environment. These changes affect companies in individual industries in similar ways. For this reason, listings of share prices are often sub-divided by business sector, and major markets have separate indices for the different sectors.

For example, the FTSE Actuaries All-Share Index in the UK and the Dow Jones Index in the US constituents are subdivided into ten broad industry groups (and can be further subdivided within these groups):

- oil and gas
- basic materials
- industrials
- consumer goods
- healthcare
- consumer services
- telecommunications
- utilities
- financials
- technology.

Factors affecting one company in a sector that are relevant to other companies in the same sector include:

- **Resources:** companies in the same sector will use similar resources (eg labour, land and raw materials), and will therefore have similar input costs.
- **Markets:** companies in the same sector supply to the same markets, and will therefore be similarly affected by changes in demand.
- **Structure:** companies in the same sector often have similar financial structures and will therefore be similarly affected by changes in interest rates.

Consider the following examples:

- Consumer expenditure is on a downward trend. All stores are exposed to the risk of a downturn in business and fiercer competition for business, hence lower turnover and lower profit margins.
- The economy is pulling out of a recession and the government is backing a widespread building programme. The building materials companies will experience a big increase in turnover and, presumably, profits.

In both cases all of the companies within the sector are likely to be affected to some degree. As companies in the same sector are influenced by similar factors, there is likely to be some correlation between the changes in profitability and between the changes in share price.

Problems with industry groupings

Whilst every effort is made to ensure that industry groupings are appropriate, there are some difficulties in practice.



Question

Identify the practical difficulties that may arise.

Solution

Two particular difficulties relate to:

1. Companies that operate throughout several sectors – *ie* conglomerate companies.
This is becoming more of an issue as companies increasingly diversify into new sectors by means of mergers and take-overs and leads to particular difficulties where the sectors involved are very different. A similar issue relates to multinational companies that may operate in several very different marketplaces.
 2. The heterogeneity of companies within particular sectors.
Companies may differ greatly even within the same sector – *eg* due to size, or because they operate within different niches of the market.
-

3 Property investment – a ‘prime’ property

Before outlining the main characteristics of property investment, we introduce the important concept of a *prime* property.

Property that is most attractive to investors is called ‘prime’. Prime property would score highly on all of the following factors:

- **location**
- **age and condition**
- **quality of tenant**
- **the number of comparable properties available to determine the rent at rent review and for valuation purposes**
- **lease structure**
- **size.**

(This definition is taken from the Glossary.)

What constitutes ‘primeness’ for each of these factors will depend on the type of property being considered.

For example:

- A prime location for an *office* may be in a major city and easily accessible by car and public transport.
- A prime location for a *shop* may be in a main shopping centre of a major town or city. Being on the main pedestrian flow can have a big impact. For a small shop, the ideal position might be on the main high street next door to a major store.
- In considering a *factory* site, the critical factors may be position relative to a suitable labour force, transport links and customers.

4 Characteristics of direct property investment

Exam Tip

As in previous chapters, the SYSTEM T acronym can be a useful starting point for exploring the characteristics of this asset. However, property investment also has a few other characteristics which can be added to the standard list, *eg* large unit size, risk of obsolescence, ability of the owner to change the investment characteristics of the asset, utility value.

Nature of return

Property is a real asset and would therefore be expected to provide a hedge against inflation.

In this context 'real' means that property returns move broadly in line with changes in inflation.

Assuming that there are no other external influences, the owners of a property should be able to increase rents in line with inflation so that the *real* value of rent is not compromised. In practice, the impact of other economic influences, operating upon the supply of and demand for property, mean that rents and capital values will increase only *broadly* in line with inflation.

Cashflow pattern

Leases are for fixed terms with relatively infrequent rent reviews. These may be 'upward only'. The income stream might, therefore, increase in steps every few years. However, for a property that is rented at a level above current market rents, the income stream may be fixed for many years.

The term of a lease may range from about five to over 100 years. The lease agreement will typically provide for periodic reviews of the rent – often at five-yearly intervals – so that the income from a property will normally increase in a series of steps. For a portfolio of properties, a broad spread of review dates should generate a gradually increasing income stream.

An *upward only* rent review is one whereby the level of rent cannot be reduced at any review. Consequently, if the level of market or *rack* rents decreases between reviews, the rent will *not* be reduced at the next review, but must remain fixed at its existing level.

Rack rent is the rent that would be received from a building if it were subject to an immediate open-market rental review. This may be different from the rent actually being received.

The running yield (*ie* rental yield) on property varies with the type of building.

The running yield of an asset tells us how much of the return is given through income as opposed to through capital growth. For property:

$$\text{running yield} = \frac{\text{rental income (net of all management expenses)}}{\text{cost of purchase (gross of all purchase costs)}} .$$

More risky types of property will generally offer a higher running yield.

Property rental yields have often been lower than conventional bond running yields because of the prospect of a capital gain, reflecting the anticipated growth of rental levels. The relationship between the running yields on property and equity is less clear cut. In addition, since the economic uncertainty that followed 2008, running yields on property (and indeed on other asset classes) have been much less stable, which makes comparisons between asset classes more difficult.

Marketability

Property is very unmarketable. It can take a long time to buy or sell and dealing costs are high.

This is because of the following characteristics of property:

- **Unit size: the unit size of most investment in property is large and, in general, single properties are indivisible.**

This is in contrast to most other securities, which may be purchased in small quantities. Indivisibility may prevent smaller investment funds from investing in property, or lead them to invest in property indirectly – for example, *via* property company shares.

- **Uniqueness: each property is unique.**

This makes it harder to value individual properties and also reduces marketability.

- **Valuation: property valuation is a matter of professional judgement and there is no central market with quoted property prices. There may be significant variations in valuations carried out by different valuers or by the same valuer on different bases. As sales take place infrequently the property market is characterised by a lack of information. ,**

Property valuation is both subjective and expensive and therefore the *true* market value of a property may be known only when a sale occurs. In addition, as sales are infrequent and prices agreed are normally treated with a degree of confidentiality, it may be difficult to place a certain value upon a particular property. This difficulty could again reduce the appeal of direct property investment to certain investors.

Security

The security of income depends very much on the quality of the tenant.

Rent payable by a company is a prior charge on its profits, but costs of recovery from tenants in arrears can be high and there is a risk of ‘voids’ – periods when the property is not let.

Whilst a property has no tenant and is therefore void, no income is received. The possibility of void periods must be allowed for when estimating the expected returns on a particular property. Rental income will be particularly secure when the property is rented to a profitable tenant for whom the rent represents only a minor proportion of their total costs.

Other risks associated with property, which compromise the security of property investment, are *obsolescence* and *government intervention*.

Obsolescence: land is virtually indestructible, and buildings normally have a long life if maintained in a satisfactory condition. Buildings can, however, suffer from obsolescence. This results in a slowdown in the relative rate of growth in value between old and new buildings. In time, expenditure on modernisation becomes necessary.

All buildings depreciate over time, as they become older and their condition deteriorates. The cost of refurbishment is thus a major expense of property management that does not arise with financial securities.

Obsolescence arises when a building becomes out of date and is no longer of use to potential tenants. It means that even if average property values rise in line with inflation, the value of a particular building may fall in real terms. On expiry of the lease the freeholder may therefore need to modernise the building prior to re-letting.

Owing to its political significance, property is susceptible to government intervention such as rent and planning controls.

Planning controls may limit the supply of property.

Spread

Capital values of buildings can be volatile over the longer term, although infrequent valuations and stable valuation methods reduce short-term volatility. As land is indestructible, a good site is always likely to have some value.

Property values tend to move in cycles, closely related to but lagging behind the general economic cycle, as supply is slow to respond to changing economic conditions. They are usually determined by reference to the expected flow of rental income, which is relatively stable. This stability may enhance the attractiveness of property to investors who prefer stable asset values.

The site value is the element of the value of a property that derives from the site alone. Where the site value represents a significant proportion of the total capital value, the property value itself will be more secure.

Yield

In comparison with index-linked government bonds, property is less marketable and less secure. Investors would therefore be expected to require a higher return from property.



Question

Describe the other factors that will influence the size of the margin between property and index-linked government bond returns.

Solution

The margin also reflects the fact that:

- Unlike index-linked government bonds, property does not provide an exact hedge against inflation. Rents tend to increase *broadly* in line with inflation, over the medium to long term.
 - Property is much more expensive to buy, sell and manage than is a corresponding portfolio of index-linked government bonds.
 - Property is also indivisible.
 - Property has the risk of obsolescence / depreciation.
-

Expenses

Property management costs are high, although the tenant is often responsible for building maintenance and insurance.

This is the case with a *full repairing and insuring lease*. The other ongoing management costs will include the costs of rent collection and review. The high expenses involved with buying, selling and ongoing management mean that for most investors property is a long-term commitment.

Investment characteristics can be changed by the owner

It is possible for the investment characteristics of individual property assets to be substantially changed by the owner. Examples of this would be redevelopment of an existing property or re-negotiation of a lease with a sitting tenant.

5 Freehold and leasehold property investment

Freehold ownership is in perpetuity. A freeholder has the right to occupy the building or let it out and, subject to planning restrictions, to refurbish the property or develop it. There may be various restrictions on what can be done with the land. These include: covenants, easements such as rights of way, planning and building regulations and statutory requirements not to cause a nuisance to others.

A *covenant* is a legal agreement. *Easements* are specific rights acquired by someone other than a landowner or tenant.

The freeholder of a property is its ultimate owner, in the sense that the property, and all of the attaching rights, reverts fully and solely to the freeholder at the end of the lease. Therefore, there can be only one freehold ownership of a property, whereas there can be any number of leases. The freehold may be:

- unencumbered – *ie* there is no existing tenant, so that the freeholder may choose to:
 - add value by re-developing the site and/or refurbishing the property
 - set up a lease on the property and receive rents
- leased – *ie* it already has a tenant, so the investor will receive the rents due under the terms of the existing lease, plus reversion of the unencumbered freehold at the end of the lease agreement.

The flexibility enjoyed by the freeholder is one of the main advantages of freehold as compared to leasehold property. The above restrictions and more will apply to leaseholders.

Where possession has been given to a third party under a long lease, the buildings revert to the freeholder at the expiry of the lease. The leaseholder pays the owner of the property an annual ground rent. Compared with freehold investment, a leasehold interest is of a fixed term and provides a higher initial rental yield and a capital loss if the lease is held to the termination date. Leases of 99 or 999 years can be treated as close to freehold interests, save for the need to pay the ground rent to the freeholder.

A capital loss occurs if the lease is held to the termination date as the lease has no value at this point because the leaseholder has no interest left in the property.

6 Indirect property investment

There are a number of major disadvantages with direct property holdings, many of which can be avoided by investing in indirect property arrangements such as pooled property funds or in shares in property companies. The disadvantages of direct property investment include:

- *Size*: many properties are too big for most investors to afford.
- *Diversification* (linked to size): many properties are needed to create a well-diversified property portfolio. The size of each investment might make this impractical for smaller funds and individual investors.
- *Lack of marketability*: the time taken, and the costs associated, with buying and selling make properties unmarketable.
- *Valuation*: property values are never *known* until sale. Estimates of values can be expensive (*ie* surveyors' fees).
- *Expertise needed*: much of the profit to be made through property investment comes through detailed local knowledge. Many investors will not have the specialist expertise.

6.1 Pooled property funds

Various vehicles exist for pooled property investment. These include open-ended unitised funds and closed-ended investment trusts.

Open-ended unitised funds and closed-ended investment trusts are considered in detail in the next chapter.

These vehicles normally have constitutions that specify the types of property that they can invest in, limits on liquidity, management charges that can be deducted from the fund etc.

6.2 Property company shares

Exposure to real property can also be gained by investment in the shares of a property company.

Property companies can be property developers or property investors.



Question

Describe the cashflows occurring when investing in property company shares.

Solution

An investor pays an initial lump sum to purchase the shares. In return, the investor receives a stream of dividends during the period they own the shares and a final lump sum at the point they sell the shares to another party.

The amount paid for and received for the shares will be set by supply and demand for the shares among investors, as for other equities. The amount of dividend will be set by the property company each year and will depend on the company's profits. For a property investment company, these profits will be generated by the excess of rental income over expenses. For property development companies, the profits will also reflect the costs and profits of the developments.

The largest companies can invest in properties beyond the scope of most pooled funds. However, a property company has no restriction on the investments it can make or the management expenses it can incur. The larger property companies also invest in property developments, which carry a greater risk than investing in an existing building with existing tenants.

Hence investment in property *via* property company shares provides the investor with access to properties that they would not otherwise be able to invest in, either directly or *via* pooled funds. Examples of these include:

- very large properties
- property developments.

Normally property shares stand at a discount to their underlying estimated current net asset value (NAV).



Question

Define net asset value per share.

Solution

Net asset value per share is the value of the company's assets divided by the number of shares. Net assets in this definition means assets *net of liabilities*. We also net off intangible assets. This is because net asset value per share represents a company's wind-up value per share. Upon wind up, intangible assets such as goodwill are unlikely to have a significant value.

The discount to NAV reflects:

- any differences between the way in which investors value shares and the way they value property
- risk of loss on forced sale – cashflow requirements result in property companies being more likely to be forced sellers of properties than institutions undertaking direct property investment on their own account.

A smaller discount, or possibly even a premium, to NAV is possible where:

- the market has a positive view of developments giving the potential for capital gains
- the valuations underlying the NAV are conservative
- the property company has a good management track record.

Chapter 9 Summary

Equities

An ordinary share is a share in the ownership of a company.

Investment and risk characteristics of equities

- security depends on the profitability of the company
- provides a long-term real yield (*ie* the return tends to move in line with inflation)
- higher expected returns than government bonds over the long term
- income (dividends) and capital values (prices) can be volatile
- equities can generally be held in perpetuity
- dealing expenses are linked to marketability
- marketability depends on the size of the company

Quoted shares

Quoted shares are listed on a stock exchange and make up the majority of available equity investment. Quoted shares are generally:

- more marketable
- more secure
- easier to value

than non-quoted shares.

Why use industry groupings to categorise shares?

Shares are grouped by industry sectors because:

- it is *practical* for analysts to specialise in one area
- the share prices of companies in the same sector tend to be *correlated*.

It is practical for analysts to specialise in one area because:

- the factors affecting one company within an industry are likely to be relevant to other companies in the same industry
- much of the information for companies in the same industry will come from a common source and will be presented in a similar way
- no one analyst can expect to be an expert in all areas, so specialisation is appropriate
- the grouping of equities according to some common factor gives structure to the decision-making process. It assists in portfolio classification and management.

Share prices of companies in the same sector are correlated because such companies:

- use the same *resources* and so have similar input costs
- supply to the same *markets* and so are similarly affected by changes in demand
- have similar *financial structures*, and so are similarly affected by changes interest rates.

Property

A prime property would score highly on all of the following factors:

- location
- age and condition
- quality of tenant
- the number of comparable properties
- lease structure
- size.

Investment and risk characteristics of property

- void and default risk
- obsolescence, deterioration and refurbishment costs
- susceptible to political risk
- long-term real returns (*ie* move in line with inflation)
- expected return higher than that on index-linked government bonds
- *stepped* income stream
- running yield varies with the type of property
- can provide high utility (*feel good factor*) to the investor
- long-term volatility of capital values but short-term stability due to infrequent valuations
- high dealing and management costs
- possibility for investment characteristics to be changed by the investor, *eg* redevelopment
- unmarketable
- large unit size
- indivisibility
- uniqueness
- subjective valuations

Freehold and leasehold

The *freeholder* of property is the absolute owner of it in perpetuity. The freeholder can let the property to a third party (a leaseholder) in return for an annual ground rent.

Compared with freehold investment, a leasehold is shorter-term and provides a higher initial rental yield and a capital loss if the lease is held to the termination date.

Indirect property investments

Indirect investments in pooled property funds and property share companies may also be available. They help overcome some of the key problems with direct property investment (*eg* lack of marketability and large indivisible units). However, they are not without their own problems. Key issues to consider when comparing direct and indirect property investments include:

- control
- discount to NAV
- diversification
- divisibility
- expenses
- expertise
- marketability
- valuation.

The practice questions start on the next page so that you can keep the chapter summaries together for revision purposes.



Chapter 9 Practice Questions

9.1 (i) Explain why investment in equities has traditionally been analysed by industry group. [3]

Exam style

(ii) Discuss the advantages and disadvantages of this subdivision. [3]

(iii) Suggest, with reasons, possible alternatives. [4]

[Total 10]

9.2 List the main expenses associated with initially investing in property, and subsequently managing a property portfolio.

9.3 Explain why an investor with long-term real liabilities might prefer a freehold to a short leasehold investment.

9.4 List factors that explain the differences in the expected returns on a 20-year conventional government bond and a commercial property.

9.5 State factors not related to location that would be taken into account in assessing a property investment.

9.6 You are the finance director of a motor car manufacturer that owns and occupies the freehold on the manufacturing facility. A property developer has offered to purchase the freehold. Outline the factors that you would need to take into account in deciding whether to recommend the offer to the board. [6]

Exam style

The solutions start on the next page so that you can
separate the questions and solutions.



Chapter 9 Solutions

9.1 (i) *Explanation of analysis by industry group*

Companies within the same industry will behave in similar ways from an investment viewpoint. [1]

The reasons for this are:

- They will probably have a similar financial structure. [½]
- They obtain the factors of production from similar markets (labour supply, raw materials, type of land needed) and presumably at similar costs. [1]
- They supply to the same market and have the same competitive pressures. [½]
- They will be influenced by the same economic and social factors. [½]

There have been several studies of movements in share prices to support the claim that industry grouping is the most suitable form of classification. No other single factor (other than overall market movements) appears to have the same influence over the performance of a stock. [1]
[Maximum 3]

(ii) *Advantages and disadvantages of grouping by industry*

Advantages

Each of the above factors contributes to the advantages of grouping by industry:

- By analysing one industry, we have prepared the basis for analysing the many companies within the industry (for the reasons outlined above). [½]
- Statistics are often presented for whole industries, and trade journals are clearly 'by industry'. [½]
- Accounts are often presented in a similar format and use the same jargon. [½]
- By looking at an 'industry', we are effectively reducing the number of factors to consider for each individual company analysis. [½]
- Investment analysts can specialise in particular industries. [½]

Disadvantages

Investment analysts may become too wrapped up in their own industry and become less proficient at choosing between industries. [½]

Not all companies operate in a single industry (*eg* the conglomerates). [½]

Sometimes companies may not conform to their 'industry norm' in every respect. For example, Company A may operate in domestic chemicals, Company B may operate in world-wide chemicals and have different exposures (*eg* to currency movements). [1]

Although industry shares are correlated, overall market movements explain *most* of the share price movements – it is important not to lose sight of this. [1]
[Maximum 3]

(iii) **Alternative classifications**

Any factor that may have some influence on company profits should be considered, giving these possible groupings:

- *market capitalisation* – larger companies may benefit from economies of scale, while smaller companies may have greater potential for rapid growth
- *price earnings ratio (or dividend yield)* – effectively this classifies companies by the relative expectations that the market has for their prospects. Could group by high growth / stable / low growth.
- *financial structure (gearing)* – this indicates the potential volatility in earnings for shareholders on changes in trading profit. Could also indicate sensitivity to interest rates, but depends on whether borrowing arrangements are short-term, variable-interest or long-term, fixed-interest.
- *overseas earnings* – companies with high proportion of earnings overseas are heavily influenced by the strength of sterling, so might be a suitable classification
- *location* – companies based in a particular area suffer similar costs for premises and availability of labour (eg 'Europe', 'North America').
- *other factors* – eg companies influenced by consumer demand (so profits could be linked, say, to interest rates), by marketability, by past share price volatility.

[½ for each suitable classification, ½ for reason why, maximum 4]

9.2 The expenses of initially investing in property may include:

- legal fees
- surveyor's fees
- any taxes on the purchase of assets, eg stamp duty in the UK
- bid/offer spread if investing *via* a property unit trust.

The main expenses incurred in the management of a property portfolio include:

- rent collection
- rent review
- valuation expenses
- management fees, if the portfolio includes indirect property investment.

Additionally, for a freehold property:

- depreciation and possible obsolescence (although strictly speaking this is not a *management expense*)
- refurbishment at the end of a lease, though the expenses here will be greatly reduced with a *full and repairing lease*, under which the leaseholder is responsible for maintaining the condition of the property.

9.3 Reasons why an investor with long-term real liabilities might prefer a freehold to a short leasehold:

- A freehold provides a better match for the term of the liabilities (*ie* longer term, particularly if the investor subsequently sells a leasehold on the property then they will end up with an investment with a very long discounted mean term).
- A freehold provides a better match for the nature of the liabilities (rents and hence freehold values should increase with inflation and possibly with real growth in the economy over the long term).
- The investor expects interest rates to fall (so wants the additional volatility of a longer-term investment).
- The investor wants to profit from possible development gains.

9.4 Factors that explain differences in the expected returns or overall investment yields on a 20-year conventional government bond and a commercial property:

- government bond more secure (income and capital)
- government bond more marketable
- lower dealing and management costs on government bond
- government bond highly liquid
- government bond more divisible
- government bond's value is quoted.

The factors given above should tend to make the expected return on a government bond *lower* than the expected return on a commercial property. Other possible differences are:

- although both are long-term, commercial property could be longer
- income on government bond is fixed, should be rises in property income
- property is a real asset (so should protect against unexpected inflation)
- commercial property is prone to deterioration and obsolescence
- the taxation bases applying to the returns from each may differ.

9.5 Non-location factors in assessing a property investment:

- price, rent and yield
- type of property (*eg* office, shop, factory, warehouse)
- ownership of property (*eg* freehold, leasehold)
- adaptability
- quality of tenant (important when a property is 'over-rented')
- age, standard of repair and modernisation
- conditions of lease (rent review periods, date of next review)
- facilities provided
- development potential.

9.6 The company will probably prefer to continue with the existing plant unless the price being offered by the developer is significantly above both the market price of the facility and the costs of uprooting and rebuilding the manufacturing facility elsewhere. [1]

The 'market price' of the facility could be estimated by looking at what other similar properties have been sold for in recent times. [½]

If the company simply wants access to fresh finance, it could obtain this by selling the property to a property investor and then leasing it back. [1]

The price offered must reflect:

- the location, in particular transport links and proximity to workforce, customers and suppliers [½]
- the age and condition of the building [½]
- whether it can be adapted to other uses [½]
- the number of comparable facilities [½]
- the lease structure [½]
- the size of the plant. [½]

The price offered would also have to be greater than the costs of relocating if required. [½]

These would include:

- the costs of laying-off local staff and re-hiring new staff in a new location [½]
- the cost of searching for a new suitable location which has all the necessary features of transport and communication links. [½]

Other implications such as taxable gains would also need to be considered. [½]

As well as considering the price offered, there will be non-financial factors that must be considered. [½]

These include:

- Does the company have an agreement with the local authority that restricts it from selling its plant to the developer? [½]
- Will public opinion swing against the car company if it sells a site to developers, particularly if redundancies are involved in the local market? [½]

[Maximum 6]

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10

Other investment classes

Syllabus objective

9.3.2 Demonstrate a knowledge and understanding of the characteristics of the principal investment assets and of the markets in such assets.

(Covered in part in this chapter.)

0 Introduction

The previous two chapters considered the characteristics of traditional investments in the domestic market. In this chapter we look at:

- indirect ways of accessing investments through pooled investment vehicles called collective investment schemes (CISs)
- gaining exposure to movements of investments, commodities *etc* by using derivatives
- the advantages and disadvantages of investing overseas and issues relating to investing in emerging markets.

1 Collective investment schemes

1.1 What is a collective investment scheme?

Collective investment schemes (usually called mutual funds in the United States) provide structures for the management of investments on a grouped basis. They provide the opportunity for investors to achieve a wide spread of investments and therefore to lower portfolio risk. Managers of such schemes are likely to have management expertise, particularly in specialist areas such as overseas investment, which is otherwise available only to the largest institutional investors.

Collective investment schemes offer the opportunity for *indirect* investment, *ie* investment through an investment scheme rather than direct purchase of the underlying assets. A key distinction between direct and indirect investment is whether the investor's assets are segregated from other investors' money.

The collective investment scheme will have a stated investment objective. The objective might be anything from general investment (whatever the investment manager chooses) to a specialism, *eg* in small bio-technology companies.

As collective investment schemes provide investment expertise and diversification, they are commonly used by individuals wanting to invest in shares for the first time.

The regulations covering collective investment schemes vary from country to country and different types of scheme will be subject to different rules. Regulations typically cover aspects such as:

- the categories of assets that can be held
- whether unquoted assets can be held
- the maximum level of gearing
- any tax relief available.

Some schemes may only be available to certain classes of institutional investors, such as pension funds.

1.2 Closed-end and open-ended collective investment schemes

There are two fundamental types of collective investment schemes: closed-ended and open-ended.

Closed-ended schemes

In a closed-ended scheme, such as an investment trust, once the initial tranche of money has been invested the fund is closed to new money. After launch, the only way of investing in an investment trust is to buy units from a willing seller (exactly as investing in ordinary shares in a trading company).

Under a closed-ended scheme, the total number of shares or units available to the investors *via* the marketplace is therefore fixed.

Open-ended schemes

In contrast, in an open-ended scheme such as a unit trust or open-ended investment company, managers can create or cancel units in the fund as new money is invested or disinvested.

1.3 Examples of collective investment scheme

Investment trusts

What is an investment trust?

Investment trusts are a form of closed-ended fund. They are public companies whose function is to manage shares and other investments. They have a capital structure exactly like other public companies, and can raise both loan and equity capital.

Despite the name, an investment trust is a company (and not a trust). The ability to borrow is a major difference between investment trust companies and unit trusts. Unit trusts have limited power to borrow.

Most investment trust shares are quoted on a stock exchange, and their shares are bought and sold in a similar way to other quoted shares.

Share price

As investment trusts are closed-ended, an investor will buy from another investor in the same way as for any other share. The price of a share in an investment trust company is determined by supply and demand, in exactly the same way as for other shares.

A guide to what that share price might be expected to be is the net asset value per share (NAV), which is the value of the company's underlying assets divided by the number of shares.

The main parties involved

The main parties in an investment trust are the:

- Board of directors – responsible for the direction of the company
- Investment managers – responsible for the day-to-day investment decisions
- Shareholders – who buy and sell the shares in the investment trust company in the same way as they would in any other company.

Unit trusts

What is a unit trust?

A unit-trust is an open-ended investment vehicle whereby investors can buy *units* in an underlying pool of assets from the trust manager. If there is demand for units, the managers can create more units for sale to investors. If there are redemptions (sales by investors), the managers will buy back the units offered to them.

Unit trusts are trusts in the legal sense. They have limited powers to borrow against their portfolio.

Unit price

The price that has to be paid to purchase one unit is the unit price. This unit price is calculated (usually daily) by the unit trust provider.

In simple terms, the unit price will be calculated as:

$$\frac{\text{Market value of underlying assets}}{\text{Number of units}}.$$

In practice, complications include:

- whether to use the bid or offer prices of the underlying assets
- how to allow for the expenses the unit trust incurs in buying and selling underlying assets
- how to adjust the unit price to apply any charges to investors
- how to round the answer.

The main parties involved

A unit trust is an investment medium set up as a trust by a management company under a trust deed. The main parties involved are:

- *Management company* – does all the work, sets up the trust, gets authorisation from the relevant authorities, advertises the trust, carries out all the necessary administration and invests the funds. Its aim is to make a profit from the charges levied. Many life offices act as unit trust managers.
- *Trustees* – as in any legal trust, ensure that the managers obey the trust deed and hold the assets in trust for the unit holders. The trustees oversee the pricing of units. The fees to the trustees are paid by the unit trust managers. The trustees are often an insurance company or large bank.
- *Investors* – buy units in the trust (and thus become unitholders), hoping that they turn out to be a good investment.

Open-ended investment company (OEIC)

An investment vehicle similar in corporate governance features to an *investment trust* but with the open-ended characteristics of a *unit trust*.

2 Differences between closed-ended and open-ended CISs

The differences between closed-ended and open-ended collective investment schemes can be summarised as follows:

- **The marketability of the shares of closed-ended funds is often less than the marketability of their underlying assets.**

However shares in a closed-ended fund may be more marketable than the underlying assets if the assets themselves are unmarketable, *eg* property investment or shares in small companies.

The marketability of units in an open-ended fund is guaranteed by the managers.

- **Gearing of closed-ended funds can make the shares more volatile than the underlying equity.**

Investment trusts are companies and can borrow, *eg* by issuing loan capital, like any quoted company. Gearing results in more volatile but higher expected returns to shareholders. Not all investment trusts borrow, so these comments apply only to those that do.

Most open-ended funds cannot be geared and those that can may only be geared to a limited extent.

Unit trusts have very limited powers to borrow. For example, in the UK, retail authorised unit trusts can borrow an amount equal to up to 10% of fund value.

- **It may be possible to buy assets at less than net asset value in a closed-ended fund.**

Traditionally the price of shares in investment trusts is often less than the value of the underlying securities (*ie* the NAV).

The fact that this difference between the actual share price and the NAV exists is a source of extra volatility in the return on investment trust company investment.

The average amount of discount from time to time will vary depending on whether investment trusts are in or out of favour. When they are out of favour (often after the stock market has had a prolonged bad run) the average discount may be quite wide, say 20% to 30%. At other times the discounts may narrow to just a few percent.

Investment trusts at a discount to NAV give investors an opportunity to increase their returns. This can be achieved as follows:

- by buying when the discounts are large and selling when they have narrowed, or
- by buying into an investment trust at a discount to net asset value, the investor effectively has the benefit of those assets (*ie* the income) having paid less than if the assets had been purchased directly.

The concept of discount to net asset value does not apply to unit trusts because the unit price is fixed by direct reference to the asset values.

- **The increased volatility of closed-ended funds means that they should provide a higher expected return.**
- **Shares in closed-ended funds are also more volatile than the underlying equity because the size of the discount can change. The volatility of units in an open-ended fund should be similar to that of the underlying assets.**
- **At any point in time there may be uncertainty as to the true level of net asset value per share of a closed-ended fund, especially if the investments are unquoted.**
- **Closed-ended funds may be able to invest in a wider range of assets than unit trusts.**
- **They may be subject to tax at different rates.**



Question

The actual share price of many investment trust companies is often lower than the NAV, *ie* the share price is said to be at a discount to NAV.

Suggest possible reasons for this.

Solution

An investment trust company's (ITC's) shares might stand at a discount to NAV due to:

- *Management charges* – the value of an ITC share might be thought of as the present value of the dividends the investor will receive. The investor will receive the dividends from the underlying share investment but only *after* deduction of the management charges of the ITC. Therefore, the management charges will have the effect of *lowering* the value of the share, causing it to stand at a discount to its NAV.
 - *Concerns over marketability* – a small ITC investing in shares of large companies will be a less marketable investment than the underlying assets.
 - *Concerns over the quality of management* – if the investment managers are poorly rated then investors will not be prepared to pay as much for a share in an investment trust.
 - *Market sentiment / fashion* – ITCs may be out of fashion with investors.
-

3 CISs vs direct investment

The advantages and disadvantages of collective investment vehicles compared with direct investment can be summarised as follows:

3.1 Advantages

The advantages of collective investment vehicles are greater for small investors than for large ones. The main ones are:

- **They are useful for obtaining specialist expertise.**
- **They are an easy way of obtaining diversification.**
- **Some of the costs of direct investment management are avoided.**
- **Holdings are divisible – part of a holding in any particular trust can be sold.**
- **There may be tax advantages.**
- **There may be marketability advantages (but they may also be less marketable than the underlying assets).**
- **They can be used to track the return on a specific index.**

The last bullet point refers to the fact that the objective of some collective investment vehicles is to track an index – these are called *index tracker funds*.

3.2 Disadvantages

The main disadvantages of collective investment vehicles are:

- **Loss of control – the investor has no control over the individual investments chosen by the managers.**
- **Management charges are incurred.**
- **There may be tax disadvantages such as withholding tax which cannot be reclaimed.**

4 Futures and options

4.1 Introduction

Futures and options belong to a class of assets called derivatives. A derivative is a financial instrument whose value is dependent on – or derived from – the value of another underlying asset. The asset may be a financial asset such as an equity or a commodity such as grain. A derivative can be thought of as a *contract* (ie a legal agreement) between two parties to trade an underlying asset at a date in the future.

The types of derivative discussed in this section are *futures*, *forwards*, *options* and *warrants*.

Derivatives can be used to control risk. They can be used to:

- reduce risk (a process known as *hedging*), or
- increase risk (known as *speculation*) in order to enhance returns.

4.2 Forwards and futures

Forwards

A forward contract is a contract to buy (or sell) an asset on an agreed basis in the future.

Forward contracts are non-standardised. The details of the contract will be tailor-made and will be negotiated between the two trading parties.

For example, someone who buys a car may well order it a few weeks in advance. They will agree the price (to be paid when they take delivery), the model, specification and colour *etc.* They may also have to make a small deposit payment. In agreeing to buy the car on a future date at a specified price, they have entered into what is known as a *forward* contract.

Forward contracts are not exchange-traded but are traded *over-the-counter* (OTC). The *counter* is a notional one – in practice it involves telephone-based trading between two financial institutions (eg banks) or between a financial institution and a corporate client. There is no exchange on which the contracts are traded, so the degree of credit risk relating to the transaction will depend upon the creditworthiness of the counterparty.

Futures

Like a forward contract, a futures contract is a contract to buy (or sell) an asset on an agreed basis in the future. However, futures contracts are standardised contracts that can be traded on a recognised exchange.

Standardised

Futures contracts are *standardised*. A standardised contract is one where all of the details surrounding the asset to be traded, with the exception of the price at which the parties agree to trade, are pre-determined.



Question

Give examples of the details surrounding the asset to be traded, which might be detailed in a standardised *car* contract.

Solution

A standardised car contract might detail the:

- unit / quantity of trading (*ie* one car)
 - exact make and model of the car
 - exact specification of the car (colour, alloy wheels, air conditioning *etc*)
 - delivery date or dates
 - currency of trading.
-

All that is left to be agreed by the individual buyers and sellers of the contract is the price at which the underlying asset, *ie* the car, will be traded on the delivery date.

Because futures are standardised, lots of identical futures are arranged between lots of different parties. The result of this is that the futures market is very liquid. Standardisation also results in ease of administration.

Exchange-traded

Futures contracts are traded on a recognised exchange. The functions of the exchange include:

- setting the details of the standardised contracts
- authorising who can trade on the exchange and bringing buyers and sellers together
- operating a sub-institution called the *clearing house*.

As described in the earlier subjects, a clearing house is a self-contained institution whose only function is to clear futures trades and settle margin payments (described below). The clearing house checks that the buy and sell orders match each other. It then acts as a *party to every trade*. In other words it simultaneously acts as if it had sold to the buyer, and bought from the seller. Following registration, each party has a contractual obligation to the clearing house. In turn the clearing house guarantees each side of the original bargain, removing the credit risk to each of the individual parties.

Credit risk and margin

Credit risk is the risk of one of the parties to the trade defaulting on the agreement. In the futures market, the clearing house intervenes to guarantee each side of the original bargain. In order for the clearing house to uphold this guarantee, each party makes a small good faith deposit with the clearing house, which is called *initial margin*. *Variation margin*, which depends on the movement in the price of the underlying, is payable during the term of the contract. Therefore, the credit risk to each individual party under a futures contract is minimal.

Long and short positions

Having a long position in an asset means having an economic exposure to the asset.

This means having a *positive* economic exposure.

In futures and forward dealing the long party is the one who has contracted to take delivery of the asset in the future.

Having a short position in an asset means having a negative economic exposure to the asset. In futures and forward dealing the short party is the one who has contracted to deliver the asset in the future.

If someone *sells* a futures contract, they have declared that they will receive the agreed price in, say, three months' time and in return they will have to hand over the underlying asset in three months' time. The seller of the future is said to be the *short* party (because when the contract is settled the party will be short of the asset, *ie* have less of the asset).

4.3 Options

An option is the right, but not the obligation, to buy or sell an asset.

Options are contracts agreed between investors to trade in an underlying security at a given date at a set price. The difference between options and futures is that the holder of the option is not obliged to trade, hence the name *option*.

An option writer sells options.

The option writer is the other party to the trade from the option holder. The writer, however, *is* obliged to trade if the holder of the option wants to.

The price paid to the writer for an option is called the option premium.

When someone *writes* an option, they collect a premium for giving the *holder* the right to exercise (or not) the option. This represents a difference between futures and options. It costs nothing to enter into a futures contract, with the exception of the margin payment (which is a deposit, not a premium). The option premium is also referred to as the option price.

A call option is the right, but not the obligation, to buy a specified asset for a specified price on a set date or dates in the future.

A put option is the right, but not the obligation, to sell a specified asset for a specified price on a set date or dates in the future.



Question

Explain why buying a put is not the same as selling a call.

Solution

The difference is between *right* and *obligation*. Buying a put costs the purchaser money and allows them to choose whether or not to sell the underlying asset. Selling a call means that the option seller receives money and must sell the underlying asset if, and only if, the holder of the option wants to.

If someone buys a put they are likely to choose to sell the underlying asset if the market price is *less* than the exercise price. If they sell a call they are likely to be forced to sell the underlying asset if the market price *exceeds* the exercise price.

Exercise (or strike) price

The exercise price is the price at which an underlying security can be sold to (for a put) or purchased from (for a call) the writer or issuer of an option (or option feature on a security). This is also known as the strike price.

The exercise or strike price is not the same thing as the option premium. The option premium or option price is the price that the option holder pays to the option writer for the *right* to exercise (or not) the option. The exercise or strike price is the price at which they have agreed to trade the underlying asset.

Exchange-traded or OTC

Traded options are option contracts with standardised features actively traded on organised exchanges.

Options, unlike futures and forwards, can be traded either on an exchange (called traded options) or OTC. The global OTC market for options is now bigger than the exchange-traded market.

Timing

A *European* option is an option that can only be exercised at expiry.

An *American* option is an option that can be exercised on any date before its expiry.

4.4 Warrants

A warrant is an option issued by a company over its own shares. The holder has the right to purchase shares at a specified price at specified times in the future from the company.

A warrant may be issued by any company and shares some of the characteristics of a traded call option. As the definition suggests, most warrants are *equity warrants*, which give the right to subscribe for the ordinary shares of the issuer however *bond warrants* also exist.

The price at which the option can be exercised is called the *exercise price*, or *strike price* or *subscription price*. This price may be very different from the current market price.

The holder of an equity warrant does not have the rights associated with ordinary share ownership. They have no right to dividends, or to voting rights. However, the warrant holder is protected from changes in the ordinary share capital such as rights issues and scrip issues. If such an event occurs while the warrant is in existence the exercise price and the number of shares that can be subscribed for are adjusted.

Warrants are often issued as *add-ons* to other benefits.



Question

Explain why a company want to offer a warrant as an added benefit.

Solution

A company may offer a warrant as an added benefit to make the bond more attractive to investors. The potential advantages of this are:

- The existence of the warrant makes the bond appeal to a different sector of the investment market enabling finance to be raised more easily.
 - Finance may be arranged more efficiently. The existence of the warrant (*ie* an extra option to the investor) should mean that the investor is prepared to pay more for this investment relative to an identical investment without the warrant. This means it is cheaper for the company to raise the finance needed (*ie* the gross redemption yield on the bond is reduced).
-

4.5 Uses of derivatives

Futures contracts can be used to set a price in advance. For example, utility companies can offer fixed price tariffs to consumers by using futures to buy gas and electricity in advance. A chocolate manufacturer can buy cocoa futures to secure the price of ingredients.

While a financial institution can trade in futures, it needs to be sure of being able to sell long positions before delivery – an insurance company doesn't want several tonnes of sugar arriving on its doorstep.

Investors trading in futures rarely want to actually receive delivery of the underlying asset.

For example, consider an investor who wants to speculate on the price of sugar over the next three months. The investor buys a sugar future now for delivery in three months' time, when a price of X will be paid. This means that the investor has agreed to *receive* a specified quantity of sugar (as defined in the contract) in three months' time for price X .

However, three months later, just before delivery, the investor sells an identical sugar future (identical because the contract is standardised) at the then price Y . This means the investor has agreed to *deliver* the same specified quantity of sugar on the same date for a price of Y .

By taking out an equal but opposite contract, the investor has carried out what is called *closing out their position*. The investor will neither receive nor deliver any sugar but makes a profit / loss of $Y - X$, ie the investor has speculated on the price movement of sugar.



Question

Explain what the investor would do if they actually wanted the sugar in three months' time.

Solution

If the investor actually wanted the sugar in three months' time, they could choose not to close out their position. Alternatively, the investor could buy a three-month sugar forward contract. In this case they would have to find a counterparty willing to trade with them.

Options also give financial institutions the opportunity to alter the structure of their portfolios without needing to trade in the underlying assets.

Suppose an insurance company has a risk appetite that states that it must sell £5m of equities if the price falls by 20%. If the company is required to hold capital against a 40% fall in equities, then it can reduce the equity exposure by buying a put option on the equity market at 20% below current levels. If, by expiry of the option, the market has fallen and risen again, the company will not have had to exit the market and lose the costs of re-entry.

The put option reduces downside equity exposure to a maximum of 20% of the initial value of the equity portfolio. If the term to expiry of the option is consistent with the period over which the capital requirement is assessed, this means that the company would only need to hold sufficient capital to cover a 20% equity price fall rather than a 40% fall.

With the put option providing this equity downside protection, the company could adjust its defined risk management action so that rather than selling equities as soon as a 20% equity market fall happens, it could hold the assets until the option expiry date and reassess the position then. If the equity price has fallen by 20% or more as at that date, the company could exercise the option and suffer a 20% reduction in value – which could be considerably less than the actual fall in equity values. If the equity price has fallen by 20% or more but then has recovered as at the expiry date, the company would not exercise the option and has saved itself the loss that it would have incurred by having to exit the market at a low and then missing out on the recovery.

Derivative transactions are not cheap and the cost of the derivative and any collateral the counterparty may require need to be included in the calculations.

5 Overseas markets

5.1 Introduction

For any investor, the overall objective of the investment strategy is to strike the correct balance of risk and reward. The main asset classes used as part of this strategy will in most instances be available in overseas investment markets, in addition to domestic markets. Investment in overseas assets is justified because, in some circumstances, it can help reduce the level of risk – primarily by diversification or by matching the liabilities – and/or increase the expected returns. There may, however, be additional investment and management problems associated with overseas investment.

5.2 Reasons for overseas investment

There are three main reasons why an investor may wish to hold foreign assets:

1. **to match liabilities in the foreign currency**
2. **to increase the expected returns**
3. **to reduce risk by increasing the level of diversification.**

Matching liabilities in the foreign currency

An investor with liabilities expressed in an overseas currency will be exposed to the risk of adverse currency movements unless those liabilities are matched with investments in the appropriate currency. A fund with such liabilities will usually want to match them by investing in appropriate overseas assets.

Investors with only domestic liabilities need to consider the effect that overseas investments have on the expected risk / return performance of the whole portfolio.

Increasing expected returns

Returns on overseas investment can be higher than domestic returns either because they are fair compensation for the higher risk involved, or if inefficiencies in the global market allow fund managers to find individual countries whose markets are undervalued.

Over long periods of time, the *actual* returns provided by the major markets have been reasonably similar (when measured in the same currency). This suggests that in practice matching or diversification *may* be more important arguments for overseas investment than increasing returns.

The argument of increased returns is more likely to apply in the case of emerging markets, which we discuss later in this chapter.

Diversification

A major benefit of overseas investment is diversification. Investing in different countries or economies with a low degree of correlation helps to diversify risk. Diversification is also achieved by investing in industries that are not available for investment in the home market.

Put simply, a fund that invests in more than one country is less vulnerable to a downturn in the economic fortunes of any single country. This is because investment markets in different countries are not perfectly correlated.



Question

Give specific examples of how overseas investments help diversify a portfolio.

Solution

Specific examples of how overseas investments can help diversify a portfolio are:

- investment in a different economy
 - investment in a different currency
 - investment in a different stock market
 - investment opportunities that may not be available domestically
 - a larger number of companies from which to construct a diversified portfolio.
-

5.3 Problems of overseas investment

Overseas investment is not necessarily entirely advantageous.

Problems that may be encountered with overseas investment include:

- **a different market performance to the home market and the associated mismatching risk**
- **currency fluctuation risk**

Significant losses can be made very quickly if the currencies purchased fall in value. Similarly, losses in domestic currency terms are made if the domestic currency rises in value. It can be surprising how volatile even major currencies can be.

After the Japanese tsunami in March 2011, the Yen increased by 8.6% within just a few days. This is because it was anticipated that Japanese insurers would be forced to sell their overseas assets in exchange for Yen, in order to pay claims. This would have had a strengthening influence on the Yen, but the impact was accelerated and exaggerated because overseas investors anticipated this move and bought Yen themselves in an attempt to take advantage of the expected increase.

- **increased expertise needed to assess the market**

This arises because:

- there are extra variables to analyse (*eg* overseas economies and currencies)
- more work is required to overcome the problems with poor information.

- **additional administration functions: custodian, dividend tracking and collection**

It may be necessary to appoint an overseas custodian who would safeguard the assets, including holding the stock certificates, and take responsibility for activities such as handling rights issues and receiving dividends and other investment income.

- **different tax treatment**

Overseas investment will often result in higher overall tax charges for the investor. *Withholding tax* is tax deducted at source from dividends or other income paid to non-residents of a country. Investors could then be liable for further tax in their own country.

The adverse effect of this will be reduced where there is a *double taxation agreement* between the domestic tax authorities and the particular overseas country, as this means that the domestic tax is reduced or even eliminated because of the overseas tax already paid.

- **different accounting practices**
- **less information may be available than in the home market**
- **language problems – although many of the larger overseas companies publish accounts in English**
- **time delays – timing differences have presented difficulties in the past, but advances in communications have made this much less of a problem**
- **poorer market regulation in some countries (although some large companies are listed in more than one major financial centre)**
- **risk of adverse political developments**
- **liquidity – many less developed markets are not very liquid**
- **restrictions on the ownership of certain shares.**

The examiners will not expect you to demonstrate knowledge of particular overseas markets, for example, the specific details of property investment in Outer Mongolia. You should, however, be able to comment on such investments in terms of their likely features and potential issues arising.



Question

Describe the likely key features of freehold property investment in Outer Mongolia and the issues that a European investor would have to consider before making such an investment.

Solution

- It will presumably be a long-term investment, providing real returns (*ie* returns that reflect movements in inflation).
 - It will probably be unmarketable.
 - Care might be needed regarding political risks of foreigners owning Outer Mongolian property.
 - The investor would need to check the basis for repatriation of funds, legal protection for landlords and/or tenants, and the basis for rental growth.
 - There may be other disadvantages such as language and cultural differences, problems obtaining information on property investments and difficulty in maintaining a property so far away.
 - The return achieved in the investor's domestic currency would depend on exchange rate movements between the domestic currency and the Outer Mongolian currency.
 - The investor would need to check whether there is a double taxation agreement with Outer Mongolia.
-

6 Indirect overseas investment

6.1 Ways of achieving indirect overseas exposure

Indirect means by which an investor can obtain overseas exposure include:

1. Investment in multinational companies based in the home market.

The advantages are that:

- it is easy to deal in the familiar home market
- the companies will have expertise and tend to conduct their business in the most profitable areas overseas, including areas where direct investment may be difficult.

The disadvantages are that:

- such a company's earnings will be diluted by domestic earnings
- the investor will have no choice in where the company transacts its business.

2. Investment in collective investment vehicles specialising in overseas investment.

3. Investment in derivatives based on overseas assets.

In each case, one of the primary advantages over direct investment is that at least some of the practical problems associated with direct overseas investments are avoided. We look at the advantages and disadvantages in more detail below.

In general, indirect investment is particularly suitable for small funds, although even large funds can sometimes benefit from vehicles investing in specialist areas which are outside the funds' own areas of expertise.

6.2 Overseas investment *via* domestic companies with overseas exposure

Many of the largest domestic companies have significant overseas exposure, *eg* amongst the largest 100 companies in the UK more than 75% of the profits are earned internationally.



Question

Explain which type of domestic company is likely to have exposure to overseas influences that act in the opposite direction to usual overseas investment, and would therefore *not* be appropriate as an alternative to direct overseas investment.

Solution

Companies that rely upon imports have overseas exposure in the opposite direction to direct overseas investment. If the domestic currency weakens, the imports become more expensive. This is likely to reduce the profits of the importing company – unless it can pass the higher charges directly on to their clients without losing any sales (which is unlikely).

7 Investing in emerging markets

Stock markets in countries with developing economies such as Brazil, China, Mexico, Singapore etc are known as emerging markets. They offer high expected returns due to rapid industrialisation. They are also very risky markets.

7.1 Factors to consider before investing

Emerging markets will differ from each other in practice, but points to consider will generally include the following:

- current market valuation
- possibility of high economic growth rate
- currency stability and strength
- level of marketability
- degree of political stability
- market regulation
- restrictions on foreign investment
- range of companies available
- communication problems
- availability and quality of information.

The following sections explore these points in more detail.

7.2 Attractions of investment in emerging markets

With the prospects of high growth rates, and possible market inefficiencies, opportunities exist for profitable investment, but with a correspondingly higher level of risk.

Current market valuation

Inefficient markets: buy cheaply

The pricing of the currencies and the stock markets of developing economies is less *efficient* than that of the world's largest markets. This means that there may be significant anomalies from time to time, giving investors the opportunity to buy cheaply (or to make expensive mistakes).

Perceived to be risky: buy cheaply

Which is more risky, investing in Manila or in London? The vast majority of responses will be 'Manila', even from people who are unaware of the relative risks. In other words, investment in emerging markets is often perceived to be risky. This should lead to lower demand, and lower prices.

Rapid economic growth

Some of the developing economies will grow at rates that are just not attainable by the large developed economies (*eg* over 6% per year). Equity investors in fast-growing economies share in this increase in wealth (provided share prices don't fully reflect it already!).

Better diversification

The economies and markets of many smaller countries are less interdependent than those of the major economic powers. Therefore investment in emerging markets may provide a good method of diversification.

There is also better diversification to the extent that emerging markets will provide opportunities to invest in a range of industries not available domestically.

7.3 Drawbacks of investment in emerging markets

Volatility

The markets of small economies can be significantly affected by large flows of money, leading to stock markets and currencies of developing economies being potentially very volatile. An example of this was given by the substantial fall in many Asian markets in the second half of 1997. The best performing and the worst performing of the world's stock markets in a given period will often be from the emerging markets. This will give investors an unwanted extra level of uncertainty.

Marketability

Stocks issued in emerging markets may be less marketable, this will be of concern to many investors.

Political stability

The governments of some emerging markets lack stability, this can increase the volatility of investment returns.

Regulation of the stock market

Investors in London or New York should be reasonably comfortable that the markets are well regulated and that investors are well protected. Because the emerging markets are newer and generally smaller, there are more question marks against the efficiency of the processes for regulating the markets. Where markets are poorly regulated, foreign investors may lose out through:

- insider trading by local investors
- fraud.

Restrictions on foreign investment

Some of the emerging markets have tight controls on ownership by foreigners. On a related issue, there is (probably) a greater chance of direct action against foreign investors, *eg* following a change in political leadership. Developing nations *tend* to be less stable politically.

There may be severe problems in repatriating funds (both income and capital).

Communication problems and availability and quality of information

Under the advantages discussed above, we said that the inefficiency of the markets leads to opportunities to buy cheaply. The drawback here is that it is much more difficult for the investor to get enough good quality information to substantiate a view that investment is worthwhile. Specialist local expertise is therefore especially important. There may be greater communication issues, for example language barriers, time zones and how information is presented.



Question

- (i) Explain why there is likely to be more anomalous pricing of stocks in a new or emerging stock market than in an established market.
 - (ii) Comment on whether this is good or bad for investors.
-

Solution

- (i) The pricing of stocks in a new or emerging market is likely to be less efficient than in an established market because:
 - *Fair* prices are set by lots of buyers and sellers agreeing prices. Where there are fewer dealers and investors, it is likely that the mechanism for establishing correct prices will be less efficient.
 - Dealing costs are likely to be relatively high, putting a barrier to active buying and selling. Pricing anomalies have to be bigger before buyers and sellers decide to act.
 - Investment analysts are likely to have less sophisticated techniques and methods for spotting anomalies. Similarly, investors are likely to be less sophisticated.
 - The quality of information is likely to be inferior.
 - (ii) This situation is good for the clever, well-informed or lucky investors who buy cheaply and sell dear. It's not so good for other investors.
-

Chapter 10 Summary

Collective investment schemes (CISs)

CISs provide the opportunity for investors to achieve a wide spread of investments, whilst benefiting from specialist management expertise.

There are two fundamental types of CIS – *closed-ended* and *open-ended*. In a *closed-ended* scheme, such as an *investment trust*, once the initial tranche of money has been invested the fund is closed to new money. In an *open-ended* scheme, such as a *unit trust*, managers can create or cancel units in the fund as new money is invested or disinvested.

Regulation of CISs typically covers aspects such as:

- the categories of assets that can be held
- whether unquoted assets can be held
- the maximum level of gearing
- any tax relief available.

Closed-ended and open-ended CISs

In a closed-ended scheme, once the initial tranche of money has been invested the fund is closed to new money.

In an open-ended scheme, managers can create or cancel units in the fund as new money is invested or disinvested.

Investment trusts

The key features of investment trusts include:

- a stated investment objective
- the key parties involved are the board of directors, investment managers and shareholders
- investors buy shares in an investment trust company, which are priced by supply and demand
- share price often stands at a discount to net asset value per share (NAV)
- the funds are closed-ended
- they are public companies (and so are governed by company law)
- gearing is allowed.

Unit trusts

The key features of unit trusts include:

- a stated investment objective
- the key parties involved are trustees (*eg* an insurance company or bank), the management company (including investment managers) and unitholders
- investors buy units in a UT, which are priced at net asset value per unit
- the funds are open-ended
- they are trusts (and so are governed by trust law)
- limited power to use gearing (*ie* to borrow).

Open-ended investment companies

Similar to investment trusts in terms of corporate governance, but open-ended characteristics like unit trusts.

Differences between closed-ended and open-ended funds

- Investments in closed-ended funds are often less marketable than the underlying assets, whereas the marketability of investments in open-ended funds is guaranteed by the managers.
- Closed-ended funds can gear, leading to extra volatility. Open-ended funds have limited power to gear.
- It may be possible to buy assets at less than NAV in a closed-ended fund.
- The increased volatility of closed-ended funds implies a higher expected return.
- Shares in closed-ended funds are also more volatile than the underlying assets because the size of any discount to NAV can change. The volatility of units in an open-ended fund should be similar to that of the underlying assets.
- There may be uncertainty as to the true level of NAV per share of a closed-ended fund, especially if the investments are unquoted.
- Closed-ended funds can invest in a wider range of assets.
- They may be subject to different tax treatment.

CISs vs direct investment

Advantages of CISs compared with direct investment are:

- access to expertise
- diversification
- some of the direct costs of investment are avoided
- holdings are divisible
- possible tax advantages
- marketability may be better than that of the underlying.

Disadvantages of CISs compared with direct investment are:

- loss of control
- management charges incurred
- may be tax disadvantages.

Futures and options

A *derivative* is a financial instrument with a value dependent on the value of some other, underlying asset.

A *forward contract* is a non-standardised, over-the-counter-traded contract between two parties to trade a specified asset on a set date in the future at a specified price.

A *futures contract* is a standardised, exchange-tradable contract between two parties to trade a specified asset on a set date in the future at a specified price.

A *long position* in an asset means having a positive economic exposure to that asset. In futures and forwards dealing, the long party is the one who has contracted to take delivery of the asset in the future.

A *short position* in an asset means having a negative economic exposure to that asset. In futures and forwards dealing, the short party is the one who has contracted to deliver the asset in the future.

An *option* gives an investor the right, but not the obligation, to buy or sell a specified asset on a specified future date at the specified exercise (or strike) price. *Call* options give the right to buy. *Put* options give the right to sell.

An *American* option is an option that can be exercised on any date before its expiry.

A *European* option is an option that can only be exercised at expiry.

A *warrant* is an option issued by a company over its own shares. The holder has the right to purchase shares from the company at a specified price at specified times in the future.

Futures contracts can be used to set a price in advance. Options enable financial institutions to alter the structure of their portfolios without need to trade in the underlying assets.

Derivative transactions are not cheap, and need to allow for any collateral the counterparty may require.

Overseas markets

Reasons for investing overseas

There are three main reasons why an investor may wish to hold foreign assets:

1. to match liabilities in the foreign currency
2. to increase the expected returns
3. to reduce risk by increasing the level of diversification.

Drawbacks of investing overseas

Overseas investment has some potential drawbacks:

- different market performance to the home market and therefore mismatching risk
- currency fluctuation risk
- cost of obtaining expertise
- additional administration functions: custodian, dividend tracking and collection
- possible tax disadvantages, eg withholding tax
- different accounting practices
- lack of good quality information
- language problems
- possible time delays
- poorly regulated markets
- political risks (eg confiscation of assets)
- possible lack of liquidity
- restrictions on ownership of certain shares by foreign investors.

Indirect overseas investment

Indirect overseas investment may involve investment in:

- multinational companies based in the home market
- collective investment schemes specialising in overseas investment
- derivatives based on overseas assets.

Emerging markets

Emerging markets (stock markets in countries with developing economies) can offer high growth rates and possible market inefficiencies, giving investors the chance of making very big gains (or very big losses).

The economies and markets of many smaller countries are less interdependent than those of the major economic powers, resulting in good diversification.

Factors to consider before investment in emerging markets include:

- current market valuation
- possibility of high economic growth rate
- currency stability and strength
- level of marketability
- degree of political stability
- market regulation
- restrictions on foreign investment
- range of companies available
- communication problems
- availability and quality of information.

The practice questions start on the next page so that you can keep the chapter summaries together for revision purposes.



Chapter 10 Practice Questions

- 10.1 State eight advantages of overseas investment trust companies over direct investment overseas.
- 10.2 Discuss the factors to take into account when deciding whether to invest directly or indirectly in property. [8]
- Exam style
- 10.3 List the advantages and disadvantages of investing in equities *via* a collective investment scheme for: [8]
- Exam style
- (i) an individual investor
 - (ii) a large institutional investor.
- 10.4 Outline the practical difficulties of running a unit trust investing solely in property that do not normally arise when running unit trusts based on other investments.
- 10.5 Suggest reasons why an investment in the XYZ property company might produce a higher rate of return than an investment in the ABC property unit trust.
- 10.6 Contrast the features of a forward and an exchange-traded option.
- 10.7
- (i) Define a futures contract.
 - (ii) Define a forward contract by changing two words in the definition in part (i).
 - (iii) Define an options contract.
 - (iv) List the key differences between futures and option contracts.
- 10.8 List 16 potential problems of investing overseas.
- 10.9 A small fund invested predominantly in UK assets but also has US equity investments. The investment manager wishes to invest in emerging markets but the settlement and administration resources required cannot be set up to facilitate investment in these countries.
- Outline the ways of gaining exposure to emerging markets without direct investment.
- 10.10 Outline the main attractions of investment in emerging markets.

The solutions start on the next page so that you can
separate the questions and solutions.



Chapter 10 Solutions

10.1 Eight advantages of overseas investment trust companies (ITCs) over direct investment overseas:

1. expert management provided by the ITC
2. might operate in regions where it is not practicable for fund to invest directly
3. should provide ready-made diversification within its field of operation
4. administration, accounting and dealing are much easier
5. share price of ITC might be relatively low, so assets are bought at a discount to their value, which *might* reduce in the future (ITCs are usually priced at a discount)
6. may benefit from gearing
7. possible lower dealing costs
8. marketability is improved.

10.2 *Control vs expertise*

Direct property investment gives maximum control over investments. [½]

However, specialist expertise is needed to select and manage a direct property portfolio, which the investor may not have. [½]

Diversification

Direct property investment gives diversification away from equities, as its performance tends to be less correlated with the equity market than does that of indirect property share investments. [1]

However, small funds cannot afford to invest directly in big properties and they will struggle to get adequate diversification within the property sector through direct property investment. [1]

Through indirect property investment using a pooled property fund, investors can gain exposure to large or unusual properties ... [½]

... *eg* development sites or overseas properties, to which direct access may be difficult or impossible. [½]

Marketability

Direct property investments are less marketable and less divisible than indirect property investments ... [½]

... in particular property unit trusts where marketability is guaranteed. [½]

Direct property investors are unlikely to be forced sellers of property. However, if a property company has a cashflow problem or is facing bankruptcy, it may be forced to sell property at a depressed price. [½]

Valuation

Indirect property investments are easier to value as shares or units are likely to have readily available quoted prices. [½]

Direct property investments are infrequently and subjectively valued ... [½]

... leading to lack of volatility in the short term. [½]

Expenses

For a small fund the fixed costs of direct property investment would be a significant proportion of the fund size, putting the fund at a competitive disadvantage. [½]

However, for a large fund, direct property investment avoids the additional management charges associated with indirect property investment ... [½]

... *ie* contributing to the profits of the management company or to an inefficiently run company. [½]

Indirect property investment could result in cost savings from economies of scale. [½]

Expected return and volatility of return

Property development companies or investment trust companies can borrow against their portfolios, this may enable the investor to gear returns. [½]

This ability to gear is likely to cause more volatile returns but also higher expected returns. [½]

Investment trust company shares normally stand at a discount to their underlying estimated current net asset value (NAV). This discount acts as another source of volatility. [½]

However, a discount to NAV means that property assets can be bought cheaply. [½]

A narrowing of the discount to NAV will increase the return. [½]

Property unit trusts may have to hold cash to guarantee marketability, and this may dilute the expected return. [½]

The running (*ie* income) yield on the investments may differ ... [½]

... for example, for property company shares, the income payable consists of share dividends; for direct property investment the income payable consists of rents. [½]

Other

The taxation treatment of direct and indirect property investments may be different, making one or other of the two options more favourable to the investor. [½]

Direct property may be favourable if the investor wants to physically occupy the property. [½]

[Maximum 8]

10.3 (i) **Individual investor***Advantages*

- ability to achieve diversification even with small amounts of investment [½]
- access to specialist expertise of the investment manager [½]
- access to larger investments than could be secured directly, *eg* property [½]
- benefit from lower dealing costs than would be available if undertaking direct investment [½]
- holding likely to be more marketable than underlying assets [½]
- holdings are divisible [½]
- can be used to track an investment index [½]
- possible tax advantages [½]

Disadvantages

- loss of control over investments [½]
- management charges incurred [½]
- possible tax disadvantages [½]

(ii) **Institutional investor***Advantages*

- access to specialist expertise in new sectors [½]
- convenient and quick way to get exposure to new sectors [½]
- to enhance expected return, *ie*:
 - exposure to gearing (more limited for UTs) [½]
 - narrowing of the discount to NAV (ITCs only) [½]
- diversification from direct investments, *eg* different underlying investments and management [½]
- possible tax advantages [½]

Disadvantages

- loss of control over investments [½]
- higher charges as have to pay for collective investment scheme management expertise [½]
- possible tax disadvantages [½]

[Maximum 8]

10.4 Practical difficulties of running property-based units trusts are:

- establishing property prices, and hence unit prices
- buying and selling properties quickly to meet new and cancelled units
- the large minimum size of property investment.

The last two points will result in the fund having to hold relatively large amounts of cash, which may reduce the expected return on the fund.

10.5 XYZ might have better performance generally.

XYZ might be involved in a higher risk (higher return) activity (*eg* property development).

XYZ will probably have lower charges (initial and annual) than the unit trust.

XYZ benefits from gearing when property prices are rising.

The return on XYZ would be enhanced by a reduction in the discount to net asset value.

ABC would need to hold cash in case units were cancelled – this might reduce the return.

10.6 The differences are that:

- With a forward both parties are obliged to trade, whereas with an exchange-traded option the option holder has the *choice* to either trade or not trade.
- A forward is a non-standardised over-the-counter contract, whereas an exchange-traded option is standardised and traded on a recognised derivatives exchange.
- An exchange-traded option position can be easily closed out, whereas negotiation would be required to close out a forward position.
- An institutional investor will normally arrange a forward directly with a bank, whereas for an exchange-traded option it will approach a derivatives broker who will deal in the options market on its behalf.
- A forward involves no up-front payment, whereas the holder of an exchange-traded option must pay a premium to the writer, who in turn makes a margin payment to the clearing house.
- The counterparty to a forward is usually a bank, whereas with an exchange-traded option it is the clearing house. A forward therefore involves possibly material credit risk, unlike an exchange-traded option.
- The price of an exchange-traded option is quoted in the marketplace, whereas the valuation of a forward is more subjective.

- 10.7 (i) A futures contract is a standardised, exchange-tradable contract between two parties to trade a specified asset on a set date in the future at a specified price.
- (ii) Change standardised to non-standardised and exchange-tradable to over-the-counter-traded in the definition in part (i).
- (iii) An *option* gives an investor the right, but not the obligation, to buy or sell a specified asset on a specified future date.
- (iv) The table below shows the key differences between futures and options contracts.

Futures	Options
Obligation to buy / sell	Right (not obligation) to buy / sell
Exchange-tradable	Exchange-tradable or OTC-traded
Standardised	Standardised or non-standardised
No premium paid by buyer or seller	Premium paid from holder to writer
Margin paid to clearing house by both parties	Margin paid to clearing house by writer only* (exchange-tradable only)

** Only the writer of an option has an obligation to trade if the holder exercises their right to trade. The holder of an option has a right to trade but not an obligation. Therefore, the only party that poses a credit risk is the writer of the option. Hence margin is only required from the writer of an option.*

10.8 Potential problems of investing overseas:

- currency mismatch to liabilities
- greater volatility of returns due to currency fluctuation
- tax disadvantages, *eg* withholding taxes
- higher dealing costs
- possible lower liquidity of markets
- poorer market regulation
- higher management costs
- adverse political changes in overseas countries
- restrictions on investing overseas / ownership of overseas assets
- additional expertise required

- lack of information
- different time zones
- different accounting methods
- different languages and cultures
- problems repatriating funds
- need to appoint overseas custodian.

10.9 Exposure can be gained to emerging markets by:

- investment *via* collective investment schemes such as unit trusts, US mutual funds and investment trusts (there are a number of specialist *country-specific* funds that invest in a particular market, *eg* China, as well as funds that invest in a range of emerging markets)
- investment *via* UK (or US) companies with subsidiaries or other operations in emerging markets
- investment in multinational companies, which will often give some exposure to one or more emerging markets
- investment *via* OTC derivative securities based on overseas assets.

10.10 The main attractions of investing in emerging markets include:

- the possibility of rapid growth in market values
 - thus buying under-priced shares if this rapid growth is not already in the price
 - and hence exploiting arbitrage opportunities
- diversification from the main world markets.

11

Behaviour of the markets

Syllabus objectives

9.3.2 Demonstrate a knowledge and understanding of the characteristics of the principal investment assets and of the markets in such assets.

(Covered in part in this chapter.)

9.3.3 Describe how the risk profile of the principal investment assets affects the market in such assets.

9.3.4 Explain the principal economic influences on investment markets.

9.3.5 Describe other factors affecting supply and demand in investment markets.

0 Introduction

In this chapter we consider a number of topics linked to the behaviour of the markets.

Investment is fundamentally concerned with *price*. One of the most important factors in any investment decision is the price of the investment under consideration. Given a choice, an investor won't buy an investment if they think its price is too high, but they might buy it if they think the price is too low.

Of course, other factors than price will also feature in their decision, *eg* is it suitable for their liabilities and does the risk profile of the investment suit their risk appetite.

Firstly we will consider the risk profile of bonds and equity investments, remembering that higher risk investments will have a higher expected return to compensate investors for the additional risk.

Then we will discuss the interaction between supply and demand for investments.

The economic environment is a key influence on the risks and returns associated with investments and so we will recap some key economic relationships which were covered in the earlier subjects and look at the impact of economic factors on bonds, equity and property.

To end the chapter we examine other (non-economic) influences on the investment markets.

1 The risk profile of different investment classes

We introduced different investment classes and considered their characteristics in earlier chapters. We now turn our attention to the risks posed, and returns offered by key investment classes.

At the highest level, asset classes with the greatest risk also have the potential for the greatest return, over the long term. However, price fluctuations can depress values in the short term.

Financial product providers are major investors in all markets.

1.1 Government bond markets

Issuing government bonds is the main way governments finance the fiscal deficit.

The demands of purchasers can influence the terms on which debt is issued.

For example, with increasing volumes of annuities in payment, the demand from UK insurance companies has increased the duration of UK government bonds so that stocks of up to 50 years maturity are available.

Government bonds issued in most developed countries are a very secure, low risk form of debt, and so suitable for matching the guaranteed payments arising from selling annuity business.

As issues are large marketability tends to be good.

Fixed-interest bonds will expose investors to inflation risk.

1.2 Corporate bond markets

Corporate bonds expose investors to default, inflation, marketability and liquidity risk. The premiums for accepting these risks are factored into the market price of the bonds – in particular the spread, which is the difference between the yield on a corporate bond compared with the equivalent government bond.

So the *expected* return on a corporate bond will be higher than on a government bond of the same terms.

The *actual* return will depend upon experience, and if some of the additional risks to which the corporate bond is exposed occur then the actual return on the corporate bond could be far lower than that of the government bond.

Financial product providers who need to match asset proceeds to a stream of benefit outgo can structure a portfolio of bonds so that the assets can all be held to maturity.

Thus by investing in corporate bonds, the 'buy and hold' investor retains the marketability and liquidity premiums as there will never be a need for the bonds to be sold. This increases the value of corporate bonds to these investors.

One of the reasons investors demand a higher expected return on the corporate bond is because these bonds are less marketable and liquid than government bonds.

If a particular investor is not concerned about marketability and liquidity because it intends to hold the bond to redemption rather than sell it, then the extra return offered on the corporate bond to reflect marketability and liquidity risk is pure reward for that investor.

1.3 Equity markets

Equities expose investors to default, marketability and liquidity risk and the risk of an uncertain dividend stream and resale price.

Equity is a real investment, over the long term it protects investors from inflation risk.

In addition to the risks directly connected with the economy and business that affect companies share values, equity markets are heavily influenced by contagion risk, driven by market sentiment.

For example, an event in the USA that causes US equity markets to fall is very likely to trigger immediate falls in other worldwide equity markets. This is despite the triggering event having no direct impact in other countries.

With the global nature of multinational businesses, some contagion is inevitable, but not to the extent that markets observe. Following a period of turmoil in one market which has impacted other markets, there is evidence that equity markets revert to levels that were seen prior to the period of turmoil, but this can take several days or weeks.

1.4 Guarantees and investment choices

Financial products generally offer guarantees and to ensure customers are not disadvantaged, regulators require providers to hold capital against guarantees.

If product guarantees are covered by guaranteed returns from assets held, the amount of capital earmarked against the product guarantees is reduced.

In other words if the provider can demonstrate that the assets held are a good match for the guarantees offered then the risk of being unable to pay benefits is small. So the capital required to be held as a buffer against poor experience can be lower.

The extent to which a product provider chooses to match its assets to its product guarantees or to depart from a matched position in the hope of achieving better returns and higher profits will depend on the provider's risk appetite – which in turn is driven by the free capital it has available.

The greater the level of free assets available, the greater the scope the provider has to depart from a well-matched position.

2 Supply and demand

The general level of all markets is determined by the interaction of buyers and sellers.

Any factor that influences price does so by altering either *supply* or *demand*. By discussing all of the factors underlying supply and demand, this covers all of the factors that affect the price of the investment.

As demand for an asset type rises, then the general level of the market in that asset type will rise. If demand falls, then prices will fall.

Demand for most investments is very price elastic because of the existence of close substitutes.

If the price of Investment A rises just a little above the price of a similar security, B, then lots of investors will want to sell A to buy B. Several results flow from this:

- The prices of any two similar securities should stay very close to each other. In the limit, two identical securities should have identical prices otherwise arbitrage opportunities arise.
- Small changes in price are normally sufficient to make large changes in the quantity demanded of an investment.
- Large changes in supply need have only a small effect on the price of an investment.

In most investment markets, it is demand that changes both more quickly and more dramatically than supply and consequently it is demand that has the primary influence on price.

The main factor affecting demand is investors' expectations for the level and riskiness of returns on an asset type.

The returns that investors expect reflect a variety of influences, most of them economic.

This is particularly true of real assets, such as equities and property, where the returns are linked directly to the state of the economy.

It applies also however to financial instruments, such as bonds.

For example, although the nominal return on a conventional bond is fixed, the real return that it ultimately provides depends directly upon the inflation rate over its lifetime. Consequently, investors' expectations of inflation will influence the demand for bonds.

In this and following sections we consider the economic factors that affect return and risk in various markets and some factors affecting supply in various markets.

Key information

An *increase* in demand *increases* price. A *reduction* in demand *reduces* price.

An *increase* in supply *reduces* price. A *reduction* in supply *increases* price.

In a free market, the price will move so that supply equals demand.

3 Factors affecting short-term interest rates

Short-term interest rates are largely controlled by the government through the central bank's intervention in the money market. The government sets interest rates, directly or indirectly, in an attempt to meet its (often conflicting) policy objectives.

The central bank will set the benchmark short-term rate at which it is prepared to lend in the money market.

All other short-term interest rates – eg those at which banks and other financial institutions are prepared to lend to each other – will be related to the benchmark rate.

By controlling the benchmark rate, the central bank is therefore able to influence the level of short-term interest rates throughout the economy.

The relationship between the government and the central bank will vary between countries:

- The central bank could enjoy complete independence from the government in carrying out monetary policy, including the setting of short-term interest rates.
- Decisions could be the exclusive domain of the government in power.
- The central bank may enjoy a degree of independence when setting short-term interest rates, whilst remaining subject to certain constraints, eg to hit a particular inflation target.

The main reasons for altering interest rates are given below.

3.1 Controlling economic growth

Low real interest rates encourage investment spending by firms and increase the level of consumer spending. Cutting interest rates increases the rate of growth in the short term.



Question

Explain the previous paragraph.

Solution

This happens because low interest rates reduce the effective cost of investment and consumption financed by borrowing and therefore encourage investment and consumption. This increases aggregate demand and hence short-term economic growth.

3.2 Controlling inflation

The quantity theory of money states that there is a direct relationship between the quantity of money in an economy and the level of prices of goods and services in that economy. According to this theory, if the amount of money in an economy were to double, then price levels would also double, causing inflation. A consumer would be able to pay twice as much for the same good or service.

Interest rates can be interpreted as the 'price' of money or credit. Reducing interest rates encourages the demand for credit from bank customers. Assuming banks meet this increase in demand, they increase the supply of money in circulation, which can lead to inflation. This is an application of the *quantity theory of money*.



Question

Describe the quantity theory of money.

Solution

The *quantity theory of money* is based upon the economic identity:

$$M \times V \equiv P \times Y$$

where: M is the nominal money supply
 V is the velocity of circulation (how often money changes hands)
 P is the price
 Y is the number of transactions (*ie* real level of economic activity).

If we assume that V and Y are fixed – as may approximately be true in the short run – then the quantity theory of money suggests that an increase in the money in circulation *will* cause an increase in prices.

So, if we accept the assumptions, we know that the level of inflation (which is the rate of change in the price) is directly dependent upon the rate of growth of the money supply.

Low real interest rates can also lead to inflationary pressures by increasing demand. The increase in demand, may well lead to *demand-pull inflation*.



Question

Explain briefly what is meant by *demand-pull inflation*.

Solution

Demand-pull inflation refers to a situation in which there is excess demand within the economy so that firms are able (and more likely) to increase their prices. As a consequence, the general level of prices may be pulled up.

3.3 Controlling the exchange rate

If interest rates in one country are low relative to other countries, international investors will be less inclined to deposit money in that country. This decreases demand for the domestic currency and tends to decrease the exchange rate.

(Conversely, *high* interest rates relative to other countries' interest rates can be used to support the value of the domestic currency.)

Note that a decrease in the exchange rate induced by a cut in short-term interest rates may lead to *cost-push inflation*.



Question

Explain briefly what is meant by *cost-push inflation*.

Solution

Cost-push inflation refers to a situation where if firms' costs go up, they will tend to pass on at least part of the increase to consumers through higher prices.

The average price level can be 'pushed' up by an increase in costs. Possible sources of cost-push inflation include:

- higher import prices due to a weakening of the domestic currency
 - higher import prices for some other reason (*eg* rise in the price of oil)
 - higher wage demands not met by productivity increases.
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4 Factors affecting the level of the bond market

4.1 Introduction

The supply of bonds comes primarily from the government, but also from corporate borrowers, whilst demand comes mainly from institutional investors (including overseas investors). Any factors that affect supply and demand for bonds will affect bond yields and hence the level and shape of the yield curve.

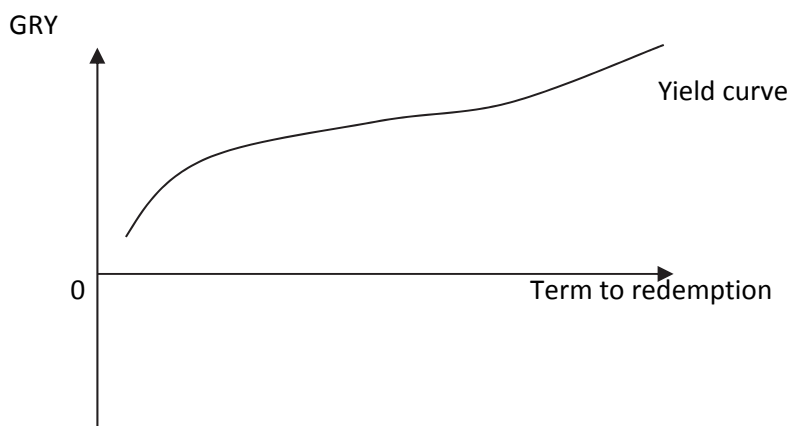
Note that it is not necessarily an *actual* change in the factors that will cause yields to change. If investors start to *expect* that there will be a change in one of the factors the price of bonds will start to move to reflect the market's expectations.

Exam Tip

Remember that bond yields and bond prices are inversely related. Therefore, an increase in demand, which leads to an increase in bond prices, will result in a reduction in bond yields.

4.2 Theories of the yield curve

A yield curve is a plot of yield against term to redemption. Usually the yield plotted is the gross redemption yield on coupon paying bonds but other yields can be used, *eg* zero-coupon bond yields.



The yield curve is a derived line of best fit through the yields of individual bonds.

There are four theories which are useful in giving an intuitive feel for the factors affecting the shape of the yield curve, interest rate risk management of bond portfolios and the pricing of interest rate sensitive derivatives. These are outlined below.

1. Expectations theory

Expectations theory describes the shape of the yield curve as being determined by economic factors, which drive the market's expectations for future short-term interest rates.

Example

Suppose that the following future short-term interest rates (forward rates) were available in the market (*ie* we give the rates of interest that can be agreed *now* for borrowing at various future dates):

<i>Period (months)</i>	<i>Interest rate</i>
0 – 6	10% <i>pa</i>
6 – 12	9½% <i>pa</i>
12 – 30	9% <i>pa</i>
30 – 48	8% <i>pa</i>

By considering these forward rates, we can determine the price of a government bond with an 11% semi-annual coupon, redeemable at par, with a remaining term of exactly 18 months.

It can be calculated by discounting the future receipts from the bond at the appropriate forward rates:

$$P = \frac{5.5}{1.10^{0.5}} + \frac{5.5}{1.10^{0.5} \times 1.095^{0.5}} + \frac{105.5}{1.10^{0.5} \times 1.095^{0.5} \times 1.09^{0.5}} = 102.33$$

We can determine the gross redemption yield for the bond as approximately 9.5% *pa* effective or 9.3% *pa* convertible half-yearly.

**Question**

Prove that the GRY in the example above is 9.5% *pa*.

Solution

$$\frac{5.5}{1.095^{0.5}} + \frac{5.5}{1.095} + \frac{105.5}{1.095^{1.5}} = 102.33$$

The gross redemption yield we have calculated here is effectively just a *weighted geometric average* of the forward interest rates over the period.

If we expect future short-term interest rates to fall (rise), then we would expect gross redemption yields to fall (rise) and the yield curve to slope downwards (upwards).

Conversely, from a given yield curve, the market's expected future short-term (forward) interest rates can be derived. For example, a downward sloping yield curve may indicate that the market expects future short-term interest rates to fall.

Changing yield curves

According to expectations theory, if the yield curve changes shape, this reflects a change in investors' view of future interest rates.

Expectations of inflation

One of the biggest influences on investors' expectations of future short-term interest rates is the expected level of future inflation.

If inflation is high, the government is likely to force up short-term interest rates in an attempt to reduce future inflation.

Investors do not like seeing the real value of their investments being eroded by inflation. They therefore like to require positive real returns, *ie* interest rates higher than inflation.

An upward-sloping yield curve may indicate that investors expect inflation and hence short-term interest rates to rise in the future, and *vice versa* for a downward-sloping yield curve.



Question

A 6-month zero-coupon bond issued in the UK has a gross redemption yield of 12% *pa*, whilst a 5-year zero-coupon bond has a gross redemption yield of 10% *pa*. Note that both yields are quoted *convertible half-yearly*.

Calculate the price in six months' time of the 5-year zero-coupon bond.

Using expectations theory, calculate the expected gross redemption yield of the 5-year bond in six months from now, when it will have four and a half years until redemption.

Solution

The price of the 5-year zero-coupon bond today is:

$$\frac{100}{1.05^{10}} = £61.39$$

According to the expectations theory, this bond should give an effective half-yearly return of 6% over the next six months. (If it did not, then the 6-month bond is at an anomalous price in comparison.) The price of £100 nominal of the 5-year zero-coupon bond in six months should therefore be:

$$61.39 \times 1.06 = £65.07 \quad (\text{ie giving a gain of 6\%}).$$

The gross redemption yield i (based on nine periods now) can be calculated as:

$$65.07 = \frac{100}{(1+i)^9}, \text{ giving } i = 4.89\% \text{ for each half year.}$$

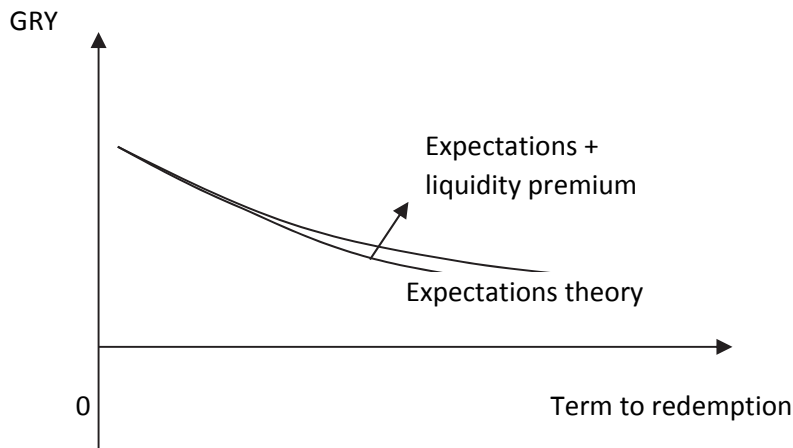
This is equivalent to 9.78% *pa* (convertible half-yearly).

2. Liquidity preference theory

The liquidity preference theory is based on the generally accepted belief that investors prefer liquid assets to illiquid ones.

Investors require a greater return to encourage them to commit funds for a longer period.

Long-dated stocks are less liquid than short-dated stocks, so yields should be higher for long-dated stocks.



According to liquidity preference theory, the yield curve should have a slope greater than that predicted by the pure expectations theory.



Question

Comment on the relative liquidity of short- and long-dated government bonds.

Solution

Long-dated government bonds have more volatile prices than short-dated government bonds.

Thus short-dated government bonds are more liquid.

There are many other factors that may influence the yield curve more than liquidity preference (eg expectations of interest rates and supply and demand from different investors), so do not assume from this theory that the *normal* shape of the yield curve is upward-sloping.

3. Inflation risk premium theory

An investor buying a conventional government bond and holding it to redemption is locking into a known rate of nominal return (ignoring the reinvestment of coupons).

However, many investors will be more interested in the *real* return (ie the return in excess of inflation) than the nominal return.

Investors should therefore require a higher nominal yield to compensate for the risk that inflation is higher than expected and the real return lower than expected.

Crucially, the uncertainty about future inflation is greater over longer periods. Consequently, the risk premium should be greater for longer-dated stocks to compensate investors for the fact that long-term estimates of inflation are much less certain than short-term estimates.

This is known as the *inflation risk premium* theory.

The theory applies if it is assumed that some investors have real liabilities (*ie* liabilities that change as inflation changes), and so purchasing conventional bonds leads to a mismatching risk.

Under the inflation risk premium theory the yield curve will tend to slope upwards because investors need a higher yield to compensate them for holding longer-dated stocks which are more vulnerable to inflation risk than shorter-dated stocks.

Its effect will therefore be similar to that of the liquidity preference premium.

As index-linked bonds are protected against the effects of inflation (ignoring the lag in indexation), inflation risk premium theory does not apply to index-linked bonds.

4. Market segmentation theory

Market segmentation (or preferred habitat) theory says that yields at each term to redemption are determined by supply and demand from investors with liabilities of that term.

The concept of market segmentation is based on the following fundamental ideas:

1. Different providers and investors have different needs.
In particular, they have liabilities of different terms, so they are active at different terms of the yield curve.
2. Price is a function of supply and demand, and yields are simply a function of price.
Hence supply and demand determine yields.
3. Suppliers will wish to supply investments of different terms, and so will be more active at different terms in the yield curve.

These concepts together lead to market segmentation theory: the yields at different segments of the curve are set by the supply and demand from providers and investors active in that segment.

Demand

Principal buyers of short bonds are banks and general insurers, with short-term liabilities to match.

The major investors in long bonds are pension funds and life assurance companies, who have long-term liabilities.

The two areas of the bond market may move independently.

Supply

The supply side features relating to government bonds are influenced by the size of the fiscal deficit and the actions being taken by government to finance the deficit.

If there is a demand at certain durations it will be cheaper for issuers to raise capital at those durations.

The supply of corporate bonds will reflect companies' requirements for additional finance, as well as the relative cost of raising finance via new issues of shares and bonds.



Question

Explain what might happen to the yield curve if life offices sold a very large amount of annuity business.

Solution

If life offices sold a large amount of annuity business, there would be extra demand for bonds with medium and long terms.

The yields of these bonds should fall (as prices rise), so the yield curve at these terms should fall.

4.3 Theories of the real yield curve

The real yield on an investment is the yield after allowing for inflation. In practice, it is sometimes approximated as the difference between the (nominal) yield realised and the average rate of inflation over the corresponding period.

The real yield curve is the curve of real yields on index-linked bonds against term to maturity.

The real yield curve, like the conventional yield curve, is determined by the forces of supply and demand at each maturity duration.

Thus, it can be viewed as being determined by investors' views on future real yields (ie expectation theory) modified according to market segmentation theory and liquidity preference theory.

The government's funding policy will also influence the shape of the curve. (This is the supply side of market segmentation theory.)

As already mentioned, inflation risk premium theory is irrelevant to index-linked bonds.



Question

Explain what an upward-sloping real yield curve may reflect.

Solution

It might reflect:

- liquidity preference theory
 - an expectation that real yields are going to rise due to:
 - demand for investments in general falling in the future (*ie* the level of saving in the economy as a whole falling)
 - demand for index-linked stocks in particular falling
 - supply of investments in general increasing in the future (*ie* the level of borrowing in the economy as a whole rising, possibly due to a large government deficit)
 - supply of index-linked stocks in particular increasing (*eg* if government funding is no longer conducted through sales of *conventional* bonds).
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4.4 Principal economic factors

The economic factors influencing bond yields include:

1. inflation
2. short-term interest rates
3. the exchange rate
4. public sector borrowing – the *fiscal deficit*
5. institutional cashflow
6. returns on alternative investments
7. other economic factors.

In practice, views on the first four of these are linked and often the market's estimates for the future values of these variables may change simultaneously. Below we discuss each factor in turn, assuming for each that there is no change in the other factors.

1. Inflation

Key information

Inflation erodes the real value of income and capital payments on fixed coupon bonds. Expectations of a higher rate of inflation are likely to lead to higher bond yields and vice versa.

The paragraph above closely reflects expectations theory which we introduced earlier in this section.

Investors will try to estimate the average level of inflation over the whole life of the bond. They will only buy bonds if redemption yields are higher than their estimate of inflation by at least as much as their required real rate of return.

It is inflation over the whole life of the bond that we are interested in. This might be quite different from the current rate of inflation.

The bond market usually takes a big interest in the announcement of each month's inflation figures. This is because the monthly inflation figures are one of the most useful pieces of new information available to investors for refining their estimates of future inflation and short-term interest rates.

2. Short-term interest rates

The comments in this section are closely related to expectations theory and inflation risk premium theory introduced earlier in this section.

The yields on short-term bonds are closely related to returns on money market instruments so a reduction in short-term interest rates will almost certainly boost prices of short bonds.

Short-term interest rates can therefore be regarded as fixing the short end of the yield curve.

The effect of changes in short-term interest rates on yields on long-dated stocks is not clear-cut.

Expectations theory predicts that if there was a cut in short-term interest rates, and if the market also revised downwards its estimate of future short-term interest rates at all terms, then long-term bond yields would fall.

However, investors in long bonds may interpret a cut in interest rates as a sign of monetary easing, with potentially inflationary consequences over the longer term. So, the yield on long bonds might decline by a smaller amount, or even rise.

As we saw in an earlier unit, the nominal yield on a conventional government bond can be expressed as:

$$\text{Nominal yield} = \text{risk-free real rate} + \text{expected inflation} + \text{inflation risk premium}$$

If inflation is expected to rise in the longer terms then the last two terms on the right-hand side of the expression above will increase leading to a higher nominal yield, and therefore lower price of long-term bonds.

In summary, the impact of a change in short-term interest rates on long-term bond yields can therefore go either way.

3. The exchange rate

A significant part of the demand for government bonds in many markets comes from overseas.

Changes in expectations of future movements in the exchange rate will affect the demand from overseas investors. It will also alter the relative attractiveness of domestic and overseas bonds for local investors.

If an investor invests in a foreign country their return has two components:

1. the return achieved by the investment as measured in the local currency
2. the profit or loss from exchange rate movements.

For example, when a US investor looks at the expected return from investing in UK government bonds, compared with investing in US government bonds, the *expected* profit or loss from exchange rate movements over the whole term of the investment needs to be allowed for.

If investors simply choose the investment that gives them the highest return (*ie* they ignored currency risk and the need to match liabilities) then we would expect the following equation to hold when investment markets are *in equilibrium*:

$$\begin{aligned} \text{Return on } n\text{-year UK government bond} &= \text{Return on } n\text{-year US government bond} \\ &+ \text{expected appreciation of } \$ \text{ against } £ \text{ over } n \text{ years} \end{aligned}$$

In the short run, interest rates are a key determinant of the exchange rate. This means for short-term interest rates, a change in US interest rates may lead to a change in the £/\$ exchange rate.

In the long run, however, the exchange rate will tend to follow its *purchasing power parity (PPP) path* reflecting the market's view of relative levels of US and UK inflation, in other words, changes in inflation and changes in exchange rates may offset, so that there will be a strong link between UK and US bond yields.

4. Fiscal deficit

The comments in this section relate closely to market segmentation theory discussed earlier in this section.

If the government's fiscal deficit is funded by borrowing, the greater supply of bonds is likely to put upward pressure on bond yields, especially at the durations in which the government is concentrating most of its funding.

As well as affecting particular maturities, the choice of which bonds to sell may affect yields on conventional bonds and index-linked bonds differently.

For example, an decision to increase the use of index-linked bonds might lead to lower prices and higher yields on index-linked bonds and higher prices and lower yields on conventional bonds.

The impact of the fiscal deficit depends upon the *funding policy* adopted by the government:

- if the current government is committed to a *full funding* policy, this means meeting the whole of the deficit through borrowing, rather than printing money
- the form the government borrowing takes, *eg* conventional or index-linked bonds, Treasury bills and/or other forms, such as borrowing from individual investors.

Selling Treasury bills would increase short-term interest rates, while printing money will lower rates but increase expectations of inflation.

Either way, bond yields would tend to rise. Thus, however it is funded, an increase in the fiscal deficit will tend to cause bond yields to rise.



Question

- (i) Explain why selling Treasury bills increases short-term interest rates.
- (ii) Explain why selling Treasury bills may cause bond yields to rise.
- (iii) Explain why does printing money lower (short-term interest) rates.
- (iv) Explain why does printing money increase expectations of inflation.
- (v) Explain why might printing money cause bond yields to rise.

Solution

- (i) To sell more Treasury bills the central bank needs to reduce their price.
So a higher interest rate is required to discount the proceeds.
 - (ii) To sell more Treasury bills the central bank needs to reduce their price.
This makes Treasury bills seem relatively attractive compared with bonds.
Bond prices may subsequently fall and yields rise.
 - (iii) More money in circulation makes more money available for short-term deposit.
Consequently, banks can offer lower interest rates on deposits.
 - (iv) The quantity theory of money tells us that there is a direct relationship between the money supply and the level of prices.
More money chasing the same quantity of goods must cause prices to rise.
 - (v) The increased expectations of inflation will make investors demand higher nominal yields in order to maintain the required level of real yields.
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5. Institutional cashflow

The demand for bonds can be affected by institutional cashflow.

If institutions have an inflow of funds because of increased levels of savings they are likely to increase their demand for bonds.

Changes in regulations and investment philosophy can also affect institutional demand for bonds.

6. Returns on alternative investments

The relative attractiveness of alternative investments, both at home and overseas, will influence the demand for bonds, and hence the yields that they offer.

The yields on US government bonds are particularly important due to their vast quantities.

7. Other economic factors

Almost any piece of economic news has implications for inflation and short-term interest rates. The impact of other economic factors can therefore usually be understood in terms of these two quantities.

4.5 Comparison of government and corporate bond yields

Economic factors which adversely affect prospects for corporate profitability are likely to increase the perceived risk of corporate bonds relative to government bonds.

This will increase the general level of the yield margin of corporate over government debt.

The yield margin of corporate over government bonds primarily reflects differences in marketability risk and default risk. Investors' perceptions of default risk may increase in times of recession, so the size of the yield margin is expected to increase (fall) as the economy moves into (out of) recession.



Question

Describe how much the yield margin of the following companies' debt over a comparable government bond will increase in a recession:

- large food retailer
- small industrial company?

Solution

Large food retailer

As food retailing is a relatively 'defensive' sector, whose profitability is little affected by a recession, the very low default risk and yield margin are not expected to increase much.

Small industrial company

A small industrial company is much more exposed to the economic cycle. The non-negligible default risk is likely to increase materially, resulting in a material rise in the yield margin.

The availability and price of government debt might affect the actions of otherwise risk-averse investors.

For example, if government debt was offering very poor returns compared with high quality corporate debt, some investors may weaken their normal risk profile to secure the extra return. This would tend to narrow the gap between corporate and government debt.

Supply side issues also have an impact. If equity market conditions are depressed, companies may find it easier to raise funds through issues of corporate debt than through equity issues. Oversupply of corporate debt reduces prices and increases yields.

5 Factors affecting the level of the equity market

5.1 Introduction

As with other markets, equity prices are determined by the interaction of supply and demand and, in practice, the demand factors usually predominate.

5.2 Expectations of profits

Equities can be valued by discounting the stream of future dividends that the investor expects to receive by purchasing the shares in the particular company. These dividends will themselves reflect the expected future profitability of the company.

Investors' expectations of future corporate profitability and the value of those profits which largely determines the general level of the equity market.



Question

An influential economic forecasting group publishes an annual prediction of the future growth of corporate profits.

The group is about to publish their latest report which estimates profits to be generally 5% higher than they had predicted in their previous report.

Describe what will happen to share prices on the day the report is published.

(There may be more than one possible answer!)

Solution

Here is a range of possible answers:

1. No change to share prices. The market had already decided for itself that growth was on the up, so this view was already in the prices.
2. No change to share prices. The results of the report were leaked last week.
3. No change to share prices. The stock market doesn't believe the group (even though it is influential).
4. A slight rise in the market to reflect the increased confidence generated by the report.
5. A slight fall in the market. Investors had expected the report to say 10% higher.
6. A 5% rise. No one had expected the report to change from the previous year and the investors fully believe the forecasting group.

In practice, the result will probably be a watered down version of point 4, tempered by 1, 2 and 3. Besides, the day the report is published, there may be a more influential piece of news that will swamp the influence of the report (eg interest rates cut by 1%, war breaking out).

Amongst the main factors that influence the general level of the equity market are:

- **expectations of real interest rates and inflation**
- **investors' perceptions of the riskiness of equity investment**
- **the real level of economic growth in the economy**
- **expectations of currency movements.**

In addition to the factors listed above, any factor affecting supply eg:

- **the number of rights issues**
- **share buy-backs**
- **privatisations**

and any factor affecting demand eg:

- **changes to tax rules**
- **institutional flow of funds**
- **the attractiveness of alternative investments**

will affect market prices.

To help understand the factors above it can help to think about one approach that can be used to value equity, a discounted dividend model. This model values shares by:

- **projecting the future cashflows from the shares (ie the dividends)**
- **discounting these dividends back at a rate of return that allows for the investor's perceptions of the riskiness of the investment.**

Future real dividend growth might be expected to occur in line with real economic growth. The discount rate will typically be a risk-free rate (a real rate if it is being used to discount real cashflows) plus a risk premium. So, this model helps us to identify real risk-free interest rates, the equity risk premium and real economic growth as the key factors underlying the general level of the equity market. These points are brought out in the discussions below.

Real interest rates

Real interest rates have two important effects:

1. **Low real interest rates should help to stimulate economic activity, increase the level of corporate profitability, and hence raise the general level of the equity market.**
2. **Also, the rate of return required by investors should be lower, so the present value of the future dividends will be higher.**

Inflation

Equity markets should be reasonably indifferent towards high nominal interest rates and high inflation. If the rate of inflation is high, the rate of dividend growth would be expected to increase in line with the return demanded by investors.

There may be timing differences to the extent that increases in dividends may not coincide exactly with short-term inflation. However, in the long term, inflation should not depress the *real* value of equities. If the income and outgo are increased through inflation by $x\%$, then profits are increased by $x\%$, and the value of the shares should be $x\%$ higher (*ie* same *real* value).

There are some indirect effects from inflation:

- **It might be argued that high interest rates and high inflation are unfavourable for strong economic growth, so fears of inflation will have a depressing effect on equity prices.**
- **Real interest rates are probably more important than nominal interest rates. Investors expecting high inflation may also expect the government to increase real interest rates in response.**
- **Often a rise in inflation makes the prospects for inflation less certain.**
Uncertainty about future inflation would make investors more nervous about fixed-interest bonds.

Nervousness in the bond market might result in an increase in equity investment, as equities should provide a hedge against inflation. This would tend to increase the relative level of the equity market at the expense of the bond market.

Equity risk premium

The equity risk premium is the additional return that investors require from equity investment to compensate for the risks relative to risk-free rates of return. The equity risk premium fluctuates from time to time, depending on the overall level of confidence of investors and their views on risk.



Question

State the main factors that would lead us to require a higher return from equities than from government bonds.

Solution

We would require a higher return from equity risk to compensate for the:

- greater risk of default – with respect to both income and capital payments
 - lower marketability of equities compared with government bonds
 - greater volatility of income and capital values, ie lower liquidity
-

Real economic growth

In general, real dividends, and therefore the fundamental value of companies, would be expected to grow roughly in line with real economic growth.

Therefore, changes in investors' views on economic growth have a major effect on the level of the equity market.

Currency

A weaker domestic currency makes exports more competitive, so profits of companies that export goods and services, should increase. Profits earned in other currencies are more valuable when converted into the domestic currency.

A weaker currency makes imports more expensive. This reduces corporate profits if firms cannot pass the higher costs of imported raw materials to consumers. Higher costs of raw materials also lead to inflation. However, if manufactured imports are more expensive, the market share of domestic producers of the same goods should increase.

In countries like the UK, where a high proportion of profits are earned abroad, sterling depreciation should raise the general level of the equity market.

The impact of exchange rate movements will be smaller for countries for which overseas trade and capital flows are less important.

6 Factors affecting the level of the property market

6.1 Introduction

Economic influences have an impact on the property market in three main inter-related areas:

- occupation
- development cycles
- the investment market.



Question

Explain what is meant by the terms:

- (i) occupation
- (ii) development cycle
- (iii) investment market

in the paragraph above.

Solution

- (i) occupation – the demand for property for occupation, *eg* businesses seeking commercial property to rent
- (ii) development cycle – the supply of newly completed property developments
- (iii) investment market – supply and demand for properties as investments.

The interaction between occupational demand and the supply of property for rent determines the market level of rents. The capital value of rented property is determined by the investment market.

The capital value will reflect the market level of rental income (just as the capital value of shares reflects dividend income).

We will firstly concentrate on commercial property investment. Economic influences on residential property are covered later in this section.

6.2 Commercial property and occupation

Economic growth

Tenant demand is closely linked to the buoyancy of trading conditions and GDP.

Other things being equal, economic growth increases demand for commercial and industrial premises.

The increased demand should feed through to higher rents and higher property values.

However, the impact of economic growth will not necessarily be uniform across the different property sectors or throughout all regions of a country.

For example, industrial property is exposed to the fortunes of the manufacturing industries but shops are dependent on the retail sector (so consumer expenditure is important).

Any factor that affects economic activity, such as real interest rates, will affect occupational demand for property.

For example, levels of employment in the service sector tend to influence occupier demand for offices significantly.

The level of real interest rates has a strong effect on the level of economic activity and so will affect the property market. Lower real interest rates should stimulate economic activity and should therefore have a positive effect on rental and property values.

Structural changes in the demand for property

New patterns of economic activity, domestically and globally, change demand patterns.

An example would be a trend for firms to move staff out of expensive capital city locations to cheaper areas.

Other examples are increases in the number of people working from home and shopping online.

6.3 Commercial property and development cycles

Property is fixed in location and takes time to develop.

Markets can be viewed in terms of the existing stock plus forecast additions to stock. But there are supply-side lags and these can be difficult to forecast.

The development pipeline can be up to five years long. This can result in surpluses of available property when the economic cycle is in a downturn, and shortages as the economy improves.

Property use may be subject to statutory control. Local planning authorities may frequently restrict development.

This makes the supply of properties relatively inelastic (*ie* fixed). Therefore, when demand factors change, the supply does not change with it, and so there are big movements in property values. This makes property values more volatile.

6.4 Commercial property and the investment market

The property investment market relies on the occupancy market as this provides the investment income and the potential for rental growth.

Inflation

Property investment returns have been a good hedge in the long run against unexpected inflation.

If there are no other external influences, freeholders should be able to increase rents with inflation so that the real value of the rent is not maintained.

However, for properties with infrequent rent reviews, inflation erodes the real value of the rental stream between reviews.

The prices of such properties will behave more like the prices of conventional bonds. For example, if investors start to anticipate higher future inflation, prices should fall.

Real interest rates

Higher real interest rates should lead to a lower valuation of future rents and therefore lower capital values.

This assumes that capital values represent the discounted present value of the future rents yielded by the property.

The relationship between interest rates and property rental yields is unclear in the short term. In the longer term, high long-term bond yields tend to push up property investment yields.

An increase in bond yields leads to a decrease in the demand for property, and hence an increase in property yields.

Other factors

The sources of investment, and whether cashflows are positive or negative, are important in determining the state of the property investment market.

The main sources are:

- institutional investors
- public / private property companies using bank debt
- international investors.

Where overseas investors are significant purchasers of property, the exchange rate will influence demand levels.

This is especially true for office properties in a capital city or major financial centre.

For example, UK property is attractive to foreign buyers when the value of sterling is expected to strengthen in the future.



Question

Explain why an increase in the demand for office space can have a big impact on the level of rents.

Solution

The supply of office property is very inelastic in the short term.

So, an increase in the demand for property cannot immediately be met by an increase in the supply, so this increases the upward pressure on prices.

Also, in some major financial city-centre locations it is very hard to increase the supply physically because there is so little unused space.

6.5 Residential property

Additional economic considerations apply to the residential property market in territories such as the UK where owners occupy their own property, usually purchased with the aid of a mortgage. These considerations do not apply where major landlords rent out many residential properties.

Residential property values are entirely driven by supply and demand. The State can influence supply by constraints on new development in high demand areas. This can be done through planning restrictions or zonal prohibitions around major cities.

High house prices compared to earnings levels restrict the number of individuals who can access adequate mortgage funds to make a purchase even at low interest rates.

In the UK average house price in the UK is currently around 8x the average salary, this is more than double the level 20 years ago. This acts as a constraint on property prices as many people will not be able to afford to buy a property, even with a mortgage, given lenders typically allow residential customers to borrow 3-4x their salary.

In theory, this constraint on demand should cause prices to fall. However, if interest rates are low, there is an alternative demand from investors to buy residential property and rent it out. The continuing demand for places to live drives up rental levels. Rents are substantially more than can be earned on fixed-interest investments and rental income is relatively secure in times of high demand.

If there are sufficient investors to replace the individual buyers who cannot raise funds, capital values are maintained.

7 Other influences on the investment markets – demand

In this section we consider the factors affecting the *demand* for different asset classes and in the next section some of the *supply* factors.

Demand for an asset will change in one of two main circumstances:

1. **Investors' opinions of the characteristics of the asset remain unchanged but external factors alter the demand for that asset. These external factors include:**
 - **investors' cashflows**
 - **investors' preferences**
 - **the price of other investment assets.**
2. **Investors' perceptions of the characteristics of the asset, principally risk and expected return, alter.**

We look at these in more detail in the remainder of this section.

7.1 Investors' cashflows

The amount of money available for investment by institutional investors can have a significant impact on market prices.

The level of cashflow in to, and also out of, the main financial institutions has a major impact on the demand for assets and hence market prices.

The level of net cashflow itself will primarily reflect the level of saving throughout the economy, whilst the balance between the different institutional investors will reflect the relative popularity of the savings vehicles that they provide.

This cashflow may be invested in short-term money market instruments whilst the investor determines the appropriate destination for its long-term investment.

This is especially true of changes in the flow of funds into institutions with tightly specified investment objectives.

For example, an open-ended fund investing in emerging markets that receives a large inflow of cash must invest it in the markets specified in the marketing literature.

This can force up prices in the target markets. The good returns generated might then encourage further investment, setting off a spiral of growth.

Equally, if investors decide to withdraw their money from emerging markets due to worries about falling market levels, then this withdrawal of funds will exacerbate the original problem.

7.2 Investors' preferences

Investors' preferences for a particular asset class can be altered by:

- a change in their *liabilities*
- a change in the *regulatory* or *tax* regimes
- uncertainty in the *political* climate
- '*fashion*' or sentiment altering
- *marketing*
- investor *education* undertaken by the suppliers of an asset class
- sometimes for no discernible reason.

Liability changes

For example, a pension scheme that has closed to new entrants and offers fixed increases in deferment may now prefer shorter-term fixed assets, whereas previously they may have preferred long-term real assets.

Regulatory changes

A change in the statutory provisioning requirements that financial institutions are required to meet will clearly have an effect if requirements change so as to specify the actual investments in which the institution can invest.

Even if the requirements are not this onerous, they may still influence the relative attractiveness of different asset classes to the institutions.

For example, if a requirement is introduced used to value its liabilities is no higher than the running yield obtained on investments, this would increase the relative appeal of investments, such as bonds with high running yields.

Tax changes

Investors will attempt to maximise their returns net of tax so if investors are taxed less heavily on income than capital gains, they will tend to prefer investments with a high running yield.

A change to the tax rules for a particular investment, will correspondingly change the attractiveness of that investment to the investor, producing a consequent change in the demand for that investment.

The political climate

Investors prefer to invest in the economies that are politically stable, so in times of political uncertainty, there may be an increased demand for 'safer' investments.

Marketing and education

If there is a marketing campaign to help investors better understand investments then they may be more attractive to investors.

For 'new' types of investment, investors will need to be educated about their existence, their potential uses and their relevance.

For example, derivatives exchanges used educational campaigns to increase investor awareness.

7.3 The price of alternative investments

All investment assets are, to a greater or lesser extent, substitute goods. This is particularly so if we consider investment at the individual security level, but it is also true across asset classes or across international markets.

The greater the similarity (*eg* the degree of correlation of investment returns) between different assets, the greater will be the extent to which they can be viewed as substitutes.

For example:

- the shares in two water companies will have very similar risk and investment characteristics, and hence will be very close substitutes
- to a lesser extent, UK and US government bonds represent alternative investment choices for many international investors, and hence the yields that they offer will be related
- even assets in different classes may be viable alternative investments for many investors.

There is therefore a strong correlation between the prices of different asset classes.



Question

Explain which of the following assets is the closest substitute for a property investment:

1. index-linked bond
 2. ordinary share in industrial company
 3. conventional bond.
-

Solution

It is impossible to give a definite answer here without knowing the exact nature of the property investment – *ie* if it is freehold, leasehold, direct or indirect. Each of the three alternatives given in the question could be the correct answer depending upon the type of property investment concerned, for example:

- an index-linked bond might be the closest substitute for a freehold property where rents are automatically increased in line with inflation each year
- conversely, an ordinary share in an industrial company could be the closest substitute for a property company share, especially if the property is a factory
- a conventional bond might be the closest substitute for a leasehold investment in which rents and capital values are not expected to change much over the lifetime of the lease.

Here we have interpreted substitute solely in terms of the cashflow pattern that each asset provides. It could alternatively be defined in terms of the wider investment and risk characteristics of the assets concerned.

8 Other influences on the investment markets – supply

In this context ‘supply’ means the amount of investment in issue (*eg* for equities the number of shares in issue), rather than the number an investor will supply at a given price.

8.1 Equity markets

An increase in supply – *eg* a lot of new issues – will cause downward pressure on share prices.

The supply of shares available increases as a result of:

- rights issues, by existing share-based companies
- privatisations of previously nationalised companies
- new share issues by companies moving to a shareholder structure.

A spate of *rights issues* is most likely when:

- company directors think that the stock market is unusually buoyant
- company balance sheets are too weak to support the scale of operations desired by the directors.

Additionally, however, it might be expected that during a recession there will be more rights issues aiming to raise additional finance for companies that are in financial difficulty.



Question

Explain why *new share issues* from new and existing companies seeking a listing will also tend to be more common when the stock market is buoyant.

Solution

By issuing shares when the market is buoyant – *ie* at a high level – the company is able to raise the greatest amount of money, whilst minimising the risk of being left with unsold shares.

The additional supply of shares should, in isolation, depress the general price of shares (although the impact may be minimal given the overall size of the market) although it could increase the price if there is a prevailing mood of optimism.

Conversely, share buy-backs or re-nationalisations reduce the supply of equities.

8.2 Bond markets

In government bond markets the supply is largely controlled by:

- **the government's fiscal deficit**
- **its strategy for financing the deficit.**
- the redemption of existing government bonds.

As with new share issues, non-government borrowers will prefer to issue debt when the bond market is performing well, and so borrowing is effectively cheaper.

In particular, when prices are high and yields are low, they will be able to raise more money for a given level of interest payment and consequently the ongoing costs of servicing the debt will be lower.

8.3 Other investment markets

Occasionally, supply is increased by technological innovation. It can be argued that this is the case in the derivatives markets where a greater understanding of the pricing of and reserving for complex products has allowed investment banks to supply them to end users more cheaply, thus increasing the quantity demanded.

The increasing sophistication and availability of computer technology has enabled creative investment banks to come up with increasingly innovative and complex over-the-counter derivatives to meet the requirements of their clients.

In theory, an appropriate derivative security could be created to reduce or even eliminate the risks associated with almost any event or set of circumstances – albeit at a price. The advances in the available technology, plus the reduction in its cost, have also reduced the cost of creating such complex securities.

As a result, the range of investments available to investors has been greatly increased, enabling:

- investors to meet their objectives more closely, *eg* matching their liabilities and/or minimising the risks that they face
- the creation of more innovative products, such as tailor-made derivatives to greatly reduce any risks involved, *eg* equity-based products that offer guarantees.

The resulting expansion of the range of investments available to investors, together with the awareness that banks are able to meet their particular requirements, have led to an increasing demand from investors for further complex made-to-measure derivative securities.

A distinction between derivatives and other securities is that they can be created and destroyed on demand. The supply of any particular derivative is therefore limitless – in theory at least.

The chapter summary starts on the next page so that you can keep all the chapter summaries together for revision purposes.

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Chapter 11 Summary

Risk profile of asset classes

Assets with the greatest risk have the potential for the greatest long-term returns.

The extent to which investors seek a matched position depends on their risk appetite, which relates to their level of free capital.

Fixed-interest government bonds are exposed to inflation risk.

Corporate bonds are exposed to default, inflation, marketability and liquidity risk.

Equities are exposed to default, marketability, inflation risks and the risk of an uncertain dividend stream.

Supply and demand

As demand for an asset rises, the price of the asset will rise.

Demand for most investments is very price elastic due to close substitutes.

Interest rates

Short-term interest rates are determined largely by *government policy*, as the government balances:

- the need to control inflation
- the need to encourage economic growth
- management of the level of the exchange rate.

The level of interest rates is usually a little above the rate of inflation.

Factors affecting the level of the bond market

Theories of the yield curve

The *yield curve* is a plot of yields against term to redemption. Several theories have been put forward to try and explain the shape of the yield curve:

Expectations theory – yields reflect expectations of future short-term interest rates and inflation.

Liquidity preference theory – investors require an additional yield on less liquid (longer-term) bonds.

Inflation risk premium theory – investors require an additional yield on longer-term conventional bonds to compensate for the risk of inflation being higher than anticipated.

Market segmentation theory – yields at each term are determined by supply and demand at that term. Demand comes principally from institutional investors trying to match liabilities.

Theories of the real yield curve

The *real yield curve* is a plot of real gross redemption yields on index-linked bonds against term to maturity. The difference between the conventional yield curve and the real yield curve is approximately the market's expectations of future inflation.

Principal economic factors affecting bond yields

- inflation
- short-term interest rates
- public sector borrowing – the fiscal deficit
- the exchange rate
- institutional cashflow
- returns on alternative investments
- other economic factors.

Comparison of government and corporate bond yields

Economic factors affecting the prospects of company will increase the perceived riskiness of corporate bonds and hence the yield margin of corporate bonds over government bonds.

If government bonds are offering poor returns, some investors may switch to corporate bonds, narrowing the gap in yields between government and corporate bonds.

The level of the equity market

The general level of the equity market is determined by investors' expectations of future corporate profitability and the value of those profits.

The main economic influences affecting demand in equity markets are:

- expectations of real interest rates and inflation
- investors' perceptions of the riskiness of equity investment
- the real level of economic growth in the economy
- expectations of currency movements.

Factors affecting supply in equity markets include:

- the number of rights issues
- share buy-backs
- privatisations.

The level of the property market

Economic factors can affect:

- occupation
- development cycles
- the investment market.

Interaction between occupational demand and supply determines the market level of rents.

The capital value is determined by the investment markets.

Economic factors have a big impact on the property market. The key factors affecting demand are:

- economic growth
- inflation
- real interest rates.

Institutional cashflow and exchange rates are relevant to a lesser degree.

The inelastic supply of property, *eg* due to planning restrictions, magnifies the impact of the factors on overall property values.

Residential property values are driven by supply and demand. Supply can be influenced by government policy.

Other influences on the investment markets

Demand factors

Demand for an asset will change if either:

- investors' perceptions of the characteristics of the asset, principally risk and expected return, alter
- investors' opinions of the properties of the asset remain unchanged but external factors alter the demand for that asset. These external factors include:
 - investors' cashflows
 - investors' preferences
 - the price of other assets (which may be substitute goods).

Investors' preferences are influenced by:

- a change in their *liabilities*
- a change in the *regulatory* or *tax* regimes
- uncertainty in the *political* climate
- '*fashion*' or sentiment altering, sometimes for no discernible reason
- *marketing*
- investor *education* undertaken by the suppliers of a particular asset class
- sometimes for no discernible reason.

Supply factors

An increase / decrease in the supply of an asset will lead to downward / upward pressure on the price of the asset.

The supply of a financial asset will be increased by new issues of that asset and decreased by redemptions.

Supply of government bonds is influenced by the fiscal deficit and the Government's strategy for financing the deficit.

Supply may also be increased by technological innovation. This is particularly true of derivatives markets.



Chapter 11 Practice Questions

- 11.1 'Bonds that are riskier will give higher returns.' Comment.
- 11.2 Outline why a government may sometimes issue index-linked securities rather than fixed-interest securities.
- 11.3 (i) State how the expectations theory explains the shape of the yield curve. [2]
- Exam style** (ii) Describe three other theories that explain deviations from the expected shape of the yield curve. [6]
- (iii) Explain why a corporate bond might have a significantly higher yield than a government bond of the same duration. [5]
- [Total 13]
- 11.4 Describe how economic factors can influence the *investment* market for property.
- 11.5 Describe the economic factors that affect the level of conventional government bond yields.
- 11.6 Suggest why the equity market may rise on a day when government bond yields fall at all durations.
- 11.7 A country has seen a steady acceleration in the growth of the money supply.
- Exam style** (i) Outline the possible government policy responses. [2]
- (ii) Describe the likely impact on a portfolio of short-term, medium-term and long-term conventional and index-linked government bonds. [3]
- (iii) Explain the *economic* circumstances that might cause corporate bonds to underperform government bonds. Consider the case where the bonds are held to redemption and the case where they are sold prior to redemption. [3]
- (iv) State three policy objectives that a government may try to achieve by altering the level of short-term interest rates and explain how changing interest rates can achieve these objectives. [6]
- [Total 14]
- 11.8 Describe three external factors that could influence demand for an asset.

The solutions start on the next page so that you can
separate the questions and solutions.



Chapter 11 Solutions

11.1 Normally, riskier bonds would give higher *expected* returns ...

... but there is no guarantee that they will *actually* give higher returns (given they are risky).

Also, the meaning of risk can vary between different investors.

For example, according to the liquidity preference theory, long-dated bonds normally give higher (expected) returns since they are more volatile...

...however, for a life office or pension fund, longer-dated bonds may be less risky since they more closely match some of the fund's liabilities.

In this case, less risky bonds may give higher expected returns.

Also, other characteristics such as marketability may explain differences in expected returns.

So the statement is not necessarily true.

11.2 Three reasons why a government may sometimes issue index-linked securities rather than fixed-interest securities:

- to offer a range of different types of securities...
... so as to attract a range of investors ...
... and thus be able to issue at the lowest possible cost
- it believes that inflation will fall ...
... so that index-linked issues will turn out to be a cheaper source of finance than fixed-interest debt
- it wants to convince the private sector that it will reduce inflation ...
... issuing index-linked government bonds shows a commitment to this ...
... as index-linked government bonds are more expensive to service than fixed-interest bonds if inflation is high.

11.3 *This question is Subject CA1, September 2005, Paper 1, Question 2*

(i) ***Expectations theory***

Expectations theory describes the shape of the yield curve as being determined by economic factors which drive the market's expectations for future short-term interest rates. [1]

If we expect future short-term interest rates to fall (rise), then we would expect gross redemption yields to fall (rise) and the yield curve to slope downwards (upwards). [1]

[Total 2]

(ii) ***Other theories of the yield curve****Liquidity preference theory*

The liquidity preference theory is based on the generally accepted belief that investors prefer liquid assets to illiquid ones. [½]

Investors require a greater return to encourage them to commit funds for a longer period. [½]

Long-dated stocks are less liquid than short-dated stocks, so yields should be higher for long-dated stocks. [½]

According to liquidity preference theory, the yield curve should have a slope greater than that predicted by the pure expectations theory. [½]

Inflation risk premium theory

Under the inflation risk premium theory the yield curve will tend to slope upwards ... [½]

... because investors need a higher yield to compensate them for holding longer-dated stocks which are more vulnerable to inflation risk than shorter-dated stocks. [½]

Market segmentation

Market segmentation (or preferred habitat) theory says that yields at each term to redemption are determined by supply and demand from investors with liabilities of that term. [1]

Demand for short bonds comes from banks, which compare their yields with short-term interest rates. [½]

Demand for long bonds comes from pension funds and life assurance companies, whose main objective is protection against future inflation. [½]

The supply of bonds of different terms will reflect the needs of borrowers ... [½]

... for example the government may issue short-term bonds if it has a short-term need for cashflow. [½]

The two areas of the bond market may move somewhat independently. [1]

[Maximum 6]

(iii) ***Why corporate bonds have higher yields than government bonds****Security*

In general, corporate bonds are less secure than government bonds. [½]

The degree of security offered by government bonds will vary between different governments. [½]

Bonds issued by politically stable, developed governments may be perceived as being virtually default risk-free ... [½]

... this may not be true in the case of unstable, less developed countries. [½]

The degree of security offered by a corporate bond will depend on the issuing company ... [½]

... and the industry in which it operates. [½]

A large multinational firm with an AAA credit rating in a 'safe' industry might be considered to have a very low default risk. [½]

A small company with a lower credit rating (*eg* less than BBB) in a high risk industry might have a significant risk of default. [½]

The difference in yield will be higher for unsecured and subordinated corporate bonds, as opposed to debentures that have charges over the assets of the company. [½]

Yield margins will vary from time to time. They will tend to be higher when economic conditions are poor, so that the risk of default is relatively high. [½]

Marketability

In general, corporate bonds are less marketable than government bonds. [½]

The marketability of corporate bonds will depend on the issuer of the debt, the size of the issue and the frequency of trading. [½]

Large issues of regularly traded stocks of reputable companies might be very marketable. Small issues of infrequently traded stocks of lesser-known companies might have low marketability. [½]

Marketability of corporate bonds will also be higher if the issuing company is quoted on a stock exchange. [½]

Volatility

The yield on a fixed-interest bond is a function of price, which will be determined by supply and demand, and will hence be affected by investor sentiment. [½]

Tax

There may be features of a bond issue that makes it particularly desirable to certain investors, *eg* a high coupon bond to non income tax paying investors. This will increase demand for the bond and therefore reduce the yield. [½]

Yield margins will also tend to reflect any differences in tax treatment. [½]

Therefore if government bonds have preferential tax treatment, then a higher yield might be required on corporate bonds to compensate investors for holding them. [½]

[Maximum 5]

11.4 *Comment*

It can aid idea generation to split 'economic factors' into:

- *macroeconomic factors (eg inflation, interest rates, economic growth, currency), and this area should form the majority of the answer*
- *microeconomic factors (eg supply and demand factors linked to the local economy.)*

The property investment market is the market for the sale or purchase of properties for investment (rather than for occupation).

Economic factors influence:

- the investment market for property by altering either the *demand* for, or *supply* of properties for sale on the market.
- the level of rents in the occupancy market.

For example, higher inflation and higher economic activity will increase rents hence increase the capital values of property.

Other factors will influence the property investment market directly:

- An increase in real interest rates should increase the rate of return required by investors leading to a lower present value of a given stream of rents.
- Increasing uncertainty about inflation may increase demand for property investment (a real asset) as a hedge against inflation.
- An expectation of a long-term strengthening of the domestic currency might encourage demand from overseas investors.
- Strong (institutional) cashflows, *ie* into life offices and pension funds, could increase these institutions' demand for property.
- The relative attractiveness of other asset classes will also affect the demand for property.

11.5 *Inflation expectations*

Inflation erodes the real value of income and capital payments and so expectations of a higher rate of inflation are likely to lead to higher nominal bond yields.

Inflation uncertainty

Additionally, uncertainty about the level of future inflation will affect conventional bond yields ...

... the higher the uncertainty, the higher the inflation risk premium.

Short-term interest rates

The yields on short-term bonds are closely related to returns on money market instruments so a reduction in short-term interest rates will mean a reduction in short-term bond yields.

However, investors in long bonds may interpret a cut in interest rates as a sign of monetary easing, with possible inflationary consequences over the longer term ...

... so the yield on long bonds might decline by a smaller amount, or even rise relative to the yield on short bonds.

Fiscal deficit

If the government's fiscal deficit is funded by borrowing then the resulting supply of bonds is likely to put upward pressure on bond yields ...

... especially at the durations in which the government is concentrating most of its funding.

Exchange rate

A significant part of the demand for government bonds in many markets comes from overseas ...

... so changes in expectations of future movements in the exchange rate will affect the demand from overseas investors ...

... and alter the relative attractiveness of domestic and overseas bonds for local investors.

Institutional cashflow

If institutions have an inflow of funds because of increased levels of savings there will be increased demand for bonds of their desired term. The yield on such bonds will fall.

Changes in investment philosophy can also affect institutional demand for bonds.

Other economic factors

Almost any piece of economic news has implications for inflation and short-term interest rates.

The impact of other economic factors can therefore usually be understood in terms of these two quantities.

11.6 Lower bond yields mean higher bond prices.

But equity prices could also increase as lower yields should reduce the rate of return required on equities by investors and hence increase the present value of a given stream of dividends.

Lower yields may reflect an expectation of lower interest rates, increasing profits after interest.

Lower interest rates tend to increase economic activity and hence company profits.

Lower interest rates reduce companies' borrowing costs (so increasing profits).

For domestic companies earning a large proportion of their profits from abroad, a cut in interest rates may weaken the domestic currency ...

... and increase value of such profits made in overseas currencies ...

... and increase the competitiveness of domestic firms relative to overseas firms allowing them to increase profit margins and/or sales volume both at home and abroad.

11.7 Comment

Remember with economics questions that there is not necessarily a single right answer. It is perfectly acceptable to put down opposing arguments (ie arguments that could both be true, but probably not at the same time!) as long as you clearly explain your logic. An example of this is given in part (ii).

(i) **Policy response**

An acceleration in the money supply is likely to lead to inflation. [½]

The response is likely to be to tighten monetary policy by raising short-term interest rates (by a sufficient amount to increase *real* short-term interest rates). [½]

In principle this might be supplemented by other tightening of monetary policy, *eg* selling Treasury Bills to reduce the money supply or unwinding quantitative easing. [½]

Fiscal policy may also be tightened (*ie* government expenditure reduced and/or taxes raised). [½]

It is possible that the government may not respond at all, *eg* if it believes that the figures have been distorted, or for political reasons. [½]

[Maximum 2]

(ii) **Impact on medium and long government bonds**

The rise in short-term interest rates should result in a rise in short-term conventional bond yields ... [½]

... due to the high positive correlation between the two (as money market instruments and short-term bonds are substitute investments). [½]

The rise in short-term interest rates has an uncertain effect on medium-term and long-term conventional bond yields:

- If the market expects higher interest rates to continue, expectations theory suggests that there will be a rise in medium-term and long-term conventional bond yields. [½]
- If the rise in interest rates is expected to successfully dampen the rise in inflation, there will be downward pressure on medium-term and long-term conventional bond yields. [½]

The price of index-linked bond yields may rise (and real yields fall) at all terms if investors become more worried about the uncertainty of future inflation and switch from conventional into index-linked bonds. [1]

Alternatively, the price of index-linked bonds may fall, (and real yields rise) at all terms if the government is expected to have to increase *real* interest rates to bring inflation under control. [½]

It will depend upon whether the market had anticipated higher inflation and/or the government's response. [½]

[Maximum 3]

(iii) Economic circumstances under which corporate bonds underperform

If the bonds are held to redemption, corporate bonds may underperform government bonds if the *actual* level of default is significantly higher than expected. [½]

For example, this could happen in a recession. [½]

If the bonds are sold before redemption, corporate bonds will underperform government bonds if the price of the corporate bonds falls relative to that of government bonds. [½]

This could happen, if at the point of sale:

- the economy enters a recession and the yield margin widens due to its expectations of higher default risk (higher) or marketability (lower) [1]
 - the size of the government's fiscal deficit reduces, leading the government to issue fewer bonds ... [½]
 - a reduction in the supply of government bonds results in an increase in prices. [½]
- [Maximum 3]

(iv) Policy objectives and changing interest rates

Increasing the level of economic growth ... [½]

... by reducing interest rates. [½]

This reduces the cost of borrowing ... [½]

... and hence encourages investment spending by firms ... [½]

... and increases the level of consumer spending. [½]

This leads to an increase in demand for goods and services, and economic growth. [1]

Reducing inflation ... [½]

... by increasing interest rates. [½]

This reduces the quantity of money demanded, which in turn can lead to a reduction in the quantity of money supplied. [1]

This can reduce inflation, by the quantity theory of money. [½]

High interest rates can also reduce aggregate demand, and demand pull inflation. [½]

Devaluing the domestic currency ... [½]

... by reducing interest rates. [½]

If interest rates in one country are low relative to other countries, international investors will be less inclined to deposit money in that country. [½]

This decreases demand for the domestic currency and tends to decrease the exchange rate. [½]

This reduces the price (in other currencies) of exports, which may lead to an increase in economic growth. [½]

This increases the price (in the domestic currency) of imports, which may lead to cost push inflation. [½]

[Maximum 6]

11.8 *Investors' incomes*

Both the amounts available for investment by institutions in aggregate ...

... and also in specific sectors of the market (*eg* a large inflow of cash into technology stocks) can have a major impact on demand and hence prices.

Investors' preferences

These might change as a result of tax or regulatory changes for example.

Other reasons for changes are changed liabilities, fashion, education or marketing, *eg* promotion undertaken by the suppliers of particular assets.

The price of other assets

To some extent different asset classes are substitutes for each other and so their price movements are correlated.

12

Valuation of investments

Syllabus objectives

- 11.6.2 Discuss the different methods for the valuation of individual investments and demonstrate an understanding of their appropriateness in different situations.
- 11.6.4 Discuss the different methods for the valuation of portfolios of investments and demonstrate an understanding of their appropriateness in different situations.

0 Introduction

There are many different methods applied to valuing investments. Different investors may use differing methods depending upon:

- their general aims and objectives of investment
- the reasons for valuing the particular asset
- the type of asset being valued.

The ability to value individual assets is crucial for:

- identifying whether a particular asset or asset class appears to be cheap or dear and hence we should include it within our portfolio in the first place
- monitoring the ongoing performance of the individual asset to assess whether or not we should continue to hold it – *ie* monitoring the experience of the investment portfolio.

We will outline some of the general valuation methods that are used to value individual investments.

Then we will cover particular approaches to valuation used for various specific investments.

Finally we will consider some issues relating to the valuation of a portfolio of assets in relation to a corresponding portfolio of liabilities. An important principle here is that the methods and bases used to value assets and liabilities must be consistent if the results obtained are to be sensible.

1 Valuing individual investments – the role of market value

If the asset is traded on an open market and published prices are freely available then market value is a reference point for all valuations. If there is no market price then other methods of determining the best proxy for market value should be used.

Possible proxies for market price are considered later in this chapter.

Having first established either the market value or the proxy market value on the valuation date, the actuary may then decide to employ an alternative asset valuation method appropriate to the purpose of the valuation, in particular adopting consistent methods for the values of assets and liabilities.

Actuaries are often interested in the relationship between the value of a fund's assets and its liabilities. But as it may be difficult to place a market value on the liabilities, it may be appropriate to use an alternative value for the assets.

Increasingly the trend has been to use a market value of assets (or a proxy to it) for all purposes and then to ensure equivalence by adopting a market-consistent method of valuing the liabilities. Previous methods of adjusting the asset valuation method to fit with a predetermined liability valuation basis have fallen out of favour as they mean that neither the value of assets nor liabilities are related to observable data.

A market-consistent method of valuing liabilities will involve determining a market-consistent discount rate for discounting the liabilities, so the value of assets and liabilities will react in a similar way to changes in the investment environment, *eg* interest rates, inflation. There are a number of ways of determining an appropriate market-related discount rate that we will meet in a later chapter, Valuation of liabilities.

We will discuss the merits of market value, and a range of other approaches to valuing an individual investment, in the next section.

2 Valuation methods for individual investments

Some of the methods used are:

- market value
- smoothed market value
- fair value
- discounted cashflow
- stochastic models
- arbitrage value
- historic book value
- written up and written down book value.

2.1 Market value

The market value of an asset varies constantly and can only be known with certainty at the date a transaction in the asset takes place.

Even in an open market more than one figure may be quoted at any time.

However, for many traded securities it is an objective and easily obtained figure and is a starting point for asset valuation.

Quoted securities generally have the following prices:

- the bid price at which market makers are prepared to buy
- the slightly higher offer price at which market makers are prepared to sell
- the mid-market value – an average of the bid and offer prices.

Arguably, the bid price should instead be used for some purposes (*eg* assessing the realisable value of a portfolio), possibly with allowance for sale costs.

Market values are:

- generally fairly easily available
- objective
- well understood.



Question

Suggest reasons why someone selling an asset may not obtain its 'market value'.

Solution

An investor may not obtain the 'market value' because:

- 'market value' may mean mid-market value rather than bid value
 - 'market value' may mean *yesterday's* market value
 - net proceeds from a sale will be reduced by dealing costs and possibly tax
 - if they sell a large holding of an asset they may depress the price of the asset
 - if they own a strategic block of shares, they might receive more than the market value from a predator wishing to gain control of the company.
-

There are several possible problems that may arise when using market value:

- Volatility – market values may be subject to wide fluctuations in the short term, which may not reflect changes in the expected future proceeds from the assets. Consequently, there may be quite different results from a valuation depending on the exact date.
- Achieving consistency – the volatility of market values makes it difficult to value liabilities in a consistent manner, unless they are very closely matched, in which case their value will vary correspondingly.
- No quoted price – in general, determining market value for quoted securities is relatively straightforward. This is not so true for unquoted investments such as direct property investment and venture capital holdings. (Nevertheless, the vast majority of assets held by most funds for which actuaries have to perform valuations have clearly identifiable market values.)

2.2 Smoothed market value

Where market values are available they can be smoothed by taking some form of average over a specified period to remove daily fluctuations.

There are many different ways of obtaining a smoothed market value. One way is to use a moving average, so that the value of an asset on any particular day is taken as the average of the market price over, say, the previous three months.

This method does not lend itself to consistent liability valuations because the appropriate discount rate for the liability valuation is indeterminate and requires judgement.

There may be judgement, for example, in:

- the length of the smoothing period
- whether the average should be a simple average or a weighted average, with more weight on recent values.

In practice the assessment becomes a view as to whether the asset is cheap or expensive in relation to its smoothed market value.

2.3 Fair value

In recent years, there has been a move towards market-based methods of valuation. *Fair value* is a concept developed by The International Accounting Standards Board (IASB) and is a market-based method of valuation used for financial reporting.

In accounting terms, fair value is the amount for which an asset could be exchanged or a liability settled between knowledgeable, willing parties at arm's length.

This definition does not specify how such a value is calculated.

For most assets, in most market conditions, the fair value will simply be the market price.

If the market price of an asset is not readily available, *eg* because the asset is not frequently traded, then a proxy might be sought in the form of an alternative fair value. There are various options available for calculating a fair value, for example:

- seek an indicative price from a broker or market maker
- use the most recent known price and adjust in line with the movement in an appropriate index
- use a stochastic asset model to determine a market-consistent value.

Determining the fair value of *liabilities* is discussed in more detail in a later chapter.

2.4 Discounted cashflow

This method involves discounting the expected future cashflows from an investment using long-term assumptions.

The discounted cashflow (also called 'discounted proceeds') approach thus values an asset as the present value of the expected income stream and capital from the assets.

Examples of this approach, which we discuss later in this chapter, include:

- the discounted dividend model for equities
- the discounted rental income approach to valuing property.

This method has the advantage of being easily made consistent with the basis used to value an investor's liabilities.

The method used will be consistent if the assets and liabilities are valued on a discounted cashflow basis using the same approach to determine the discount rate. This consistency is fundamentally important.

Where a portfolio of assets is held, a weighted discount rate can be calculated reflecting the proportions in each asset class, and this weighted discount rate can be used to value the liabilities.

However, it relies on the assessment of a suitable discount rate, which is straightforward where the assets are, for example, high-quality fixed-interest stocks but is less so otherwise.

Where an investment has some adverse feature (*eg* default risk or poor marketability) it is usual to increase the rate of interest used to discount the cashflows. In this way a lower value is placed on more risky investments.

2.5 Stochastic models

These are an extension of the discounted cashflow method in which the future cashflows, interest rates or both are treated as random variables.

The result of a stochastic valuation is a distribution of values from which the expected value and other statistics can be determined.

This method is particularly appropriate in complicated cases where future cashflows are dependent on the exercise of embedded options, such as the option to wind up in adverse financial circumstances.

The advantages of a stochastic approach are:

- it is good for valuing derivatives
- it gives a better picture of a valuation, *eg* by giving a distribution of results
- consistency with the liability valuation is also achievable.

The disadvantages are that:

- it may be too complex for many applications
- the results are dependent on the assumed distributions for the variables – these assumptions may be highly subjective.

2.6 Arbitrage value

Arbitrage value is a means of obtaining a proxy market value and is calculated by replicating the investment with a combination of other investments and applying the condition that in an efficient market the values must be equal.

The technique is often used in the valuation of derivatives.

In other markets the technique is difficult or impossible to apply because it is difficult to replicate many assets.

The use of arbitrage value to value futures and options is considered later in this chapter.

2.7 (Historic) book value

This is the price originally paid for the asset and is often used for fixed assets in published accounts.

In its favour, this method is:

- objective
- conservative (but only if the value has risen since purchase)
- well understood
- used for some accounting purposes.

But for most valuation purposes, book value has little merit, since it is historical.

2.8 Written up or written down book value

Written up or written down book value is historic book value adjusted periodically for movements in value.

For example, a property investment may be revalued, say every three years.

The current market value or the discounted cashflow value may influence the adjustment.

But the adjusted book value may still not equal the market value.

Arguably, the method is no more sensible than book value. Unlike book value, the method may be subjective.

Neither of these book value based methods lends itself to the use of a consistent liability valuation (because the appropriate discount rate for the liability valuation cannot be determined).

Remember that if we are looking at the relationship between assets and liabilities, such as in a pension scheme valuation, we need to use a consistent valuation basis for both.

3 Market values compared with calculated values

Modern finance theory suggests that where an efficient market exists, the resulting market value will reflect all publicly available information and is the underlying 'economic value' of the asset at a given point in time.



Question

Before reading on, list possible advantages and disadvantages of market values.

Solution

Advantages:

- objective
- realistic as realisable value on sale (assuming the bid price is used)
- easy as doesn't require calculation
- well understood and accepted
- can be used as a comparison to other valuation methods to see whether an asset seems over or underpriced

Disadvantages:

- may not be readily obtainable (eg unquoted instruments)
- volatile – values may fluctuate greatly even in the short term
- may not reflect value of future proceeds
- a decision is required about whether bid, mid or offer prices should be used
- difficult to ensure consistency of basis with that of the liability valuation
- value reflects the position of the marginal investor rather than the individual (eg taxation)
- may not be the realisable value on sale (eg if dealing in large volumes or illiquid stocks)

Market values can be subject to considerable fluctuation and it is sometimes argued that the use of market value depends on the vagaries of the market and obscures the underlying or intrinsic value of the asset. The counter argument is that using another valuation method in an attempt to identify the intrinsic worth of an asset involves an investment call as to the direction the market in that asset (or class of asset) will move.

A market method or a calculated method can be used as a filter for selecting shares for sale or purchase for further consideration.

In practice other factors would be taken into account before making buying or selling decisions.



Question

List some examples of such other factors.

Solution

Other factors might include:

- the nature, term, certainty and currency of the investor's liabilities
- the investor's tax position
- the investor's risk appetite
- regulatory restrictions
- dealing costs
- temporary inefficiencies in the market.

If a value other than market value is used, then it is important to make the implications of this clear to the client.

For example, if a discounted cashflow approach is used, then the client needs to be aware that this is not necessarily the value that would be obtained on the sale of the assets.

This is particularly true when short-term solvency is being considered.

For example, a discounted value of the assets may make it appear that the client is solvent, when in fact, if the assets were realised at their market value, they would be insufficient to cover the cost of the liabilities.

Conclusion

There are many different ways in which assets can be valued.

None of the methods is necessarily better than the others, although may be a preferred method for valuing a particular asset type for a particular purpose.

In the next sections of the chapter, we describe the ways in which some of the above methods are used to value particular asset classes.

4 Bond valuations

4.1 Discounted cashflow approach

Government or similar high-quality bonds can be valued by discounting cashflows at rates consistent with the market spot rate yield curve.

The market spot rate yield curve can be derived from the yields available on zero-coupon bonds, where they exist, or from government bond 'strips'. In a developed economy, the risks arising due to lack of security and marketability may be negligible and so these rates may reflect a risk-free yield.

Other bonds, such as corporate bonds, can be valued similarly but adjusting the yield to allow for lower security and marketability.

4.2 Valuing bonds with option features

Many bonds have option features (eg callable and puttable bonds).

A *callable* bond is a bond that the borrower can choose to repay at any time. Similarly, with a *puttable* bond, the investor can demand repayment at any time.

Such bonds should theoretically be valued using option pricing techniques, although this is not always done in practice.

The value of a *puttable* bond to the investor – and so the market price – should equal:

- that of an otherwise identical bond that does not include an option
- *plus* the value of the choice provided by the option.

The value of the option will be greater, the more likely it is that the option will be exercised.



Question

Explain how the value of a *callable* bond compares with a similar bond without the call option.

Solution

It is lower due to the additional uncertainty that the investor faces, being unsure of the exact date at which the capital will be repaid, and hence unsure of the future series of cashflows received.

The option has a *positive* value to the borrower and a *negative* value to the investor.

5 Equity valuations

In this section we look at a number of approaches for placing a value on equity:

- market value
- dividend discount model
- net asset value per share
- value added measures
- measurable key factors.

5.1 Market value

The starting point for valuation of an individual equity is the market value, if there is a suitable market.

For most shares this will be a simple and objective means of valuation.

5.2 Dividend discount model

A discounted cashflow calculation may be carried out to value the shares, if the investor wants to:

- value unlisted shares.
- check whether they think the market value is reasonable, or under- or over-priced.

The dividend discount model derives the value of a share as the discounted value of the estimated future dividend stream.

We start with a general approach, and then introduce simplifying assumptions so that we end up with a very useful, simple model for valuing the shares of a company.

Pay close attention to the assumptions that are used in order to appreciate the limitations of the discounted dividend model.

General model

The general model can be expressed as:

$$V = \sum_{t=1}^{\infty} D_t v(t)$$

where: V is the value of the share

D_t is the gross amount of the t^{th} dividend payment

$v(t)$ is the discount factor applied between time 0 and the time of the t^{th} dividend payment.

Simplified model

A simplified equation can be obtained by assuming:

- that dividends are payable annually, with the next payment in one year's time;
- that dividends grow at a constant rate, g , per annum;
- and that the required rate of return, i , is independent of the time at which payments are received
- $i > g$
- i and g are defined consistently – eg both include inflation or are net of inflation
- the dividend proceeds can be reinvested at i pa
- no tax and expenses.

It is also assumed that shares are held forever, as per the general model.

With these assumptions the equation becomes:

$$\frac{D}{(1+i)} + \frac{D \times (1+g)}{(1+i)^2} + \frac{D \times (1+g)^2}{(1+i)^3} + \dots$$

where D is the dividend to be paid one year from now. We can simplify the model for the assessed value, V , of a share as follows:

$$\begin{aligned} V &= \frac{D}{1+i} \left(1 + \frac{(1+g)}{(1+i)} + \frac{(1+g)^2}{(1+i)^2} + \dots \right) \\ &= \frac{D}{(1+i)} \times \frac{1}{1 - \frac{(1+g)}{(1+i)}} \\ &= D \frac{1}{(1+i) - (1+g)} \\ &= \frac{D}{i - g} \end{aligned}$$

Thus we now have a very simple model for assessing the value of the share. We started with D , the dividend to be paid one year from now because it gives a very neat result. In most investment textbooks, the algebra starts with the dividend just paid, which is arguably more sensible as this is known.

The equation is then:

$$V = \frac{D_0(1+g)}{(i-g)}$$

where D_0 is the most recent dividend received.

Issues to consider when applying the simplified model

There are several issues to be aware of when applying the model:

1. We do not know the value of i to use in the model. Additionally, the assumption of a constant required rate of return i over time might not be appropriate during an era when the yield curve is steeply sloping upwards or downwards.

In order to calculate a value it is necessary to decide on an appropriate required rate of return. This would often be calculated as the yield on long-term government bonds plus an appropriate addition for the riskiness of the income stream.

Conventional investment wisdom says that we will require a higher return from equities than from government bonds to compensate for the:

- risk of dividends being reduced or even not be paid and loss of capital on wind up
- uncertainty of return and the volatility of the share price
- lower marketability and higher dealing costs.

2. We do not know what the growth rate g should be.

Investors with real liabilities might start from an index-linked government bond yield and estimate the real, rather than nominal, rate of dividend growth.

The value of g used in the model will reflect the investor's estimates of the future dividend growth of the company, which will in turn reflect the investor's view concerning the future profitability of the company.

In practice it might be felt that constant dividend growth is not a realistic assumption. An alternative approach would be to use dividends based on profit forecasts for the first few years, then apply a short-term rate of growth for a period until the growth rate settled down to a long-term average.

3. The results obtained are very sensitive to the assumed level of $i - g$.
4. **The equations given above ignore tax. Tax-paying investors should use the net dividends received and a suitable after-tax rate of return.**

The equations given also ignore expenses.

5. This model assumes annual dividend payments even though the payments might be half-yearly on individual shares. This is not a key factor; there are much bigger causes of uncertainty within this model than the frequency of dividends.
6. The model is of no use unless $i > g$.



Question

Company *X* has just paid an annual dividend of 53p. Estimate the price of a Company *X* share on each of the following sets of assumptions:

	required annual rate of return	constant dividend growth per year
(i)	10%	5%
(ii)	10%	8%
(iii)	10%	10%
(iv)	8%	6%

Solution

This is a simple question designed to reinforce:

1. how silly it is to assume constant growth for ever greater than or equal to the required rate of return
2. how volatile the share price is to small changes in g when $i - g$ is small but is relatively unchanged if both i and g change by the same amount, leaving $i - g$ unchanged.
3. the art of good question reading ... *last year's* dividend is given.

- (i) £11.13
- (ii) £28.62
- (iii) infinite!
- (iv) £28.09

5.3 Net asset value per share

A net asset value per share approach can be adopted for companies with significant tangible assets.

A similar approach can be adopted to shares of a property investment company.

For example, a property company could be valued as the sum of the value of the buildings and land that it owns less any liabilities, *eg* borrowing.

Such an approach would not give a realistic value for companies whose value comprises of significant intangible assets, *eg* intellectual property rights.

A net asset value per share approach might be used to value an investment trust company.

Investment trusts comprise several holdings in other assets, although the investment trust itself is a company.

The shares of the investment trust will trade at a price set by the market, following principles of supply and demand and shareholder perceptions of risk and the future for the company.

It is also possible to determine the market price (or proxy) for each a shareholding in the investment trust.

These can be aggregated and divided by the number of shares in issue to give a net asset value per share. This is what the investors would receive, less expenses, if the investment trust was wound up, all its assets sold and the proceeds distributed to shareholders.

Investment trusts are frequently quoted as the market price being at a percentage premium or discount to NAV.

5.4 Value added measures

***Shareholder value* is an attempt to get at the intrinsic or underlying value of an investment rather than its accounting value.**

As an alternative, economic value added (EVA) looks at one year's results and deducts the cost of servicing the capital that supports those results.

The idea is that if the EVA is positive, then the company's activities over the year have added or created value for the shareholders – as the shareholders would want the company to do – which should ultimately be reflected in the share price.

Thus, a company's EVA provides an indication of its success or otherwise over a particular year and can therefore be used as a measure of performance.

EVA acts as a bridge between quoted share value and accounting values to give a framework for executive compensation schemes designed to produce results that increase shareholder value.

5.5 Other equity valuation methods

Where companies are not making profits and a net asset valuation is not appropriate, other methods have to be employed if a calculated valuation is required of an individual share.

The methods discussed above all implicitly assume at least one of the following:

- the company is declaring dividends
- it is making profits
- net asset valuation is suitable.

But this will not always be the case, for example, if the company is young and yet to declare any dividends, is making losses or has few tangible assets. Other methods must then be used to assess the value of the shares in the company in question.

These methods often involve determining a relevant and measurable key factor for the company's business. The relationship between this factor and the market price of other quoted companies is then used as a basis for valuation. The factor used will depend on the business of the company.

It will also depend upon exactly what information *is* available and may be either qualitative or quantitative.

In some instances, a site visit to meet the managers of the company, and discuss its aims and objectives, might be of use.



Question

Outline the factors that might be investigated in the case of a food retailer.

Solution

Large food retailers typically operate with high volumes of sales and low profit margins.

Efficiency of sales and turnover is therefore likely to be a crucial determinant of success.

So investigate such factors as:

- turnover per square metre of selling space or per member of staff
- the inventory turnover ratio ($\text{inventory} \div \text{turnover} \times 365$)
- the trade payables turnover ratio ($\text{trade payables} \div \text{turnover} \times 365$) – the company may be able to increase profitability by delaying payments to suppliers as long as possible.

Market share and quality of management might also be of interest.

6 Property valuations

As with all investments, the true market value is only known when there is a transaction that equates a willing buyer with a willing seller. This happens frequently with stocks and shares that are actively traded on regulated markets, but real property changes hands infrequently.

Indications of value can be taken from similar recent transactions but the uniqueness of each property means that considerable skill is needed to assess property market values.

Such valuations must be regarded as a matter of the valuer's opinion rather than fact.

Property can be valued using an explicit discounted cashflow approach, but as with equities it is now more common to use a market-consistent valuation of liabilities.

The cashflows discounted should be net of all outgoings and should make explicit allowances for expected rental increases.

Unlike equity dividend growth, which is generally assumed to happen smoothly, property rental increases are typically *stepped*, ie the rental income is typically level for a period and then step changes to a new level at the next rent review.

Allowance needs to be made if the passing (ie current) rent is different from the current open market rental value.

In this situation the current rent level will be valued to the next rent review, and thereafter the open market rental value is valued.

In the situation where the current rent is greater than the open market rental value (ie the property is over rented), then it will be necessary to know whether the terms of the lease allow for downward rent reviews.

6.1 Discounted cashflow formula

Consider a freehold property that is let on a commercial lease. We can value this by applying the discounted cashflow approach. Let's assume for simplicity that:

- rents are payable in perpetuity
- rents quoted are net of expenses and tax
- rents quoted are also net of any costs of modernising or refurbishing the property.

Then, the value of the freehold is given by:

$$R_0 \ddot{a}_{n_1|}^{(12)} + R_1 v^{n_1} \ddot{a}_{n_2-n_1|}^{(12)} + R_2 v^{n_2} \ddot{a}_{n_3-n_2|}^{(12)} + \dots @ i\%$$

where:

- R_0 is the initial rent
- n_1, n_2, n_3 etc are the timings of the rent reviews
- R_1, R_2 etc are the rent levels set at the rent review times $n_1, n_2 \dots$
- i is the discount rate, ie required rate of return.

The discount rate used should depend on the riskiness of the investment and could be based on the yield on a bond of suitable term, plus margins for factors such as risk and lack of marketability.



Question

Outline the factors that should be considered in determining a suitable margin to use in the discount rate.

Solution

In determining a suitable discount rate it will be necessary to consider a number of factors (many of which are related to the primeness of the property), including:

1. use (office, shop, factory *etc*) and size
2. location – a poor location may mean a significantly higher yield
3. prospects for rental growth
4. nature of lease, *eg* term, rent reviews, whether full repairing and insuring
5. quality of tenant (or tenants if there is multiple occupation)
6. quality of building, *ie* design, age, condition, access *etc*
7. whether there are alternative uses for the property so that rental income can be maintained if the market for the present use fails
8. whether there is development potential
9. macro and micro economic factors such as oversupply or a weak local economy.

The above factors will affect the level of risk (default risk, void risk, volatility, marketability risk).

7 Valuation of options, futures and swaps

Options and futures are usually valued using techniques based on the principle of 'no arbitrage'. The value taken is the cost of closing out the contract by buying an equal and opposite option or future on current terms.

This is also true for swaps.

Arbitrage is defined as the simultaneous buying and selling of two economically equivalent but differentially priced portfolios so as to make an instant and *risk-free* profit.

In this context, economically-equivalent means that the two portfolios yield exactly the same returns under every possible scenario and outcome.

In an efficient market, the principle of *no arbitrage* implies that all such portfolios must be priced identically, otherwise it would be possible to buy the cheaper and sell the dearer portfolio so as to make an immediate, risk-free profit. Indeed, arbitrageurs would do just this, thereby forcing the portfolio prices back into line.

Let's consider an interest rate swap, where payments based on a fixed interest rate are swapped for payments based on a floating rate, *eg* LIBOR (London Interbank Offered Rate).

Swaps can be valued by discounting the two component cashflows. At inception the value (at market rates of interest) of a swap to both parties will be zero, ignoring the market maker's profit and expenses.

In other words, the present value of an investor's income from a swap minus the present value of their outgo is expected to be zero. Strictly, this also requires that we ignore tax and risk, and assume that both parties have the same view of future interest rates.

As market interest rates change the value of the two cashflows will alter, leading to a positive net value for one party and a negative net value to the other.

Even if rates don't differ from those expected, the value of a swap is likely to be positive for parts of its term and negative for others.

The discount factors, and estimates of short-term rates for the floating side of the swap, are extracted from the appropriate yield curve. This is equivalent to viewing a swap as a combination of bonds.

For example, ignoring the risk of default, a party which has swapped dollar payments for sterling receipts is in an equivalent position to being long a sterling bond and short a dollar bond of the same maturity.

An alternative way of viewing a swap contract is as a series of forward agreements. If each of these forward agreements can be valued, then so can the swap.



Question

The consensus view of the current forward interest rate for each of the next four periods of twelve months is:

year 1	5% <i>pa</i>
year 2	6% <i>pa</i>
year 3	7% <i>pa</i>
year 4	6% <i>pa</i>

A fixed / floating swap provides payments at the end of each of the next four years, based on notional principal of \$100*m*. Calculate the appropriate fixed payment (ignoring profit, expenses, risk etc).

Solution

The *amount* of the variable payments are expected to be \$5*m*, \$6*m*, \$7*m* and \$6*m* at the end of each of the next four years. Let the fixed payment be \$*xm* at the end of each year.

Each payment should be discounted to the present at the appropriate *spot* rate of interest (found as the product of the appropriate forward rates). So:

$$\begin{aligned}
 &5v_{0.05} + 6v_{0.05}v_{0.06} + 7v_{0.05}v_{0.06}v_{0.07} + 6v_{0.05}v_{0.06}v_{0.07}v_{0.06} \\
 &= x(v_{0.05} + v_{0.05}v_{0.06} + v_{0.05}v_{0.06}v_{0.07} + v_{0.05}v_{0.06}v_{0.07}v_{0.06})
 \end{aligned}$$

Using:

$$v_{0.05} = 0.95238$$

$$v_{0.05}v_{0.06} = 0.89847$$

$$v_{0.05}v_{0.06}v_{0.07} = 0.83969$$

$$v_{0.05}v_{0.06}v_{0.07}v_{0.06} = 0.79216$$

This gives $x = \$5.97m$ – a weighted average of the four payments. In other words, the fixed interest payment should be 5.97%.

8 Placing a value on a portfolio of investments

The approaches that we have covered so far in this chapter to value individual investments can also be used to value a portfolio of investments.

The straightforward way of valuing a portfolio of investments is to sum the market values of the individual holdings, or if there is no active market, a proxy market value.

In the past other methods have been used that generate a method of asset valuation from the features of the liabilities.

In particular discounted cashflow techniques were used historically, with both the asset proceeds and liability outgo discounted at the same rate and consistent assumptions used for the valuation.

However, most of these methods are becoming less common in practice. Instead, effort is spent in determining methods and bases for the valuation of liabilities that are consistent with a market value of assets. Some of the other methods of asset valuation that are still in use are mentioned below.

8.1 Purpose of the valuation

The method and basis for any actuarial valuation will depend on the purpose of the valuation and the type of liability.

Valuations for regulatory purposes

For certain supervisory valuations the actuarial method and basis will be set out in regulations. In other cases there is less prescription.

Discontinuance valuation

Sometimes funds are valued assuming an immediate wind-up. In this case assets need to be valued at their immediate realisable value.

Usually this means looking at the realisable market value (*ie* the bid value) and comparing this with the liabilities on a discontinuance basis – *eg* a pension fund buying insurance contracts to provide pension benefits.

Approaches such as smoothed market value and discounted cashflow are unlikely to be appropriate.

Ongoing valuation

If the liabilities are being valued on the assumption that the fund is ongoing then the assets should be valued on the assumption that the investments are managed on an ongoing basis too.

If the liabilities are considered as a stream of future cash outflows, the discounted cashflow approach to valuing assets may be more appropriate than, say, a market value approach.

Alternatively, a market value of assets may be appropriate if associated with a valuation of the liabilities performed at market rates of interest.

8.2 The need for consistency when valuing assets and liabilities

It is important that the valuation of assets and liabilities are consistent.

To achieve consistency this means that if assets are valued at market value then liabilities should be valued at appropriate market-based discount rates.

It may be difficult to determine an appropriate market-related discount rate.

Alternatively, both assets and liabilities could be valued using the same interest rate, which would normally represent the long-term expected return on the assets held to back the liabilities.



Question

Outline the main advantages and disadvantages of valuing both assets and liabilities using an interest rate representing the long-term expected return on the assets.

Solution

- + The interest rate used for discounting will be stable, so yielding stable valuation results.
 - + Easier to ensure that the discount rates used to value assets and liabilities are consistent.
 - + Removes the difficulties involved with determining suitable market-based discount rates.
 - The discount rate used is entirely subjective.
 - A single discount rate is unrealistic, as investment returns will vary over time.
 - It may be difficult to explain or justify to other parties, *eg* trustees or directors.
-

Alternative approaches include:

- to use a single interest rate to discount all future liabilities, reflecting the average rate of expected return expected across the entire asset portfolio of the fund
- to use different assets to match different types of liability by nature, term *etc* and then discount each liability type by the average rate of expected return on the matching assets.

Any market value implies an expected rate of return linked to the risk of the asset.

Therefore, it can be argued that the use of a single discount rate to value all assets and liabilities is inappropriate and different discount rates should be used depending on the risks within the assets and liabilities to be valued and possibly other factors such as marketability and term.

So consistency does not necessarily mean that all assets and all liabilities must be valued using *exactly* the same interest rates for discounting.

The issues around valuing liabilities are explored further in a later chapter on the Valuation of liabilities.

9 Allowing for the variability of asset prices

Volatility of asset value is often stated as the main problem with a market value of assets. However, it can be argued that stability itself is not a desirable feature of asset valuation, and that consistency overrides the question of stability.

Volatility of asset value is not a problem in itself – a volatile asset value may *correctly* reflect the underlying reality.

However, in the context of the ongoing valuation of a long-term fund, comparing volatile asset values with a value of liabilities calculated using a *stable* interest rate is potentially misleading.

In other words, the problem with a market value of assets is not the volatility of asset valuation as such, but inconsistency of asset and liability valuation bases.

The key aim therefore is to create a consistent approach to the valuation of assets and liabilities, so that appropriate conclusions can be drawn from the valuation.

In some situations, stability is considered a desirable feature of asset valuation. An unstable value of assets may make results harder to communicate and interpret.

Also, it may be difficult in practice to establish a market-consistent value of liabilities.

One possible solution is to modify the method of valuing assets to make the value more stable and hence more consistent with a value of liabilities calculated using stable assumptions.

Some sort of smoothed market value is sometimes seen as the solution to the problem with market values.

However, smoothing does create a major problem. If a smoothed market value of assets is used, it is very hard to know what should be taken as a consistent rate of interest for the purpose of valuing liabilities.

Chapter 12 Summary

Valuation methods for individual investments

There are many different ways in which assets can be valued, with a trend towards the use of market value. Common methods of valuing assets include:

- (historic) book value
- written up or written down book value
- market value
- smoothed market value
- fair value
- discounted cashflow
- stochastic modelling
- arbitrage value.

The fair value of an asset is the amount for which an asset could be exchanged or a liability settled between *knowledgeable, willing* parties at *arm's length*.

Market values vs calculated values

Advantages:

- objective
- realistic as realisable value on sale (assuming the bid price is used)
- easy as doesn't require calculation
- well understood and accepted
- can be used as a comparison to other valuation methods to see whether an asset seems over or underpriced

Disadvantages:

- may not be readily obtainable (*eg* unquoted instruments)
- volatile – values may fluctuate greatly even in the short term
- may not reflect value of future proceeds
- a decision is required about whether bid, mid or offer prices should be used
- difficult to ensure consistency of basis with that of the liability valuation
- value reflects the position of the marginal investor rather than the individual (*eg* taxation)
- may not be the realisable value on sale (*eg* if dealing in large volumes or illiquid stocks)

Using a value other than market value implies taking view as to where the market is going. Under such circumstances the actuary must ensure the client understands the implications, especially with respect to short-term solvency.

Bond valuations

Bonds can be valued by calculating the discounted value of the constituent cashflows, ie the coupon and redemption payment.

The discount rate should be adjusted to reflect the riskiness of the payment and the marketability of the particular bond.

Equity valuations

The starting point is usually the market value, if one exists.

The discounted dividend model derives the value of a share as the discounted value of the estimated future dividend stream.

The general discounted dividend model, for the value V of a share, is given by:

$$V = \sum_{t=1}^{\infty} D_t v(t)$$

- D_t is the gross amount of the t^{th} dividend payment
- $v(t)$ is the discount factor applied between time 0 and the time of the t^{th} dividend payment.

The simplified discounted dividend model, for the value V of a share, is given by:

$$V = \frac{D}{i - g}$$

The definitions and assumptions underlying this discounted dividend model are:

- D is the prospective dividend, paid annually, starting in one year
- g is the assumed constant rate of growth each year in dividend payments ad infinitum
- i is the required constant annual rate of return from the share(s)
- $i > g$
- i and g are defined consistently, *eg* both include or both are net of inflation
- Dividend proceeds can be reinvested at i *pa*
- tax and expenses are ignored.

The valuation formula can be modified for any changes in the assumptions.

Other equity valuation methods include:

- net asset value per share
- value added methods, such as economic value added (EVA)
- measurable key factors of a company's business.

Property valuations

Property can be valued using an explicit discounted cashflow approach. The cashflows valued should be net of all outgoings and should make explicit allowances for the expected rate of increase of rental income.

The discount rate used should depend on the riskiness of the investment and could be based on the yield on a bond of suitable term, plus margins for risk and lack of marketability.

Valuation of derivatives

Options and futures are usually valued using techniques based upon the principle of *no arbitrage*.

Swaps can be valued by discounting the two component cashflows. For an interest rate swap, at inception the value (at market rates of interest) of a swap to both parties will be zero, ignoring the market maker's profit and expenses.

As market interest rates change the value of the two cashflows will alter, leading to a positive net value for one party and a negative net value to the other.

Placing a value on a portfolio of investments

The most widely used method for actuarial purposes is market value.

The method and basis for any actuarial valuation will depend on the purpose of the valuation and the type of liability. In some cases, the method and basis will be prescribed by regulations.

It is important that the valuation of assets and liabilities are done *consistently*.

If a market value approach is used to value the assets, then the liabilities must be valued using a *market-based* discount rate, which can be difficult to determine.

Discounted cashflow methods for valuing assets can more easily be made both stable and consistent with the valuation of the liabilities (which is typically done using a discounted cashflow approach).

Allowing for the variability of asset prices

Volatility of asset prices is not a problem in itself as it may *correctly* reflect the underlying reality.

However, in the context of the ongoing valuation of a long-term fund, comparing volatile asset values with a value of liabilities calculated using a *stable* interest rate is potentially misleading.



Chapter 12 Practice Questions

12.1 Discuss the suitability of using the market price to value a holding of an ordinary share.

12.2 (i) Show that, under certain assumptions (which you should state):

Exam style

$$V = \frac{D}{i-g}$$

where: V is the discounted present value of a share

D is the dividend on the share

i is the required rate of return

g is the rate of growth of dividends. [5]

(ii) Company X has just paid an annual dividend of 5p. Estimate the price of a Company X share on the following assumptions:

- required annual rate of return of 10% *pa*
- dividends grow at 15% *pa* for 2 years
- thereafter dividends grow at 6% *pa*. [3]

(iii) Company Y is not expected to make a profit for several years. Explain how you could use the discounted dividend model to price Company Y 's shares. [6]

[Total 14]

12.3 A large, modern office, located in a popular office district with good transport facilities generates annual rents of \$250,000. The rent cannot be changed until the lease with the current tenant expires, three years from now. An identical building in the same vicinity has just been let with an initial annual rent of \$175,000.

You may assume that:

- long-dated conventional government bonds yield 5% *pa*
- index-linked government bonds yield a real yield of 2% *pa*
- investor's required return on the property is 8% *pa*
- expected growth in rack rents of 3% *pa*.

The freehold for the office is for sale at a price of \$4 million.

By reference to the expected future rental income from the office, assess whether the suggested price is reasonable.

- 12.4 An investment bank is arranging a 10-year swap with a multinational company. Under the swap agreement, the company will make payments to the bank in UK pounds sterling at LIBOR + 0.5%, based on a principal of £50m, and the bank will make payments to the company in Euro at 6% fixed, based on a principal of €75m. All payments are made annually in arrears and there is no exchange of principals.
- (i) Assume LIBOR is initially 4.5%, and remains at this level for the first 4 years of the swap, and is 5.5% thereafter. Assume that the exchange rate is initially €1=£0.66, and remains at this level for the first 4 years of the swap, and is €1=£0.50 thereafter. Calculate, in UK pounds sterling, the present value to the bank of the cashflows under the swap at a discount rate of 9.0%.
 - (ii) Describe the risks the bank faces in entering into this arrangement.



Chapter 12 Solutions

12.1 *Advantages of using market price:*

- objective
- realistic as realisable value on sale (assuming the bid price is used)
- easy as doesn't require calculation
- well understood and accepted
- can be used as a comparison to other valuation methods to see whether an asset seems over or underpriced

Disadvantages of using market price:

- may not be readily obtainable (eg unquoted instruments)
- volatile – values may fluctuate greatly even in the short term
- may not reflect value of future proceeds
- a decision is required about whether bid, mid or offer prices should be used
- difficult to ensure consistency of basis with that of the liability valuation
- value reflects the position of the marginal investor rather than the individual (eg taxation)
- may not be the realisable value on sale (eg if dealing in large volumes or illiquid stocks)

12.2 (i) ***The simplified dividend discount model***

$$\begin{aligned}
 V &= \frac{D}{1+i} \left(1 + \frac{(1+g)}{(1+i)} + \frac{(1+g)^2}{(1+i)^2} + \dots \right) \\
 &= \frac{D}{(1+i)} \times \frac{1}{1 - \frac{(1+g)}{(1+i)}} \\
 &= D \frac{1}{(1+i) - (1+g)} \\
 &= \frac{D}{i-g}
 \end{aligned}$$

[2 marks for deriving the equation]

Assumptions:

- dividends are payable annually, with the next payment in one year's time [½]
 - dividends grow at a constant rate, g per annum [½]
 - the required rate of return, i is independent of the time at which payments are received [½]
 - $i > g$ [½]
 - i and g are defined consistently, eg both include inflation or are net of inflation [½]
 - the dividend proceeds can be reinvested at i pa [½]
 - tax and expenses have been ignored [½]
- [Maximum 5]

(ii) **Price of Company X's shares**

Valuing the next two dividends individually and adding on the present value of the share price that we would expect to apply in two years' time we have:

$$V = \frac{5(1.15)}{1.1} + \frac{5(1.15)^2}{1.1^2} + \frac{1}{1.1^2} \frac{5(1.15)^2(1.06)}{0.1 - 0.06} = 155.5p \quad [3]$$

(iii) **Price of Company Y's shares**

Detailed assumptions are needed regarding when dividends are first expected, how much they will be and at what rate they will grow. [1]

To make these estimates it is necessary to estimate the future profits of the company. [½]

This can be done by forecasting sales and costs, building in wage and price inflation ... [½]

... taking into account the state of the national and international economies and the economic cycle. [½]

Estimates will also have to be made about rates of interest on overdrafts, any new loan stock issues and any rights issues needed to cover the losses and to finance future expansion. [1]

Income and expenditure statements for future years can then be drawn up. [½]

To make accurate projections it is normal to look separately at different operations of the company (by geography and type of activity). [½]

Profit estimates will be based upon detailed analysis of the accounts with calculation of trends and accounting ratios. [½]

Having made forecasts for shareholders' earnings we would then estimate a payout ratio and hence dividends. [½]

The payout ratio could be very different to 1, for example: [½]

- profits may be retained for a significant period to finance expansion [½]
- to keep investors from losing patience a dividend may be paid even if no profit is made in a given year. [½]

Dividends will not start until the company becomes profitable. [½]

The resulting stream of dividends would then be valued by discounting back to the present point in time by choosing a suitable discount rate(s). [½]

The discount rate(s) used would need to reflect the level of risk attaching to our estimates (*eg* the company may *never* return to profits). [½]

[Maximum 6]

12.3 Market expected inflation is about 3% (5% – 2%).

The easiest way to value this property is to value the first three years' rental payments (until the expiry of the current tenant's lease), and then value the rack rent in perpetuity, discounted by a further three years.

The required return from the property is 8% – this is higher than the government bond yield to cover extra risks such as lack of marketability, voids, depreciation.

If rental growth is assumed to be 3%, then the rack rental income is effectively a perpetuity starting in three years' time, discounted at:

$$j = \frac{1+i}{1+\text{growth in rack rent}} - 1 = \frac{1.08}{1.03} - 1 = 4.854\% .$$

So the present value of the income on the property is:

$$\begin{aligned} PV &= 250,000a_{\overline{3}|}^{8\%} + (175,000 \times 1.03^3) \times 1.08^{-3} a_{\infty|}^{4.854\%} \\ &= 644,274 + (175,000 \times 1.03^3) \times 1.08^{-3} \times \frac{1}{0.04854} \\ &= \$3.77m \end{aligned}$$

This calculation assumes that:

- rent is paid annually in arrears
- a new tenant will be found immediately at the end of the current lease
- rent reviews will be conducted annually thereafter.

Our valuation is therefore around \$3.8m, suggesting that \$4m is not unreasonable, if a little high.

But it depends on critically on the assumptions chosen, for example:

- assuming the rent was paid in advance would bring the valuation to \$3.9m
- if the existing lease could be continued at a rate of \$250,000 *pa* (rather than \$175,000 *pa*) again increasing at 3% *pa* the valuation would increase to \$5.9m
- a 1% *pa* increase in the rental growth assumption would increase the valuation to \$4.7m
- a 1% *pa* reduction in the discount rate would increase the valuation to \$4.7m which may be appropriate, *eg* if fewer void periods were expected.

12.4 (i) **Value of the swap to the bank**

The value of the swap cashflows to the bank will be:

$$\frac{£50m}{100} \left[(4.5 + 0.5)a_{\overline{4}|} + (5.5 + 0.5)a_{\overline{6}|}v^4 \right] @9\%$$

$$- \frac{€75m \times 6.0}{100} \left[a_{\overline{4}|} \times 0.66 + a_{\overline{6}|}v^4 \times 0.5 \right] @9\%$$

$$\text{where } a_{\overline{4}|} @9\% = 3.23971 \text{ and } a_{\overline{6}|} @9\% = 4.48592$$

So, the value of the swap cashflows to the bank is £17.63m – £16.77m = £0.86m.

(ii) **Risks to the bank**

Market risk

The bank is exposed to market risk – in particular fluctuations in:

- LIBOR
- the exchange rate between pounds and Euro.

Default risk

The bank is exposed to the risk of default by the multinational company.

This is more likely when the value of the swap is negative to them

... *ie* the value of payments it is making to the bank is greater than those that it is receiving ...

... *eg* if the pound appreciates more than is expected against the Euro.

Expense risk

The bank faces the risk that the expenses of the swap are higher than expected ...

... *eg* the expenses of negotiating the agreement and making the payments or the cost of regulatory capital.

End of Part 3

What next?

1. Briefly **review** the key areas of Part 3 and/or re-read the **summaries** at the end of Chapters **8** to **12**.
2. Ensure you have attempted some of the **Practice Questions** at the end of each chapter in Part 3. If you don't have time to do them all, you could save the remainder for use as part of your revision.

Time to consider ...

... 'learning and revision' products

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13

Relationship between returns on asset classes

Syllabus objectives

- 11.6.3 Discuss the theoretical relationships between the total returns and the components of total returns on equities, bonds and cash, and price and earnings inflation.

0 Introduction

This chapter discusses the *theoretical* relationships between the total returns and the components of total returns on equities, bonds, cash and earnings inflation. The material in this chapter underlies some of the approaches used to value asset classes that we considered in the previous chapter.

The returns offered by a particular asset or asset class are, of course, always a key consideration in the development of an investment portfolio, given that the investment objectives will normally make some reference to expected returns.

Finally, remember that it is important to bear in mind that the returns that we *actually* receive on any investment or asset class are in practice unlikely to exactly equal those that we *expected* to receive.

We will look at the definitions of expected and required return and when the two are equal.

We will also consider how we may analyse historical returns for a range of asset classes.

1 Expected and required returns

1.1 Required return



The return that investors, as a whole, require on any asset class can be written as:

$$\text{Required return} = \text{required risk-free real rate of return} + \text{expected inflation} + \text{risk premium}$$

This makes sense if we consider that investors will require:

- that the value of their investments do not decrease in real terms
- additional compensation over and above this in return for giving up the use of the cash that they invest over the period of investment.

The risk premium then reflects the compensation required for the risk (that either of the above requirements may not be fulfilled) that investors incur by undertaking the investment.

The terms on the right-hand side of the above equation represent market averages as investors are considered as a class here.

Individual investors will of course have differing views on each of the components on the right hand side of the equation, upon which they will base their decisions to buy or sell particular securities or asset classes.

However, it is the interaction of the overall market demand with supply that determines market price.

It is assumed that the market defines 'risk-free' in real rather than nominal terms.

The risk-free real rate of return can then normally be taken as the real yield on an index-linked government bond of an appropriate term.

The risk premium on a particular asset class will depend on the characteristics of the asset and investors' preferences, which will be largely driven by their liabilities. A higher return would be required from riskier asset classes. The risk premium in the equation above may cover any adverse feature of one investment relative to another for which investors require compensation.

For example, if investors have predominantly real liabilities and so are concerned with the real returns offered by investments, then they will require an additional risk premium to hold assets whose returns are not protected against inflation.

1.2 Expected return



Expected return can be analysed as:

$$\text{Expected return} = \text{initial income yield} + \text{expected capital growth}$$

The expected return is what the investor *expects* to achieve on the asset, given the:

- price paid for the asset, and
- the price for which the investor expects to sell / redeem the asset, and
- the expected income whilst the asset is held.

1.3 Required vs expected return

If assets are fairly priced, required and expected returns will be equal.

One market model that expresses this idea is the Capital Asset Pricing Model (CAPM) where expected returns are expressed as the return on a risk-free asset plus a risk premium dependent on the systematic risk of the asset.

The CAPM determined the expected to be the required return, *ie* it suggests that the expected return on any asset is:

- equal to the *risk-free rate of interest*, plus an additional risk premium to reflect its systematic or market risk
- *linearly related* to its systematic risk (as measured by its beta factor).

Assuming that these results of the CAPM hold in practice, the model can be used to estimate the expected return on any asset, given its estimated level of systematic risk.

1.4 Determining whether an asset seems cheap

The required and expected return expressions can be used to determine whether particular asset classes appear good value to a particular investor.



If for an investor, the expected return exceeds the required return, then the asset appears cheap.

2 Further analysis of expected returns

2.1 Introduction

In practice, investors in risky assets may not have received the returns they were expecting.

If they always did, then asset returns would be entirely predictable, and so the assets themselves would not be risky!

Therefore, even if assets were fairly valued at the time of purchase, risk premiums cannot be measured simply by comparing the returns on risky and risk-free assets.

Expected return = initial income yield + expected capital growth

Alternatively, the total return on an asset class can be expressed, to a first approximation, as:

Expected return = initial income yield + income growth + impact of change in yield

Here, income growth and change in yield represent capital growth.

This statement is not intuitively obvious.

The usual interpretation of capital growth is a change in the *price* of an investment. So why does capital growth equate to income growth and a change in yield?

Consider an investment that provides a stream of income payable in perpetuity, then the price of an investment can be calculated as the discounted value of this stream of income, *ie*:

$$price = \frac{income}{income\ yield}$$

In other words, the price is just the initial level of income multiplied by an annuity payable in perpetuity. (Remember that a perpetuity is valued as $\frac{1}{i}$.)

So from the equation above capital growth, *ie* a change in price, will occur if there is:

- a change in the income level, *ie* income growth, or
- a change in the income yield.

In the case of an equity investment, with dividends assumed payable in perpetuity, the price can be written as:

$$price = \frac{dividend}{dividend\ yield}$$

Therefore, for an equity investment, we can see that capital growth, *ie* a change in price, will occur if there is:

- dividend growth, or
- a change in the dividend yield.

When analysing the expected return on asset classes over long periods of time it is also necessary to take account of the effect of the reinvestment of income at different initial yields and second-order terms arising from the fact that the expected return is expressed as a sum of percentage increases rather than as a product.

Strictly speaking, we should always combine capital growth and income in a multiplicative, rather than an additive, manner, for example:

$$1+i = (1+d)(1+g)$$

where: i is the expected return

d is the income yield

g is the capital growth.

However, in some practical situations, using the additive approximation:

$$i = d + g$$

is not a major concern, as there are much more heroic assumptions being made elsewhere in the model in question.

2.2 Equities

Economic growth, *ie* GDP growth, comes from land, labour and capital.

The use of land, labour and capital within a business gives rise to revenue. The money made by a company will be shared between the providers of labour (the workers) and the providers of capital (shareholders).

Over the long term equity dividend growth might be expected to be close to growth in GDP, assuming that the share of GDP taken by 'capital' remains constant.

Equities would therefore be expected to give a real return close to the growth in real GDP plus the equity yield.

From historical data this seems to be a reasonable model, but the short-term fluctuations are significant and the actual returns achieved by investors will depend on the exact timing of deals as well as their tax position.

If, for example, you buy equities at a market peak and sell them at a trough, then you can end up with a substantially lower return.

There is, however, a dilution effect due to the need for companies to raise new equity capital from time to time if dividend yields are high.

This arises through new issues of shares in existing companies, *eg* rights issues or the conversion of convertibles. If you do not take up all of your rights, then the proportion of the total equity market that you hold must decrease, and so will the share of total dividends that you receive.

The dilution effect also depends on the extent to which economic growth is generated by start-up companies.

If the earnings of unquoted companies grow more quickly than those of quoted companies, then the share of profits attributable to quoted companies must decline.

2.3 Conventional bonds

For fixed-interest stocks there is no income growth. The initial yield and the capital value change for a bond held to redemption combine to give a fixed nominal total return, referred to as the gross redemption yield.

The analysis of total returns compared with inflation is relatively straightforward:

- **in periods when inflation turns out to be higher than had been expected, real returns from fixed-interest stocks are lower than expected and are poor compared with equities**
- **in periods when yields are rising, real returns from fixed-interest stocks are poor.**

In both cases, the argument can be reversed to give the periods when fixed-interest stocks give good returns.

The second bullet point makes sense if we consider what happens to returns when a bond is *not* held to redemption, *ie* the bond is bought and subsequently sold.

In periods when nominal yields are rising, bond prices will be falling. Therefore, an investor who has bought a bond and subsequently sold it at a reduced price will achieve a poor nominal return.



Question

Suggest why the purchaser of a bond might not receive a return equal to the quoted gross redemption yield offered by that bond even if it is held to redemption.

Solution

The return received may not be equal to the gross redemption yield, for example:

- due to the impact of tax, dealing costs or exchange rate movements
 - because the coupons are reinvested at rates that differ from the quoted GRY
 - because the issuer defaults on either the interest payments or the capital payment at redemption.
-

2.4 Index-linked bonds

The real return on index-linked bonds is known at outset, if they are held to redemption. This real yield is often taken as the benchmark required real yield for the analysis of expected returns on equities.

In other words, if equities are fairly priced in the market, then the expected return on equities should equal that on long-dated index-linked government bonds, plus a suitable risk premium.



Question

List the factors that will be reflected in this risk premium.

Solution

The risk premium will reflect the:

- differences in marketability
 - uncertainty of the income and capital values provided by the equity
 - possibility of default on the equity.
-

Index-linked bonds will not afford complete inflation protection if the coupon and redemption payments are related to an appropriate price index with a time lag.

The time lag exists so that the nominal amount of the next payment is always known. Thus, if payments are linked with say a k -month time lag, then the index-linked bond offers no protection against inflation over the final k months of its life – when it is essentially a fixed-interest investment.

However, if index-linked bonds are sold before redemption then the actual real return will depend on the price for which the bonds are sold. This will be influenced by the normal supply and demand issues.

2.5 Cash

Returns on cash might be expected to exceed inflation except in periods where inflation is rising rapidly and is under-estimated by investors.

This is because investors will normally expect to achieve a real rate of return on their investment, for the reasons outlined earlier in the chapter. However, historically this has not always been the case in practice.

Short-term real interest rates can also be kept very high or very low by governments for significant periods.



Question

Suggest why the government may keep real interest rates very high for a significant period.

Solution

The government might keep real interest rates very high in an attempt to try and control aggregate demand, and hence economic growth and price and wage inflation.

Real interest rates may need to remain high for a significant period if it takes a while for their effects to work through the economy into lower inflation.

2.6 Earnings

The growth in earnings over time is of particular interest to investors with liabilities that are earnings-related. For example:

- defined benefit pension schemes – in which benefits are related to the final or average salary of the employee
- general insurers – who may face earnings-related claims.



Question

Explain why it might be reasonable to assume that salaries would grow in line with economic growth over time.

Solution

The increase in economic growth comes from the various factors that contributed to its production – ie land, labour and capital.

If the benefit of economic growth is shared equally between land, labour and capital, then wages should grow broadly in line with economic growth.

The assumption appears to have been borne out broadly in the past, as earnings in most of the major economies have generally increased steadily in real terms.

The chapter summary starts on the next page so that you can keep all the chapter summaries together for revision purposes.

Chapter 13 Summary

Expected and required return

Required return = required risk-free real rate of return + expected inflation + risk premium

Expected return = initial income yield + expected capital growth

or $\text{Expected return} = \text{initial income yield} + \text{income growth} + \text{impact of change in yield}.$

If assets are *fairly priced*, required and expected returns will be equal.

By comparing the estimates of the two figures, an investor can determine whether or not an investment or asset class appears to be good value.

Equity

Over the long term, equity dividend growth might be expected to be close to growth in GDP, assuming that the share of GDP taken by 'capital' remains constant.

Bonds

For fixed-interest stocks there is no income growth. The initial yield and the capital value change for a bond held to redemption combine to give a fixed nominal total return, called the gross redemption yield.

The real return on index-linked bonds is known at outset, if they are held to redemption. This real yield is often taken as the benchmark required real yield for the analysis of expected returns on equities.

Cash

Returns on cash might be expected to exceed inflation except in periods where inflation is rising rapidly and is under-estimated by investors.

The practice questions start on the next page so that you can keep the chapter summaries together for revision purposes.



Chapter 13 Practice Questions

- 13.1 Consider two government bonds with the same term: a conventional bond and an index-linked bond. State the factors that will determine the size of the difference between the yields that they offer.
- 13.2 (i) Write down a formula for required return on an asset class.
- (ii) Explain what the risk premium represents in the above formula by reference to different asset classes.

The solutions start on the next page so that you can
separate the questions and solutions.



Chapter 13 Solutions

13.1 The differences in yields will reflect:

- the inflation protection provided by the index-linked bond
- the relative marketability of the two bonds (in general, index-linked bonds are less marketable than conventional bonds)
- any differences resulting from the different levels of coupon (*eg* due to differential taxation of income and capital gains, or due to differences in duration and hence volatility)
- any differences in default risk, *eg* if one of the bonds was issued in a developing country
- supply and demand issues arising due to the relative strengths of the two currencies.

So, the conventional bond will offer an inflation premium compared to the index-linked bond, and index-linked bonds may offer an additional return in the form of a marketability premium. The actual yield difference will reflect the net effect of these two factors.

13.2 (i) **Formula for required return**

Required return = required risk-free real rate of return + expected inflation + risk premium

(ii) **Risk premium**

The risk premium component reflects the characteristics of the asset class and investors' preferences.

It reflects the compensation investors require for any adverse features of the asset (*eg* default risk, low marketability / liquidity, volatility of returns).

For example, the corporate bond risk premium reflects the compensation investors require for default risk and any lack of marketability and liquidity.

For example, the equity risk premium reflects the compensation investors require for the volatility of share prices and dividend income, the risk of non-payment of dividends and any lack of marketability / liquidity of the shares.

For example, the property risk premium reflects compensation for low marketability, volatility, risk of voids, need for specialist expertise, *etc.*

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14

Choosing an appropriate investment strategy

Syllabus objectives

- 11.6.1 Discuss the principles and objectives of investment management and analyse the investment needs of an investor, taking into account liabilities, liquidity requirements and the risk appetite of the investor.

0 Introduction

The bulk of this chapter discusses the factors to consider when *strategic* (or *long-term*) investment decisions are being made by investors.

We will firstly concentrate on these from the perspective of *institutional* investors. Investment decisions primarily reflect the objectives of the investor and the fundamental aim of an investment strategy is to meet those objectives. So, a useful definition of risk may be the risk of failing to meet the investor's objectives, which often – but not always – refers to the risk of failing to meet the investor's liabilities as they fall due.

Then we will outline the factors to be taken into account by an *individual* investor when setting an investment strategy. These factors do not differ greatly from those of an institution.

The balance between the factors will, however, be different. For example, the individual will generally have different aims, less investment expertise, a smaller potential fund to invest and therefore make greater use of indirect investment.

1 Institutional investment objectives

Investment objectives should be clearly stated, and quantified where possible.

This must be the case if the investor is to be able to objectively monitor its success or otherwise in meeting its investment objectives.

Since it is generally often necessary and appropriate to invest in risky assets the objectives must be framed in such a way as to encompass the permitted degree of risk as well as the required total return and cashflow timing.

Most investment decisions will involve some degree of trade-off between expected return and risk, however defined.

However, this is not always the case. For example, the aim of an index-tracker fund will typically be to minimise tracking error or the risk of tracking error irrespective of the absolute investment return thereby achieved.

The objectives can be described in various ways:

- **One is to meet the liabilities as they fall due.**
- **Alternatively, the objective could be to control the incidence of future obligations on a third party (for example, the employer's contribution rate to a pension scheme).**

The concept of meeting the liabilities becomes more complex if liabilities continue to accrue (for example, a life fund which is still writing business or a pension scheme open to future accrual).

For a continuing entity, meeting the liabilities as they fall due and proving that there are sufficient resources to do so are separate objectives, both of which have to be met.

There may also be a need to demonstrate that there are sufficient assets available should the provision of future benefits be discontinued.

Thus, the fund may have multiple objectives of:

- being able to meet its liabilities as they fall due
- proving that it will be able to continue to do so on an ongoing basis – this requirement may itself apply on both:
 - a *realistic basis* (internally imposed and assessed) and
 - a *statutory basis* (imposed externally by the regulator)
- proving that it could do so on a discontinuance basis.

2 Risk for institutional investors

The word 'risk' has many different meanings in investment management:

- It can be used to describe the probability of an investment failing completely.
- More frequently it is used to signify the expected variability of the return from an investment.

Two possible interpretations of risk are therefore:

1. The probability of default.
2. The variance or standard deviation of returns over a single time period.

This is the definition used most generally in financial economics – *eg* within the context of both mean-variance portfolio theory (MVPT) and the capital asset pricing model (CAPM).

From a business point of view neither definition is entirely satisfactory:

- The probability of complete ruin from a well-diversified portfolio of securities is small.
- The short-term variability in the market value of a portfolio is of little relevance to many institutions, where the value of liabilities changes in line with the value of assets.

2.1 Risk as variability of return



Question

If risk is defined as the expected variability of the return, outline how you would classify a 20-year zero coupon bond issued by the US government.

Solution

If the bond is held to redemption (and does not default, the probability of which is very low given the issuer), the return is fixed so has zero variability.

But even then, it depends on the time period being measured and whether the measurement is in real or nominal terms.

If the bond is to be sold before redemption, small changes in yields would lead to large changes in market price meaning high variability of return.

If we worked in real terms (*ie* by considering the expected real return and the variability of real return), then again the investment is risky as the real return depends on inflation.

So to be more precise when defining investment risk, need to consider:

- the time period being considered
- whether the returns are measured in real (*ie* net of inflation) or nominal terms.
- the currency in which we measure returns.

2.2 Risk as probability of failure to achieve investment objective

It is difficult to say whether or not an asset is 'risky', unless we know the specific objectives of the investor.

An asset that is risky for one investor may be risk-free for another investor, it depends on how well the asset helps the investor to meet its objectives.

For investors with explicit liabilities, this reflects how well the asset matches the liabilities. A perfect match means that there is no risk. The greater the mismatch, the greater the risk.



The most practical definition of risk is the probability of failing to achieve the investor's objective.



Question

Suggest the types of objective an institutional investor aim to meet?

Solution

The objectives might include one or more of:

- meeting the liabilities as they fall due
- achieved a pre-specified target level of investment return or funding
- matching or exceeding competitors – *eg* the median return or funding level
- tracking an index as closely as possible
- controlling the amount and timing of future obligations
- satisfying statutory solvency requirements
- demonstrating that there are sufficient assets available should the provision of future benefits be discontinued

However, it must be recognised that investors are subject to many different risks. For many institutions, the risk of underperforming compared with their competitors is one of the most pressing day-to-day risks.

This risk of underperforming competitors is sometimes called *relative performance risk*. The consequences of underperformance for investment and unit trusts are obvious, as:

- their aim is normally to provide the highest possible return to investors, within the constraints set by their stated objectives
- performance comparisons are usually straightforward, given that the objectives of competitors will be very similar.

Even for life insurance companies, where comparison is difficult, a good investment record is likely to be key to attract new investment business.

2.3 Risk appetite

The risk appetite of an institution will depend on:

- **the nature of the institution**
- **the constraints of its governing body and documentation**
- **legal or statutory controls.**

The ultimate decision on how much risk is acceptable will depend on the risk appetite of the key stakeholders, for example for an employer-sponsored defined benefit scheme:

- the trustees may wish to take less investment risk as the focus is to ensure member's benefits can be paid
- the sponsor may wish to take more investment risk as higher investment returns may reduce the required contributions

Finally, additional legal or statutory constraints are likely to increase the aversion of the institution to risk.

3 Factors influencing an institution's investment strategy

The principal aim of an investing institution is to meet its liabilities as they fall due. The overriding need is to minimise risk.

3.1 The main factors

The main factors that will influence a long-term investment strategy are:

1. the nature of the existing liabilities – whether they are fixed in monetary terms, real or varying in some other way
2. the currency of the existing liabilities
3. the term of the existing liabilities
4. the level of uncertainty of the existing liabilities – both in amount and timing
5. tax and expenses – both the tax treatment of different investments and the tax position of the investor need to be considered
6. statutory, legal or voluntary restrictions on how the fund may invest
7. the size of the assets, both in relation to the liabilities and in absolute terms
8. the expected long-term return from various asset classes
9. accounting rules
10. statutory valuation and solvency requirements
11. future accrual of liabilities
12. the existing asset portfolio
13. the strategy followed by other funds
14. the institution's risk appetite
15. the institution's objectives
16. the need for diversification.

To help in remembering them, study the points listed above and divide them into four or five groups with an appropriate heading for each group.

The next sections discuss various issues around some of the factors influencing the investment strategy of an institution.

3.2 Liabilities

The liabilities are probably the main factor influencing the long-term investment strategy of the institutional investor.

The main liability aspects to be considered are the nature, term, certainty and currency of liabilities.

Institutions need to be aware of the long-term investment strategy which will most closely match their liabilities by nature, currency and term. Even if they do not, or cannot adopt such a strategy, other strategies should be evaluated against this benchmark.

Uncertainty

The uncertainty of the liability outgo, both in timing and amount, needs to be considered. Institutions with uncertain liabilities will need to have higher liquidity buffers.

For example, a general insurance company, for which both the timing and amounts of claims may be very unpredictable, must hold a sufficient level of liquid assets.

There is a complication for some investors when they try to define their liabilities. They may have two different sets of liabilities to match simultaneously, namely:

- the liabilities that they need to meet on an ongoing basis
- a statutory basis for proving solvency.

It is likely that the assets which best match the ongoing liabilities may not be the best match for the liabilities under a statutory valuation.



Question

Suggest what the investment manager should do if an insurance company has two investment objectives, each of which would require different best-matching assets.

Solution

As insurance companies rarely fail, it is probably appropriate to:

- devise the best strategy for the ongoing liabilities
- check that this strategy is at least *acceptable* in terms of the statutory liabilities (and vary it until it is).

If you cannot arrange your assets to provide an acceptable level of matching for both bases simultaneously, then you probably have not got enough assets.

In this case, radical measures may be required (*eg* seek more capital from shareholders, close to new business, merge with another insurer).

Term

Investors who have low present cashflow requirements may prefer low income yielding investments to avoid the expense and uncertainty of reinvesting income. Conversely investors who need current income may prefer high income yielding investments to avoid the expense and uncertainty of realising assets.



Question

- (i) Outline the dangers of:
 - (a) investing longer
 - (b) investing shorter
 than the expected term of the liabilities.
- (ii) Describe the implications for the investment strategy if the liabilities are uncertain.
- (iii) List the circumstances when an institutional investor would be very relaxed about volatile asset values.

Solution

- (i) ***Dangers of differing asset / liability terms***
 - (a) There is a danger that when the liability outgo is due, assets have to be realised on poor terms to meet the outgo *ie* liquidity risk. Also, the values of assets of longer duration may be more volatile.
 - (b) There is a danger that the excess investment income and capital will be reinvested on less good terms than had been expected, *ie* reinvestment risk.
- (ii) You cannot *match* as you are not sure exactly what you are trying to match. So the investment strategy is likely to hold:
 - 1. very marketable assets (*eg* cash, government bonds and top quality shares)
 - 2. liquid assets with stable values.
- (iii) Possible circumstances include:
 - no immediate need to realise assets in near future
 - no need to prove solvency on a market value basis
 - massive free assets
 - no pressure to produce consistent short-term performance
 - perfectly matched assets and liabilities (*eg* unitised funds).

Currency

Any investor (institutional or individual) may decide to mismatch the liabilities by currency.

For an investor wanting to maximise returns in their domestic currency, it is also necessary to allow for the expected changes in the currencies over the period of the investment.

The investor is exposed to the risk that the return on the asset may not be as expected, and also that the exchange rate may be worse than expected, leading to further losses.

Similarly, if the exchange rate performs better than expected, the investor would make additional gains from the overseas investment. The investor needs to ensure that the potential gains are sufficient given the additional risks investing of overseas.

An overseas market would be considered cheap if:

$$\text{expected return in local currency} + \text{expected depreciation of home currency} > \text{expected return in home currency}$$

The investor should consider investing overseas if the margin of the left-hand side over the right-hand side exceeds the risk margin the investor requires for overseas investment.

For example, a South African investor investing in Irish assets needs to consider the risk of depreciation of the Euro against the South African Rand and whether the expected return on the assets offer sufficient compensation for this risk might require an additional 2% *pa* expected return on investments in Ireland to compensate for the currency risk thereby incurred – *ie* the risk that the Euro might depreciate against the South African Rand.

3.3 Return

In some circumstances the liabilities of the investor are not absolutely critical and maximising returns may be more important. Possible examples are:

- the liabilities under a money-purchase pension plan (which are simply whatever the value of the fund turns out to be)
- the liabilities under a unit-linked savings contract, *ie* the unit fund value (which is defined in terms of the value of the underlying assets)
- future bonuses under a with-profit insurance contract.

In each of the above cases, the value of the liabilities is implied by that of the assets, so there is no 'matching' problem, and the provider is arguably free to maximise returns.

However, the liabilities are still a factor, *eg* the responsibility to achieve a reasonable real return (*ie* return in excess of inflation) for the beneficiaries of a money-purchase pension scheme or to meet the expectations of with-profit or unit-linked policyholders should not be taken lightly.

3.4 Constraints on investment strategy

Institutions may also need a strategy that will continue to satisfy the requirements of regulators.

Restrictions on investment strategy are discussed in more detail in the next chapter.

The stated investment objectives of the fund may also be interpreted as a restriction on investment policy. For example, a 'Japanese Equity Fund' should invest primarily in Japanese equities as opposed to, say, Italian bonds.

More generally, the investment fund should act in accordance with the expectations of its investors, which are influenced by:

- any explicitly stated objectives
- marketing literature
- the past investment policy of the fund.

Size of the assets – absolute

A small fund may be unable to invest in some of the available assets, primarily because it will be unable to achieve an appropriate level of diversification.



Question

It would not be sensible for a fund with assets of 100 to invest in a single property with a market value of 60. How might this fund instead invest in property?

Solution

The fund might instead invest indirectly in property, perhaps via property company shares or a property unit trust.

Size of the assets – relative to the liabilities

Having assets in excess of the liabilities is normally the most important reason why the investment manager may have freedom to mismatch. The bigger the free assets, the more scope the investment manager has for mismatching, as there is a bigger *cushion* with which to absorb any mismatching losses.

Tax

Investors' preferences for income or capital growth from their investments are governed by two main factors: tax and cashflow requirements. If an institution is subject to different taxation bases on income and capital gains it will prefer to receive as much of its total return as possible in the lower-taxed form.

The market price of low income securities is pushed up if many investors have a preference for capital gains. Therefore we really need to consider the *relative* preferences of different investors.

Demonstrating solvency

For some long-term institutional investors, fluctuations in asset market values are not of much concern particularly if the strategy is to hold assets to maturity. However, they may be important for institutions that are required to demonstrate solvency on a regular market value basis and have a low level of free assets. Fluctuating asset values are also, in general, disliked by retail customers of some institutions.

3.5 Diversification for institutions

Assets are diversified if there is a low level of correlation between the returns from the assets.

Portfolios that are highly correlated are more volatile, and have a lot more specific risk. According to CAPM, no extra return is available for specific risk as it is possible to diversify it away.

So it is important that a portfolio should be diversified, both *within* each asset category, *eg* between different industrial sectors and different individual company shares.

When selecting individual investments, the important factor for an institution is the effect that the investment will have on the performance of the total portfolio.

Thus not only are after-tax expected return and variability of the return important, but so is the covariance of that return with the rest of the portfolio.

Investments that have a low covariance with the rest of the portfolio represent diversification and will reduce overall risk. For any investment type, there are many issues to be considered.



Question

Suggest ways that a portfolio may be diversified within each of the following investment types:

- domestic equities
- overseas equities
- property
- fixed-interest bonds.

Solution

Domestic equities

- between broad industry groupings and industry sectors
- level of overseas exposure
- size of company
- level of gearing
- growth vs income

Overseas equities

As domestic equities but also:

- by country / geographic region / currency
- by state and level of economy

Property

- by property type (residential or commercial, *eg* office, shop, industrial *etc*)
- by location, region and country
- prime and non-prime
- by type of tenant
- holdings and developments
- leaseholds and freeholds
- by size of property
- direct and indirect investment

Fixed interest bonds

- by type of borrower
 - by duration
 - by currency
 - by marketability
 - by security / credit rating
-

Conclusion

Subject to the above considerations, an institutional investor will seek to maximise the investment return. This may be for competitive reasons, in order to continue to:

- **attract new business**
- **maximise shareholders' returns**
- **minimise the cost of providing for the liabilities.**

4 Factors influencing an individual's investment strategy

Most of us are investors even if we do not realise it. Examples of forms of investment that are easy to overlook are:

- being a member of a pension scheme (whether individual or occupational)
- owning your own home
- money deposited in a bank.



The main factors to be considered by an individual do not differ greatly from those that should be considered by an institution. However the balance between the factors and the details do differ.

The main factors that an individual should consider before investing are:

- their assets and liabilities and matching cashflows
- risks arising, in particular the variability of market values
- returns from different asset classes
- constraints, both investment and practical constraints.

We will now look at each of these in more detail.

4.1 Assets, liabilities and matching cashflows

When considering a personal investor's financial position, there are three main components to consider:

- existing assets
- future income
- future spending.

The first two are assets to the investor and the third is a liability.



Question

List the features of their liabilities that individuals should consider when making investment decisions.

Solution

As with institutional investors, they need to consider the:

- nature
 - term
 - currency
 - level of uncertainty of the liabilities (*ie* the amount and timing of future spending).
-

Assets

An individual's assets consist of current wealth and future income.

The main component of income will usually be pay from employment (before retirement age). Some individuals may have income from other sources (*eg* an inheritance, maintenance payments, social security). Again, the nature of the income (*ie* fixed, real, or varying in some other way) should be considered.

Liabilities

Liabilities consist of future spending, including any debt repayments. Both the term and nature of future spending will need to be considered as well as the expected level.

In practice, many people's expenditure will tend to follow their *current* income level quite closely. However, the likely pattern of *future* expenditure may form an important part of financial planning for individuals. For example, the following major expenditure items, in approximate lifetime order, *might* be factored into an individual's planning:

- house purchase and costs of setting up home
- costs of bringing up children
- holiday of a lifetime
- saving for retirement
- long-term healthcare costs.

The sophistication of the planning process used by individuals will vary greatly, but most will take some account of the pattern of their expected future income and major likely expenditure, such as a house purchase, in making their plans.

Matching cashflows

Many individual investors, particularly the retired, rely on the income from their investments for their basic lifestyle needs. In this situation it is necessary to find a strategy which will provide a high enough current income while allowing for sufficient growth of capital and income to maintain the level of income in real terms.

Income can be provided by regular redemptions or periodically selling part of a low income yielding portfolio.

A different situation is faced by investors who are investing for the long term, and don't require a current income from their investments, possibly because they are still working. They will be concerned with reinvestment of income and maturity proceeds but, in general, are freer to concentrate on maximising total return.

Nature

Most of an individual's liabilities will be real in nature (*ie* increase with inflation), **although the relevant index measure may not be any particular inflation index. Occupational income can be considered as a real income stream, but pensioners may be on a largely fixed income.**

The increases in different real liabilities may be subject to different rates of inflation. The same is also true of future income, *eg* salaries may increase with wage inflation.



Question

- (i) List possible ways that pensions could increase in payment.
 - (ii) Suggest examples of payments made by an individual that are fixed in monetary terms.
-

Solution

- (i) Pensions in payment may:
 - have no increases
 - have fixed-rate increases
 - be linked to a wage or price index
 - increase according to a formula that reflects some combination of the above, *eg* linked to price inflation, but subject to a maximum increase in any year
 - be subject to discretionary increases.
 - (ii) Possible examples are:
 - repayments on a fixed-rate mortgage
 - long-term insurance contracts or pension plans where the premiums / contributions are fixed in monetary terms
 - other regular savings plans, *eg* investment trust savings schemes.
-

Because liabilities will generally be real, assets for long-term investment should usually be real, although monetary assets may be chosen for short-term investments, diversification, because the individual is risk averse or because they appear good value.

For example, cash deposits with a bank offer both liquidity and the prospects of good returns when short-term interest rates are high.

Term

For many individuals, income will exceed necessary expenditure while in employment (except perhaps in the first few years of employment), but will not following retirement.

So much of the investment by individuals should perhaps be geared towards providing for the period after normal employment.

Despite this, individuals will often tend to have a shorter-term outlook. Five years feels like a long-term investment for many of us.

Currency

Most investors will have liabilities and hence want assets traded in their domestic currency. Investors can still obtain exposure to other currencies and overseas markets through investment funds and overseas earnings from domestic companies.

There may be special reasons for holding investments denominated in other currencies, such as incentive and performance schemes for senior employees of companies owned by overseas companies.

Another example here might be foreign holidays or plans to retire abroad.

Uncertainty

The level of uncertainty regarding future income and expenditure will affect the investment strategy. In general, high levels of uncertainty will lead to a need for more:

- liquid assets
- insurance.

4.2 Risk

Variability of market values

In some respects, individuals should be more relaxed about volatility of asset values than some of the institutions. Unlike some financial institutions, individuals are not required to prove their solvency to a regulator on the basis of market values of assets!

Random fluctuations *ought* not to trouble those investors saving for the distant future – *eg* a 40-year old saving for retirement at age 60 should not worry about day-to-day fluctuations in the stock market.

Individuals investing for the long term may not be concerned about short-term variations in the market value of their investments.

However, in practice, most people dislike excessive volatility, particularly if their liabilities are uncertain or are short-term.

Even though the theoretical argument is that asset volatility should not generally concern individuals, most people have relatively short time horizons so that stability of asset values becomes relatively important.

A suitable strategy is often to switch to less volatile assets as the time at which the investments need to be realised draws near.

Diversification

Risk can be reduced by diversifying assets both between and within asset classes.

Buying your own home may lead to very poor levels of diversification for many individuals, as the major part of your assets may then be tied up in a single domestic property.

Indeed, the ability to take out a mortgage to finance property purchases means that it is possible to invest significantly more than your total net wealth in property.

Collective investment schemes (CISs) are very important ways for personal investors to maintain high levels of diversification.

4.3 Returns from assets

In addition to the considerations of matching liabilities and allowing for uncertainty, individuals will wish to maximise their expected return. This means selecting assets that are good value after allowing for:

- **the expenses of dealing in the asset; and**
- **the individual's tax situation.**

Taxation

Taxation is often a very important factor within investment planning for individuals because:

- tax rates may be relatively high for some individuals – eg 50% or more for wealthy individuals in some countries
- of the varying tax treatment of different investment vehicles available to individuals.

Differences in taxation can mean that an investment, which is good value to one person, can be unsuitable for another.

Some investments are particularly efficient for taxpayers. This is usually because the government specifically desires to encourage investment of a particular form.

Sometimes investment products are launched that exploit an unintentional tax loophole; these are usually aimed at the wealthier investor and can have a very short lifespan before the loophole is closed.

Tax avoidance is a major factor and is legal, unlike tax *evasion* which is the illegal avoidance of tax.

As for institutions, the balance of taxation between income and capital gains will also be a major influence driving the individual investor's strategic investment decision.

'Feel good' factors

The word 'return' could mean more than just income and capital for certain types of investors.



Question

Suggest an alternative interpretation of the word 'return' other than simply income and capital in the context of each of the following:

- (i) a charity
- (ii) a person who purchases private medical insurance
- (iii) an investor in a work of art.

Solution

- (i) A charity might have different objectives than simply maximising *monetary* return. Return might have a more altruistic dimension such as *ecological value* or *human/social value*.
 - (ii) A person who purchases private medical insurance may see some of the return in terms of *peace of mind*.
 - (iii) An investor in a work of art may receive a return as *feel good factor* or *utility*.
-

Personal investors are more likely to be influenced by rather subjective factors. For example, some individuals may derive personal gratification from owning large houses and fine paintings. In general, tangible assets are more likely to produce a 'feel good' factor than, say, government bonds.

4.4 Constraints

Investment constraints

Investment constraints arise due to issues around matching and risk, for example:

Excess assets

Individuals may be constrained in their choice of investments by the size of their liabilities relative to their assets. They will often not be in a position to accept very much risk.

Uncertainty of future income and outgo

A major constraint is uncertainty. Individuals may lose much of their income for a variety of reasons, such as redundancy or ill health. Similarly unexpected expenditure requirements can easily occur. Therefore it will be desirable to keep some assets in a reasonably liquid form. Insurance can also be used to mitigate the effect of some types of uncertainty.

Uncertainty could be one of the major considerations influencing the investment decisions of an individual investor. It can, however, be reduced by insurance.

Within this context, insurance can be used to help individuals to:

- follow a 'better' investment strategy, *ie* higher risk and higher expected return
- have a 'better' spending plan, *ie* there's less need to hold back large sums of money to meet contingent liabilities.

Unfortunately for some individuals, insurance might not be possible (*eg* viewed by the insurer as bad risks). In any event, the benefits of insurance should be weighed against the cost.

Risk appetite

Attitude to risk is partly a personal matter as well as being dependent on an investor's financial position.

This may partly be a function of:

- age (older people may be more risk averse as less time to make up any loss)
- wealth (richer people may be more aggressive in their investment strategy)
- dependants (those with dependants to support may be more cautious).

Practical constraints

Individuals usually face practical constraints not suffered by institutions. These can include:

- **not enough assets for direct investment in some asset classes;**
- **high relative expenses when investing small amounts; and**
- **lack of information and/or expertise.**

Collective investment schemes may help reduce the impact of such constraints.



Question

Set out a checklist of questions that a middle-aged individual investor could use in order to decide how to invest excess income (*ie* basic salary in excess of expenditure) and/or a lump sum (*eg* an inheritance), giving the actions that should be taken in response to these questions.

Solution

Broadly in the order that they should be addressed, the checklist should be:

<i>Check</i>	<i>Response</i>
Do you have adequate insurance to protect you against adverse events?	If not, buy the necessary insurance.
Have you sufficient emergency funds?	If not, put more money into a liquid fund, <i>eg</i> bank deposits.
Will you need funds in the near future (<i>eg</i> next year or two)?	If yes, set aside enough money in an account (<i>eg</i> a term deposit with a bank).
Have you got sufficient funds being set aside for retirement?	If not, consider putting more money into a pension plan.
Are you suitably protected against long-term inflation?	If not, increase the proportion of long-term real assets.
Are your asset values very volatile, and does this matter now?	If yes on both counts, hold more funds in liquid investments.
What will be an acceptable level of investment performance?	Consider returns offered in the market by suitable funds.
Have you made maximum use of tax-efficient investment vehicles?	If no, transfer any direct holdings into tax efficient vehicles.
Are your investments sufficiently diversified?	If not, start spreading your savings between different savings institutions, savings vehicles and asset classes.

The chapter summary starts on the next page so that you can keep all the chapter summaries together for revision purposes.

Chapter 14 Summary

Institutional investment objectives

The investment objective should be clearly stated and quantified where possible. It should encompass the permitted degree of risk, required return and cashflow timing.

Risk

Risk can be defined in many ways, *eg*:

- probability of default
- expected variability of return
- risk of underperforming compared with competitors
- probability of failing to achieve the investor's objectives.

This last definition is the most practical when considering investment strategy.

The risk appetite of an institution will depend on:

- the nature of the institution
- the constraints of its governing body and documentation
- legal or statutory controls.

Factors influencing an institution's investment strategy

1. the nature of the existing liabilities
2. the currency of the existing liabilities
3. the term of the existing liabilities
4. the level of uncertainty of the existing liabilities – both in amount and timing
5. tax and expenses
6. statutory, legal or voluntary restrictions on how the fund may invest
7. the size of the assets, both in relation to the liabilities and in absolute terms
8. the expected long-term return from various asset classes
9. accounting rules
10. statutory valuation and solvency requirements
11. future accrual of liabilities
12. the existing asset portfolio
13. the strategy followed by other funds
14. the institution's risk appetite
15. the institution's objectives
16. the need for diversification.

Factors influencing an individual's investment strategy

The main factors for individuals are similar to those for institutions but the balance between the factors and the details differ.

The main factors an individual should consider in making investment decisions are:

- *the characteristics of their assets and liabilities and matching cashflows*
 - usually their liabilities are predominantly real (*ie* linked to inflation) and domestic, so real, domestic assets are preferable.
 - consider when asset proceeds are required, *ie* when total expenditure exceeds other income and the extent to which they want their investments to provide income as opposed to capital gains
- *risk*
 - the stability of values should not be a major factor for long-term investment, however the short time horizon of many individuals can make stability of asset values seem important
 - diversification is important
- *returns from different asset classes* – considering:
 - any specific tax advantages
 - 'feel-good' factors
- *investment constraints* – investment is constrained by the level of risk the individual can take on, which may depend on:
 - the level of excess assets of the individual
 - the uncertainty of future income and outgo
 - the risk appetite of the investor
- *practical considerations*, which include:
 - if the level of assets are too low to allow direct investment in some assets
 - the relatively high expenses incurred when investing small amounts
 - a likely lack of investment expertise and information.



Chapter 14 Practice Questions

14.1 Assuming risk is interpreted to be the variability of sterling nominal returns over one year, classify each of the following assets into one of the following categories:

- very low-risk
 - low-risk
 - medium risk
 - high-risk
 - very high-risk.
- (a) A 30-year index-linked government bond
- (b) Shares in a multinational company
- (c) Conventional government bond with one year to redemption
- (d) Revolving one-week call deposit with a well-known clearing bank
- (e) Shares in a small specialist mining company
- (f) One-year sterling corporate bond issued by major German company
- (g) Put options in a major food retailer
- (h) Call options on the an equity market index
- (i) One-year term deposit in dollars with a well-known global bank
- (j) One-year term deposit with a well-known clearing bank

14.2 A long-established general insurance company expects the total liability outgo (*ie* covering claims and expenses) over the next year to be \$100 million and premium income to be the same. The company's statistical department estimates that the liability outgo has a standard deviation of \$10 million.

- (i) On the basis of this data alone, calculate the amount of the existing assets of the company that should be invested in money market investments with terms of less than one year.
- (ii) State the two primary reasons why the company may hold *considerably* more than this amount in very liquid assets.

14.3 List the factors that can influence a long-term investment strategy for an institutional investor in making strategic investment decisions. [8]

Exam style

14.4 Outline the points a charity should take into account when reviewing its investment strategy. [10]

Exam style

14.5 Describe the advantages and disadvantages to personal investors of collective investment schemes. [4]

Exam style

14.6 Outline the main practical constraints faced by personal (*ie* individual) investors which are not usually faced by institutional investors (or at least not to the same extent) and how personal investors may deal with these constraints. [5]

Exam style

14.7 An insurance company sells a pension contract under which customers have a choice of funds into which their contributions are invested prior to retirement. The funds at retirement are used to purchase a level annuity at retirement at the terms then available.

Exam style

Following customer research, the company believes many customers lack the knowledge and/or time and/or expertise to choose the best funds to be invested in prior to retirement and some customers have in retrospect been dissatisfied with their decisions.

To help customers, the company is considering offering a default option with a 'lifestyle' investment approach that is to be marketed as being broadly suitable for a wide range of customers. The choice of investments under the lifestyle option will change during the life of the policy, *ie* as the customer moves towards retirement.

Describe the considerations that should be taken into account in determining the investments that will make up the lifestyle option. [7]



Chapter 14 Solutions

14.1 *The exact classification here is highly subjective. Therefore, you should check your general agreement rather than precise classifications.*

- (a) 30-year index-linked government bond: high-risk as it is a complete mismatch by nature and term, but at least does match by currency.
- (b) Shares in a multinational company: very high risk as it is a complete mismatch by all four of nature, term, certainty and currency.
- (c) Conventional government bond with one year to redemption: very low-risk.
- (d) Revolving one-week call deposit with a well-known clearing bank: low-risk, but more risky than (3) because reinvestment rates may vary.
- (e) Shares in a small, specialist mining company: very high-risk, complete mismatch.
- (f) One-year sterling corporate bond issue by major German company: very low-risk as matches by nature, term and currency and return fairly certain due to issuer.
- (g) Put options in a major food retailer: very high-risk.
- (h) Call options on an equity market index: very high-risk.
- (i) One-year term deposit in dollars with a well-known global bank: medium-risk as it matches by nature and term, and the quality of the issuer improves certainty, but there is currency risk.
- (j) One-year term deposit with a well-known clearing bank: very low-risk.

14.2 (i) ***Assets to invest in short-term money market instruments***

Suppose that the distribution of liability outgo approximates a normal distribution (or something with similar dispersion). We would therefore be very sure that the liability outgo will not exceed \$130 million, *ie* 3 standard deviations above the expected value (around 99.9% sure).

We have no measure of the uncertainty of the premium income. However, it would be imprudent to rely upon the full \$100 million. Assuming that the company's trading policy for the next year was not under threat of some radical plan (*eg* to stop writing business) then it would probably be safe to rely upon, say, \$80 million.

On the basis of these figures, we would be exceedingly surprised if \$50 million in money market investments was insufficient.

(ii) ***Reasons for holding more liquid assets***

The company may hold considerably more in liquid assets if:

- the company is concerned about its statutory solvency position (so avoid volatile assets)
- the investment manager feels that equities and bonds are considerably over-priced.

14.3 *Factors that can influence a long-term investment strategy*

- the nature of the existing liabilities – are they fixed in monetary terms, real or varying in some other way [½]
 - the currency of the existing liabilities [½]
 - the term of the existing liabilities [½]
 - the level of uncertainty of the existing liabilities (both in amount and timing) and hence the need for liquidity [½]
 - tax (both the tax treatment of different investments and the tax position of the investor need to be considered) and expenses [½]
 - statutory, legal or voluntary restrictions on how the fund may invest [½]
 - the size of the assets, both in relation to the liabilities and in absolute terms [½]
 - the expected long-term return from various asset classes [½]
 - accounting rules [½]
 - statutory valuation and solvency requirements [½]
 - future liabilities and associated cash inflows [½]
 - the existing asset portfolio [½]
 - the strategy followed by other funds [½]
 - the investor's risk appetite [½]
 - the investor's objectives [½]
 - the need for diversification [½]
- [Total 8]

14.4 *Investment objectives*

A key consideration will be the charity's objectives. The primary investment objective is likely to be to meet the charity's liabilities as they fall due. [1]

Therefore, the strategy will need to reflect the:

- nature of the liabilities, *ie* fixed monetary, real or varying in some other way [½]
- term of the liabilities [½]
- currency (*ie* geographical location) of the liabilities [½]
- uncertainty of the liabilities in both timing and amount. [½]

In addition, the characteristics of any known future accrual of liabilities would also need to be taken into account. [½]

Any regulatory requirements or restrictions arising from the legal constitution of the charity should also be taken into account. [½]

Although maximising the total return (net of expenses and tax) of the portfolio will be a factor there are likely to be other, broader, objectives that will need to be met. [½]

An example would be the need for investments to meet certain ethical or environmental standards. [½]

Risk appetite

The above objectives would need to be met subject to a specified acceptable level of risk. [½]

The view of what constitutes an acceptable level of risk would be determined by the trustees and, by implication, the supporters of the charity. [½]

Risk may be characterised in a number of different ways, for example, the ability to meet liabilities at all times, or the variability of returns may be a factor for consideration. [½]

Other charities

The investment strategy of other, similar charities may be an influence. [½]

Cashflow

The cashflow needs of the charity are likely to have a significant effect on the choice of investment strategy. [½]

Liquidity may be an important consideration if the charity is required to despatch funds at short notice, *eg* for aid appeals. [½]

The charity should also consider the pattern of future cash inflows, *eg* from regular contributions, special appeals. [½]

Assets

The size and content of the existing portfolio should be taken into account when determining the strategy in order to ensure, for example, an appropriate level of diversification is maintained. [½]

The expected risk / return profile of the various asset classes will determine their suitability for inclusion and their respective weights. [½]

The characteristics of such assets (expected returns, volatility, currency *etc*) would be considered. [½]

Possible asset classes for consideration would include equities, bonds, cash and property. [½]

Similarly the tax treatment of the assets and the impact of any tax exemptions available to the charity will be a significant consideration ... [½]

... it may mean certain assets appear cheap to the charity relative to other investors. [½]

The absolute level of assets and, critically, the relative level against liabilities will determine the suitability of certain asset classes. [½]

Resources and responsibilities

The resources available to the charity (internal and external investment advisors, managers, trustee experience *etc*) would impact upon the strategy, in that it must be within the charity's ability to operate successfully. [½]

[Maximum 10]

14.5 **Collective investment schemes and personal investors**

Advantages of collective investment schemes are:

- they offer diversification of asset classes that an individual may struggle to achieve by investing in individual assets ... [½]
... due to the amount of funds to be invested prohibiting certain asset classes (*eg* direct property). [½]
- the relative ease of investment as the individual just has to liaise with a single collective investment scheme manager ... [½]
... rather than several individual asset managers if investing directly [½]
- the investment expertise provided ... [½]
... as the individual is unlikely to be an expert in any / all assets [½]
- they are appropriate for small sums such as those of an individual investor [½]
- there may be possible tax advantages for investing via a collective investment scheme that the individual can utilise. [½]

Possible disadvantages are:

- the relatively high expense levels due to manager fees [½]
- the fund's stated investment objective might not be exactly appropriate for the specific individual's requirements. [½]
- the lack of control over the investment's chosen. [½]

14.6 **Practical investment constraints**

Individuals will typically have:

- less access to research facilities [½]
- less good quality, up to date, investment information [½]
- inappropriate levels of expertise for direct investment [½]
- less time available. [½]

Individuals will not generally have the cash resources to:

- invest directly and remain well-diversified [½]
- invest directly in assets with a large unit size, *eg* commercial property [½]
- take advantage of attractive investment opportunities that become available from time to time at short notice [½]
- achieve economies of scale (*ie* by dealing in smaller amounts, individuals will have higher relative expenses than institutions). [½]

Mechanisms to deal with these constraints

They may invest in collective investment schemes, such as unit trusts, investment trust companies and life and pensions products ... [1]

... this will give access to expertise, aid diversification and enable the investor to access asset classes that might otherwise be unavailable. [½]

They could use the services of a financial adviser, such as a private client stockbroker, to overcome the lack of information and expertise problems. [1]

[Maximum 5]

14.7 *Considerations in determining the investments*

Profile of the liabilities – there is a fundamental requirement that the investments offered are a suitable match for the liabilities in terms of nature, term and currency. [1]

For much of the pre-retirement period the liabilities are real and are best matched with asset classes that might offer returns in line with salary growth or some other measure of inflation, *eg* equity and property investments. [1]

Closer to retirement, *eg* last 10 years, the desire to match the liabilities may result in a gradual move into asset classes that match the movements in annuity rates, *eg* bond investments. [½]

If a proportion of the retirement fund is typically taken as a cash sum rather than as annuity, the funds in respect of this portion could be switched into cash as retirement approaches rather than into bonds. [½]

Profile of target market – consider the financial sophistication of the company's customers in making investment decisions. [½]

As the research suggests a lack of expertise, the lifestyle option should reflect a decision applicable to the mainstream rather than a narrow target group. [½]

The level of risk aversion of the target market is critical, as it will determine the extent to which risk (including mismatching risk) may be taken in pursuit of higher returns. [½]

Given the reasons for introducing this option, a relatively cautious approach is likely to be the most appropriate choice. [½]

The investment options offered must take account of any legislative restrictions. [½]

The tax treatment of the different asset classes should be considered. [½]

Practical issues – the size of the funds under management might limit the range of available asset classes. [½]

Frequency of switching – limits may be imposed on how often members can amend their investment choice (*eg* between the lifestyle option and other self-select choices) to reduce administration costs. [½]

Competition – consider the comparable investment options offered by competitors. [½]
[Maximum 7]

15

Asset-liability management

Syllabus objectives

- 9.3.1 Discuss the cashflows of simple financial arrangements and the need to invest appropriately to provide for financial benefits on contingent events.
- 11.8.1 Describe the principles of investment and the asset-liability matching requirements of the main providers of benefits on contingent events.
- 11.8.2 Show how actuarial techniques such as asset-liability modelling may be used to develop an appropriate investment strategy.

0 Introduction

The principles of investments state that:

- investments should be chosen that are appropriate for the liabilities (in terms of nature, term, currency and uncertainty) and reflect the risk appetite of the investor
- subject to the above investments should be chosen to maximise returns.

We will firstly look at the interaction between assets and liabilities.

Then we will look in more detail at what is meant by the characteristics of the liability cashflows and, in particular, how we might categorise them.

When determining the extent to which the liabilities should be matched, it will be necessary to consider both the level of free assets of the investor and any regulatory constraints, and we will consider these issues.

Finally, we will draw all of these considerations together and look at how an appropriate investment strategy is actually determined. One of the key techniques used to do this is an asset-liability model.

1 Interaction between assets and liabilities

Providers of financial benefits will invest the contributions received for those benefits in order to deliver the benefits. A key decision for the provider is whether to invest in such a way that the expected cashflows from the assets held match the expected cashflows from the liabilities it has taken on.

If the decision is taken to match the assets to the liabilities, then the optimal matched position will need to be determined.



Question

Suggest what is meant by the *optimal* matched position.

Solution

The *optimal* matched position will be the matched position that satisfies the provider's required degree of certainty in meeting the liabilities for the least cost. For example, given infinite resources, it will always be possible to meet the liabilities by buying excessive amounts of assets but this will not necessarily give the optimal matched position.

Given the uncertainties in the future cashflows of different liabilities, and the possible uncertainties associated with some assets, this is not a trivial exercise.

If the decision is taken not to match the assets to the liabilities, then additional capital will need to be held to cover the possibility that there are insufficient assets to meet the liabilities when they fall due. Again, the determination of how much extra capital will be needed is not trivial.

Additional capital, also called *free assets*, provides a cushion against adverse market movements. If the provider has correctly determined how much extra capital is needed, then there should be sufficient assets to meet the liabilities when they fall due despite, say, a sudden fall in the market value of the assets.

Much of the rest of this chapter looks at these decisions in more detail, in particular, exploring the non-trivial exercise of finding a matching portfolio of assets and considering how to determine a sufficient amount of free assets.

The provider's decision about the extent to which the investments chosen should match the liabilities can be summarised in the principles of investment.

1.1 Principles of investment

The principles of investment for a provider of benefits on future uncertain events can be stated as follows:

- (1) A provider should select investments that are appropriate to the:
 - nature
 - term
 - currency, and
 - uncertaintyof the liabilities, and
 - the provider's appetite for risk.
- (2) Subject to (1) the investments should also be selected so as to maximise the overall return on the assets, where overall return includes both income and capital.

These two sentences are probably the most important in this chapter.

The balance between risk and return is the key idea when developing an investment strategy.

2 Liability cashflows – identification

The practical work of the actuary usually involves the assessment and projection of future cashflows. These are sums of money which are paid or received at different times. Both the timing and the amount of the cashflows may be known or unknown.

For example, a company operating a privately-owned bridge, road or tunnel will:

- receive toll payments
- pay out money for maintenance, debt repayment and other management expenses.

From the company's viewpoint:

- the toll payments are positive cashflows (*ie* money received)
- the maintenance, debt repayments and other expenses are negative cashflows (*ie* money paid out).

Similar cashflows arise in all businesses.

In some businesses, such as insurance companies, positive cashflows (premiums) are received before negative cashflows (claims and expenses) arise. These are available for investment, and will generate investment income, which is in turn another positive cashflow.

A premium paid by a policyholder might be used to cover the immediate costs associated with setting up the insurance policy, with the remainder being invested. Investment returns will be earned on this premium until any further expenses or claims payments are paid out.

Where there is uncertainty about the amount or timing of cashflows, one actuarial technique is to assign probabilities to both the amount and the existence of a cashflow.

The probability that the payment will take place could be estimated by looking at past results. If there is no past data for the event being considered then data from similar events could be used.

2.1 Examples of cashflow scenarios

In this section, two simple examples are given of practical situations that are readily described by cashflow models.

In the examination candidates may be required to describe the cashflows resulting from other investment, insurance, or business scenarios.

Make sure in an exam question that you have a clear understanding of:

- from which party's viewpoint you are examining the cashflows
- what the main cashflows are
- whether a cashflow is:
 - positive or negative
 - fixed or real
 - known or unknown in amount
 - known or unknown in timing and term
 - the form of payments, *ie* lump sum or regular.

Example 1 : An annuity

An annuity provides a series of regular payments in return for a single premium.



Question

State the key difference between an *immediate* annuity and a *deferred* annuity.

Solution

An immediate annuity is one where the payments commence immediately after purchase.

For a deferred annuity, payments commence only after a fixed period has elapsed after purchase.

The conditions under which the annuity payments will be made will be clearly specified.



Question

List the features relating to the annuity payments that need to be clearly specified in order to describe the cashflows.

Solution

The following aspects relating to annuity payments need to be specified:

- in what circumstances the annuity ceases to be paid (*eg* after a fixed term or on death) ...
... or changes (*eg* a dependant may receive 50% of the pension in payment)
- the frequency of payment (monthly, quarterly, half yearly, annually)
- in advance (at the beginning of each period) or in arrears (at the end of each period)
- the date of the first annuity payment (if deferred)
- the length of time for which the payments will be guaranteed
- the initial amount of the annuity
- if and how the payments will vary over time (level, fixed or index-linked increases).

For an immediate annuity, payments are made as long as the annuitant is alive.

However, there is often a 'guaranteed' period, *eg* five years, for which payments will continue to be made (to a spouse or an estate) or be commuted into a lump sum even if the annuitant dies.

The cashflows for the investor will be an initial negative cashflow, for the purchase of the annuity, followed by a series of smaller regular positive cashflows throughout the annuitant's lifetime.

Annuities cannot normally be discontinued (*ie* surrendered) so there is unlikely to be a discontinuance payment.

From the perspective of the annuity provider, there is an initial positive cashflow followed by an unknown number of regular known negative cashflows.

However, if the annuity payments are specified to increase in line with an index, the amount of the regular negative cashflows will be unknown in monetary terms.

These cashflows will comprise not only the annuity instalments, but also the provider's expenses in administering the contract.

The number of future negative cashflows depends on how long the annuitant lives.

The provider is likely to invest the initial positive cashflow in the bond market (creating a negative cashflow), and will receive in return a number of interest and capital payments (positive cashflows) that will be expected to match the outgoings on expenses and annuity payments, and leave some surplus cash as profit.

Providers may invest in both government and corporate bonds.

- Fixed-interest bonds will be used to match level annuities and annuities increasing by fixed amounts.
- Index-linked bonds will be used to match index-linked annuities.
- Other investments may also be used, for example, commercial mortgages and swaps.

Example 2 : A repayment loan (or mortgage)

A repayment loan is repayable by a series of amounts, each of which includes partial repayment of the loan capital in addition to the interest payment.

If the interest rate is fixed, the payments will be of fixed equal amounts, paid at regular known times.

The cashflows are like those for an annuity except that the number of cashflows will usually be fixed, rather than related to survival.

Therefore, the cashflows are similar to those for an annuity certain.

There may be added complications if the interest rate is allowed to vary or if the loan can be repaid early. Additionally, it is possible that the regular repayments could be specified to increase (or decrease) with time. Such changes could be smooth or discrete.

With a repayment loan the breakdown of each payment into 'interest' and 'capital' changes significantly over the period of the loan:

- **The first repayment will consist almost entirely of interest and will provide only a very small capital repayment.**
- **The final repayment will consist almost entirely of capital and will have only a small interest content.**

This is particularly relevant when interest and capital are taxed on different bases.

The amount of the loan outstanding will reduce throughout the term of the loan. At the start of the contract, the entire loan will be outstanding and so the interest part of the payment is large and the capital part is small. At the end of the contract, the amount of the loan outstanding will be small and so the interest due will also be small. The capital part will then be much larger.

3 Liability cashflows – categorisation by nature

Given a detailed description of the liability cashflows of a financial product provider, we can start to categorise them, with a view to then choosing the most appropriate asset class to match each category.

The net liability outgo consists of:

$$\begin{array}{rcl} & \text{benefit payments} & \\ + & \text{expense outgo} & \\ - & \text{premium / contribution income.} & \end{array}$$

In practice, the actual liability outgo in any year, or month, depends on:

- the monetary value of each of the constituents, and
- the probability of it being received or paid out.



Question

Give examples of why these three types of outgo might not be certain.

Solution

Benefit payments may be:

- linked to a contingent event, *eg* death, accident
- subject to qualifying rules, *eg* claim exceeds excess, loss adjustment.

Expense outgo may be:

- linked to a benefit payment
- linked to the payment of a premium / contribution
- linked to other specific uncertain events, *eg* system upgrades, recruitment programs.

Premium / contribution income may be:

- uncertain in timing
 - uncertain in terms of being received, *eg* on discontinuance / lapse
 - dependent upon uncertain levels of new business / sales.
-

3.1 Benefit payments

The benefit payments can be sub-divided into four types:

- guaranteed in money (nominal) terms
- guaranteed in terms of an index
- discretionary
- investment-linked.

Guaranteed in money terms

This consists of benefit payments where the amount is specified in money terms.

For example, the sum assured on a life assurance policy might be specified as a fixed monetary amount.

Guaranteed in terms of an index of prices, earnings or similar

This consists of benefits whose amount is directly linked to an index.

The index may not be a nationally published one. For example, the benefits accruing under a benefit scheme may increase in line with pay awards granted by the sponsoring company.

Many of the cashflows that fit under this category may not be truly *guaranteed*. For example salary-related benefits may be broadly related to national average earnings index but it is rare for a sponsor to have a predetermined policy for how salary increases are awarded.

Discretionary

This consists of any payments that are payable at the discretion of the provider, eg future bonus payments under with-profit contracts or pension increases in excess of guaranteed amounts.

Investment-linked

This consists of benefits where the amount is directly determined by the value of the investments underlying the contracts.

An example is a unit-linked fund where the liabilities are directly linked to the value of the underlying investments, or a defined contribution pension scheme.

3.2 Expense outgo

Expense payments tend to increase over time. The natural rate of increase is likely to fall somewhere between price and earnings inflation. In addition, there are exceptional items which might be either expenditures or cost savings.

For investment purposes it is adequate to treat expenses as being linked to prices or earnings. Hence, they can be included with benefit payments guaranteed in terms of an index of prices or similar.

Administrative expenses may be broadly real but rarely *guaranteed* to move in line with an index.

3.3 Premium / contribution income

Premium / contribution payments may:

- **be fixed in monetary terms ...**
... and hence can be thought of as negative benefit payments guaranteed in money terms; or
- **increase in line with an index ...**
... and hence can be thought of as negative benefit payments guaranteed in terms of an index.

Again, an insurer may broadly increase premiums in line with inflation, although the rate of increase may not be guaranteed in advance.

The existence of contracts or transactions where the client can vary the amount of premium each year does not invalidate this.

The premiums may be considered fixed in the short term, between reviews.

3.4 Summary

We can therefore split the liability outgo (by nature) into four categories:

1. guaranteed in money terms, *ie*
 - benefit payments specified in money terms
 - premium / contribution income that is fixed in money terms
2. guaranteed in terms of a prices index or similar, *ie*
 - benefit payments linked to an index
 - + expense outgo that is real in nature
 - premium / contribution income that is linked to an index
3. discretionary benefit payments
4. investment-linked benefit payments.

The next section consider the appropriate assets for each of these categories.

3.5 Selecting assets by nature of liabilities

Guaranteed in money terms

Pure matching

A provider will want to invest so as to ensure that it can meet the guarantees. This means investing in assets which produce a flow of asset proceeds to *match* the liability outgo.

The match needs to be in terms of both the timing and the amount of the liability outgo. We will cover approaches to setting an investment strategy in the next chapter.

This will involve taking into account the term of the liability outgo and the probability of the payments being made, so as to indicate the term of the corresponding assets.

Approximate matching

Except for certain types of liability, it will probably be impossible in practice to find assets with proceeds that exactly match the expected liability outgo.

In particular, the terms of available fixed-interest securities may be much shorter than the corresponding liabilities, particularly when very long-term pension liabilities are involved.

Even if suitable assets are available their price may prove off-putting due to the increased demand from interested parties.

The existence of options in either the liabilities or the assets also means that full cashflow matching cannot realistically be achieved.

A best match is all that can normally be hoped for which may be achieved by investing in high quality fixed-interest bonds of a term suitable to match the expected term of the liability outgo.

Derivatives could be used to produce asset flows that match liability outgo. However, derivative strategies are generally expensive and exact matching may not always be possible.

Guaranteed in terms of a price index or similar

There are similar difficulties in matching liability outgo, as with liabilities guaranteed in monetary terms.

The most suitable match is likely to be index-linked securities, where available, ideally chosen to match the expected term of the liability outgo.

In their absence, a substitute would be assets that are expected to provide a real return, for example equity-type investments.



Question

Discuss how good a match equities would be for liabilities linked to a price index.

Solution

Equities are not a perfect match for this liability because their return is not guaranteed, either in absolute or index-linked terms.

However the return does behave to some extent in line with price inflation, and so they offer a reasonable match.

This would be contingent on diversification: any one equity stock is likely to offer a much poorer match to an inflation index (quite apart from the exposure to asset default).

The suitability of the match is also a function of how long a time period is considered:

- over a short time period the match will be poor, due to the high volatility of the return from equities over the short term
 - over a longer period the match should be better, as the long-term return from equities tends to be less volatile.
-

Discretionary benefits

If discretionary benefits are to be provided the main aim of the provider will be to maximise these and hence the investment strategy should therefore also aim to do that. This means investing in assets that will produce the highest expected return.

In theory, this would suggest a great deal of investment risk is acceptable.

However, this is subject both to the provider's appetite for risk, and also to the risk expectations of the client.

Investment-linked

The benefits are guaranteed to the extent that their value can be determined at any time in accordance with a definite formula based on the value of a specified fund of assets or index.

The provider can avoid any investment matching problems by investing in the same assets as used to determine the benefits.

Replicating a market index may involve holding a large number of small holdings and thus be too costly. Companies might choose to use collective investment schemes or a derivative strategy to achieve this.

Currency

Liabilities denominated in a particular currency should be matched by assets in that currency, so as to reduce any currency risk.

4 Mismatching

So far, we have concerned ourselves with the matching of the liabilities, *ie* the first of the two investment principles. In this section, we will look at the second principle, maximising returns, which is likely to involve a degree of mismatching.

We will consider two key influences on a provider's decision on the appropriate balance between risk and return:

- the level of free assets
- any (regulatory) constraints.

4.1 Free assets / surplus

The existence of free assets or a surplus means that the provider can depart from the matching strategies outlined above to improve the overall return on its assets and thereby benefit its:

- clients, through higher benefits or lower premium / contribution rates
- shareholders (if any), through higher dividends.

It is almost always the case that assets with the highest expected return also have the highest variance of that return.

Guaranteed benefits

If the assets supporting guaranteed benefits are invested to produce the highest expected return without any thought to the nature of the liabilities, the probability that the asset proceeds will be inadequate to meet the liabilities will be high.

If there are free assets they can be used to make up the shortfall in these circumstances.

If there are no free assets, or not enough free assets, this approach can lead to insolvency.

So, where the liabilities are fixed in money terms (*eg* guaranteed benefits), variability in the asset return can only be tolerated if there are free assets to act as a cushion for that variability. The question is then what size of free assets is appropriate given a specified variance of return?

A deterministic approach can be used to assess an appropriate provision to cover the mismatching of assets and liabilities, that is, to calculate a mismatching or resilience reserve:

- **Assets are selected to match the value of liabilities exactly.**
Or at least as closely as possible.
- **Specified 'time zero' changes in the value of these assets and in economic factors such as interest rates are assumed, and the value of assets and liabilities recalculated.**

So assumptions are made about how key economic factors may change in the future and the impact on asset values. Note the value of the liabilities may be assessed using an asset-based discount rate and therefore will change as asset values change.

- **The difference (if the value of assets is less than the value of liabilities) is the provision required, or the amount of free reserves needed to be set aside.**

Example

Suppose an institutional investor has guaranteed future fixed liabilities worth £100 now.

An investment strategy chosen to increase returns (moving away from a matching strategy) may be to invest 50% in equities and the remaining 50% in government bonds.

For simplicity, suppose:

- the value of equities might fluctuate by at most $+ / - 10\%$ in the course of any year
- accounting regulations allow government bonds to be valued at historic book value (*ie* so that we can ignore their downward market fluctuations).

If the institution possessed *no* free assets and invested in £50 in equities and £50 in bonds, then the equities could fall in value to £45 and the value of the portfolio to £95, making the institution insolvent. With no free assets, the institution cannot make *any* equity investment.

But if the institution had £5 of free assets this would enable the institution to withstand a drop in the value of equities of £5 and so the institution could invest up to £50 in equities.

In practice, the answer to the question of an appropriate free assets cushion is more complicated than in this example with its simplifying assumptions. Therefore an alternative, stochastic approach is usually used.

The main technique used to determine how much of the free assets / surplus is needed as a cushion to reduce the probability of insolvency to an acceptable level is the same as that used to assess a risk-based capital requirement against market risk.

This involves running a stochastic simulation of the markets in which funds are invested using an economic scenario generator.

Each run of the model will choose a particular combination of funds for consideration.

The capital required to just prevent insolvency at any desired probability can be determined by inspecting the tails of the output from the stochastic simulations.

Using free assets to maintain a deliberately mismatched policy has to compete with other uses of free assets, in particular financing new business growth or other new ventures.

This often means that the opportunities to depart from a matched policy for the guaranteed liabilities are limited.

When allocating free assets to support a mismatched investment policy it is necessary to take into account that the investments in which the free assets are invested will also be affected by market value changes.

For example, if £3m of capital is needed to protect a portfolio against a 25% fall in equity values, and the free assets are invested in equities, £4m of free assets needs to be earmarked to provide this capital, after the market fall.

Discretionary benefits

It could be argued that matching assets to liabilities is irrelevant where there are discretionary benefits, since a provider will want to invest in the securities with the highest expected return.

On the other hand, although the benefits are fully discretionary, beneficiaries will expect to receive something and moreover will have expectations as to a minimum level.

For example, policyholders will have expectations as to the bonuses on with-profit policies and benefit scheme pensioners will have expectations as to any discretionary pension increases.

The provider will therefore want to make use of some of the free assets / surplus, or a limited matching strategy, to ensure that the probability of the discretionary benefits falling below a particular level stays within acceptable limits.

Investment-linked

It could be argued that it is a reasonable use of the free assets / surplus to mismatch investment-linked benefits if by so doing the company can expect to achieve a higher return.

If this is done any return achieved above that on the 'matched' assets will not accrue to the beneficiaries of the investment-linked contracts but to the provider.

For many institutions 'matching' considerations may outweigh 'return' considerations, particularly for more risk-averse providers who have chosen to offer benefits that are investment linked rather than guaranteed. It is uncommon for providers to mismatch investment-linked liabilities.

In many territories, mismatching investment-linked benefits is disallowed by law or regulation.

4.2 Regulatory framework

The regulatory framework within a country may limit what a provider may be able to do in terms of investment. The following controls may be implemented:

- **restrictions on the types of assets that a provider can invest in**
- **restrictions on the amount of any particular type of asset that can be taken into account for the purpose of demonstrating solvency**
- **a requirement to match assets and liabilities by currency**
- **restrictions on the maximum exposure to a single counterparty**
- **custodianship of assets**
- **a requirement to hold a certain proportion of total assets in a particular class – for example government stock**
- **a requirement to hold a *mismatching reserve***
- **a limit on the extent to which mismatching is allowed at all.**

Where a *mismatching reserve* is required, the regulations are usually framed so that the more a company decides to invest in return-seeking higher-risk assets, the higher any resulting reserve will be. This increases the value of the liabilities and reduces the available free assets / surplus.



Question

- (i) Give two reasons why there might be restrictions on the amount of any particular type of assets that can be taken into account for the purpose of demonstrating solvency.
- (ii) Give an example of an asset class that might be subject to such restrictions.

Solution

- (i) Restrictions may be imposed to:
 - limit the use of highly risky, *eg* volatile, assets as security
 - ensure that a minimum level of diversification is achieved.
- (ii) Derivatives may be restricted due to their potential volatility of value.



Question

Describe the function and services provided by a custodian.

Solution

A custodian holds investments on behalf of an investor and is able to account independently for any financial transactions.

The principal function of custody is to ensure that financial instruments are housed under a proper system that permits investment for proper purposes with proper authority.

Custodians are usually banks or other regulated institutions. Custodians offer not only custody of documents, but also a range of services such as:

- income collection
- tax recovery
- cash management
- securities settlement
- foreign exchange
- stock lending.

Also, the custodian will often exercise voting rights on behalf of the client.

5 Investment matching

5.1 Pure matching

In its purest form matching of assets and liabilities involves structuring the flow of income and maturity proceeds from the assets so that they coincide precisely with the net outgo from the liabilities under all circumstances.

This requires the sensitivity of the timing and amount of both the asset proceeds and the net liability outgo to be known with certainty and to be identical with respect to all factors.



Question

State which factors would be considered here.

Solution

- nature – *ie* fixed monetary amounts, linked to prices or varying in some other way
- term
- currency.

Some matching exercises are easy, *eg* outgo of 70 *pa* for ten years with a final payment of 1000 would be matched precisely by 1000 nominal of a 7% coupon, ten-year conventional bond.

Unfortunately, other liability cashflows may be more difficult to match and so *complete* or *pure* matching is rarely possible in practice.



Question

A life insurance company writes without-profit term assurance and whole of life assurance contracts. Give four reasons why the company may not be able to match its liabilities *precisely*.

Solution

1. The timing of the outgo is not certain.
2. The amount of the outgo is not certain for the term assurance contracts (*ie* zero if a policyholder survives, fixed amount if policyholder dies).
3. The term of the liabilities for the whole of life contracts will probably exceed the term of the available assets.
4. Unless zero-coupon bonds (or bond strips) are used, the income from the assets will need to be reinvested on unknown terms in the future.

Unless risk-free zero-coupon bonds can be used it is rarely possible to achieve pure matching, although a close approximation to a perfect match may be possible for certain life insurance products, such as guaranteed income bonds.

Moreover, the relative price of the bonds chosen for the matching may be such as to deter all but the most dogmatic institutions.

A further problem is that for some funds the term and size of the liabilities may be such that complete matching is unattainable because suitable assets are not available.

In practice therefore, 'matching' usually means approximate matching rather than complete or pure matching. Nevertheless it is often useful to view complete matching as the benchmark position against which to judge the investor's actual asset allocation.

5.2 Liability hedging

***Liability hedging* is where the assets are chosen in such a way as to perform in the same way as the liabilities.**

In other words, hedging against (or matching) *all* of the unpredictable changes in the liabilities that arise from unpredictable changes in the factors that influence liability values, *eg* interest rates, inflation levels, mortality experience.

Approximate liability hedging

In most situations, hedging liabilities with respect to *all* factors that affect liability values will not be possible. In such circumstances, the investor might try to hedge its liabilities with respect to *specific* factors that affect liability values.

Familiar forms of hedging include matching by currency and the consideration of the real or nominal nature of liabilities when determining the choice of assets.

However, these examples relate only to specific characteristics of the liabilities, whereas liability hedging aims to select assets that perform *exactly* like the liabilities in all events.

Full liability hedging

A situation in which full liability hedging is more achievable is when we are considering unit-linked liabilities.

When choosing assets to hedge unit-linked liabilities, the normal approach is to establish a portfolio of assets, determine a unit price by reference to the value of the asset portfolio, and then use this price to value the units and hence the liabilities.

The value of the liabilities is then said to be *implied* by the values of the assets. Even here though, perfect liability hedging is likely to be impossible in practice.

For example, suppose a particular investment fund aims to track the median fund in a particular investment sector. Suppose that information as to the asset allocations of all the funds in the sector is made available four weeks after each quarter end. As information about the asset allocation of the *median* fund will therefore only be available periodically and even then, it will be four weeks out of date, it will be impossible to hold assets that exactly match the median fund's assets.

6 Using a model to determine investment strategy

An asset-liability model is a tool to help determine what assets to invest in given a particular objective or objectives.

For example, it could be used to address the questions of:

- how far from a perfectly matched investment position an investor is able to move because of its free assets
- how well the cashflows from a chosen set of assets match the liability cashflows in a range of future economic scenarios.

An investor's objectives will normally be stated with reference to both assets and liabilities.

In setting an investment strategy to control the risk of failing to meet the objectives, a method that considers the variation in the assets simultaneously with the variation in the liabilities is required.

This can be done by constructing a model to project the asset proceeds and liability outgo into the future.

An advantage of this type of modelling is that it encourages investors to formulate explicit objectives. The objectives should include a quantifiable and measurable performance target, defined performance horizons and quantified confidence levels for achieving the target.

For example, typical objectives might be to:

- maximise the expected solvency level
- at the end of a three-year period
- subject to the probability of insolvency at any time over that period being $< 0.1\%$.

The outcome of a particular investment strategy is examined with the model and compared with the investment objectives. The investment strategy is adjusted in the light of the results obtained and the process repeated until the optimum strategy is reached.



Question

List the economic and investment assumptions that will have to be made in order to project forward and value the asset proceeds in an asset-liability model.

Solution

The economic and investment assumptions depend on the asset class.

For money market investments:

- future interest rates.

For bonds:

- future inflation
- future gross redemption yields (for fixed-interest) or real yields (for index-linked).

For equities:

- future dividend growth rates
- dividend yields.

For property:

- future rental growth rates (for property)
- rental yields (to value property).



Question

State the additional assumptions needed if the asset portfolio included overseas assets.

Solution

Further assumptions for:

- growth rates and yields in each country
- exchange rates
- the extra volatility created by currency fluctuation.

Often a more pragmatic approach is appropriate, *eg* treating overseas equities like domestic equities, and assuming overseas equity is notionally invested in the domestic market.

Modelling can either be deterministic or stochastic.

In a *deterministic model* the parameter values are fixed and the result of running the model is a single outcome. We would need to carry out a number of re-runs of the model based on different sets of assumptions to understand how robust the strategy is.

Alternatively, we could use a *stochastic model* which is, arguably, the most appropriate way of allowing for the volatility and uncertainty underlying the assets and liabilities.

In a stochastic model at least one of the parameters is assigned a probability distribution. The model is run many times to generate a distribution of outcomes.

An advantage of stochastic modelling is that it encourages investors to formulate explicit objectives. The objectives should include a quantifiable and measurable performance target, defined performance horizons and quantified confidence levels for achieving the target. For a financial institution, the objectives might be specified in terms of the results of a valuation carried out at a specified time in the future. In practice, there is likely to be feedback between the model output and the setting of the objectives.

The success of the strategy is monitored by means of regular valuations. The valuation results will be compared with the projections from the modelling process and adjustments made to the strategy to control the level of risk accepted by the strategy, if necessary.

The chapter summary starts on the next page so that you can keep
all the chapter summaries together for revision purposes

Chapter 15 Summary

The principles of investment

A provider should select investments that are appropriate to the:

- nature
- term
- currency, and
- uncertainty

of the liabilities, and

- the provider's appetite for risk.

Subject to the above, the investments should be selected to maximise the overall return (income plus capital) on the assets.

Liability cashflows

In practice the actual liability outgo in any year, or month, depends on:

- the monetary value of each of the constituents, and
- the probability of it being received or paid out.

The liability outgo may be split by nature into four categories:

1. guaranteed in money terms
2. guaranteed in terms of a prices index or similar
3. discretionary
4. investment-linked.

Mismatching

The existence of free assets or a surplus means that the provider can depart from the matching strategies so as to improve the overall return on its assets and benefit its:

- clients, through higher benefits or lower premium / contribution rates
- shareholders (if any), through higher dividends.

Regulation

The following controls affecting investment strategy may be implemented:

- restrictions on the types of assets that a provider can invest in
- restrictions on the amount of any particular type of asset that can be taken into account for the purpose of demonstrating solvency
- a requirement to match assets and liabilities by currency
- restrictions on the maximum exposure to a single counterparty
- custodianship of assets
- a requirement to hold a certain proportion of total assets in a particular class
- a requirement to hold a *mismatching reserve*
- a limit on the extent to which mismatching is allowed at all.

Pure matching

In its purest form matching of assets and liabilities involves structuring the flow of income and maturity proceeds from the assets so that they coincide precisely with the net outgo from the liabilities under all circumstances.

Liability hedging

Liability hedging is where the assets are chosen in such a way as to perform in the same way as the liabilities.

Asset-liability models

An appropriate model to project the asset proceeds and liability outgo into the future can be used to help set an investment strategy to control the risk of failing to meet the objectives.

Asset-liability models can be either deterministic or stochastic.



Chapter 15 Practice Questions

- 15.1 State the two main principles of investment for providers of financial benefits.
- 15.2 State the main cash inflows and outflows associated with a motor vehicle insurance policy (from the perspective of the insurer) and the uncertainty associated with the cashflows.
- 15.3 Compare the cashflows on a standalone critical illness contract with those on a term assurance contract with a critical illness rider from the viewpoint of the policyholder.
- 15.4 Analyse the claim liabilities of a general insurance company in terms of their likely nature, term, currency and certainty.
- 15.5 A small specialist general insurance company sells only health insurance contracts. The contracts provide money to meet the cost of medical treatments and also pay a benefit for each day spent in hospital as an in-patient.
- Exam style**
- The company is reviewing its investment strategy. The current assets are a mix of index-linked government bonds and cash instruments.
- (i) Describe the company's liabilities. [2]
- (ii) Discuss the main advantages and disadvantages to the insurance company of the current asset classes. [6]
- [Total 8]
- 15.6 A proprietary life insurance company sells a range of with-profit and unit-linked savings contracts. Describe how the level of the company's free assets influences the extent to which it should match its liabilities in respect of policyholder benefits. [10]
- Exam style**
- 15.7 Outline the regulatory controls that may be imposed to limit the investment freedom of general insurance companies in a particular country.
- 15.8 A defined benefit pension scheme offers benefits linked to final salary. Pensions in payment are guaranteed to increase at the lower of price inflation or 5% each year.
- Exam style**
- The trustees are carrying out a review of the scheme's investment strategy.
- (i) Describe the characteristics of the liabilities of the scheme. [10]
- (ii) Outline with reasons suitable matching assets that might be held by the scheme. [8]
- (iii) List the factors that affect the degree to which the scheme might mismatch assets and liabilities. [6]
- [Total 24]
- 15.9 Outline the limitations of a deterministic asset-liability model when testing the suitability of a given asset distribution.

The solutions start on the next page so that you can
separate the questions and solutions.



Chapter 15 Solutions

15.1 The two main principles of investment for providers of financial benefits are:

1. A provider should select investments that are appropriate to the nature, term and currency of the liabilities and the provider's appetite for risk.
2. Subject to this, the investments should be selected so as to maximise the overall return on the assets, where overall return includes both income and capital.

15.2 **Inflows**

The premium received at the start of the year or at regular intervals, *eg* monthly.

The amount and timing of the premium is known precisely ...

... unless endorsements are made to the policy or the policy is discontinued.

Outflows

Claim payments to policyholders or to third parties, *eg* vehicle repairers.

Both the amount and timing of the claim payments are uncertain.

Expenses incurred by the office including administration, rent of offices, staff costs *etc.*

Expense outflows will be relatively fixed in the short term, with the exception of claim-related expenses (which will depend on the timing and the amount of the claim).

15.3 **Premium**

Both contracts will have a single or regular (perhaps monthly) negative cashflow, the premium.

This will be of known amount (unless the contract is reviewable) and payable for the contract term or until the benefit event or death if earlier.

Benefit

For both contracts, the size of any benefit payment will depend upon the investment type of the contract, *eg* known on a without-profit contract.

The timing of the benefit payment is unknown.

Critical illness and term assurance policies do not normally pay a benefit on surrender, but if so it would be a single positive cashflow, unknown in timing and amount at the outset.

Standalone critical illness (CI)

Under the standalone CI contract there will be a single positive cashflow, the benefit payment on diagnosis of a critical illness covered by the policy during the contract term.

On maturity or death no cashflows occur (*ie* there is no benefit payment).

CI rider to term assurance

There will be a positive cashflow, the benefit payment on:

- diagnosis of a critical illness covered by the policy during the contract term
- death during the contract term.

If the policyholder both suffers a critical illness and then dies during the policy term then two benefit payments are made, one on each event (as the critical illness is a rider benefit rather than an acceleration of the term assurance).

No benefit payment is made at maturity.

Surrender payment

Critical illness and term assurance policies do not normally pay a benefit on surrender.

However, depending upon the terms of the contracts, it may be that a single positive cashflow, the surrender payment is made if the policyholder withdraws from the contract before the end of the term. The timing and size of this cashflow are unknown at outset.

15.4 **Certainty**

A key feature of general insurance claims is the high level of uncertainty of the amount, timing and frequency of the outgo.

Nature

Some claims may be for fixed monetary amounts, *eg* prescribed payouts on particular events.

However, many claims will relate to repairing property damage or settling liabilities ...

... and these payments are real rather than fixed in monetary terms.

They will be affected by a wide variety of types of inflation (*eg* building cost inflation, property damage inflation, wage inflation, personal injury claims inflation).

In the short-term, inflation in developed countries is often low and stable, so the liabilities may be relatively fixed.

Term

Many claims are short-term, *ie* to be settled within the next couple of years.

However, for some classes of business or certain types of claim (*eg* liability claims) the liabilities will be longer term, *eg* up to ten years or even more.

Currency

Most liabilities are likely to be in the domestic currency of the insurer.

However overseas currency liabilities may arise:

- by writing business where claims can arise overseas, such as travel, marine and aviation insurance
- by underwriting overseas risks
- if the company has overseas branches / subsidiaries.

15.5 (i) **Liabilities**

The liabilities are likely to be partly *real* in nature, with claims linked to medical cost inflation ... [½]

... and partly fixed, given a payment is made for each day spent in hospital. [½]

Expenses are real in nature, linked to price and salary inflation. [½]

They are short-term. [½]

There is some uncertainty associated with the timing and amount of the claims payments. [½]

The liabilities are likely to be predominantly in the domestic currency. [½]
[Maximum 2]

(ii) **Advantages and disadvantages of the current asset classes**

Index-linked government bonds

Advantages

These provide a real return, which is appropriate to the real nature of the insurance company's liabilities (as both the claims payments and expenses are real). [½]

Index-linked government bonds are lower risk (default / volatility), and correspondingly tend to offer lower expected returns than other real asset classes, *eg* equities. [½]

Index-linked bonds may attract favourable tax treatment. [½]

Disadvantages

The claims amounts are likely to increase in line with medical cost inflation, which may be expected to exceed price inflation. [½]

In addition, a large part of the expenses will be salary related and salary inflation tends to exceed price inflation. [½]

Cash instruments

Advantages

Cash instruments provide a good match to the short term of the majority of the liabilities. [½]

Cash instruments also provide liquidity, enabling the insurance company to pay unexpected claims without forced sale of assets. [½]

Cash instruments are a secure investment, having a low risk of default. [½]

The returns on cash instruments may provide a degree of inflation protection as short-term interest rates tend to move in line with inflation. [½]

Short-term investments such as cash offer stable monetary values. This may be useful as the insurance company is small and may be more worried about random variations in its experience. [½]

Cash may be suitable if the company expects other asset classes to perform badly, *eg* if the company anticipates a recession or an interest rate rise ahead of the market. [½]

Disadvantages

Cash investments tend to offer low expected returns. [½]

Cash does not provide a good match to medical cost inflation. [½]
[Maximum 6]

15.6 The existence of free assets means that the company can depart more from the matching strategy. [½]

So there is less need to choose investments that are appropriate to the nature, term and currency of the liabilities ... [½]

... but instead can look to improve the overall expected return on its assets. [½]

Improved returns would benefit the company's:

- customers – through higher benefits on with-profits business ... [½]
... and higher benefits and/or lower premiums on unit-linked business [½]
- shareholders – through higher dividends. [½]

With-profit liabilities

Broadly, with-profit liabilities will be a mix of:

- guaranteed benefits [½]
- discretionary benefits. [½]

It is almost always the case that assets with the highest expected return also have the highest variance of that return. [½]

Guaranteed benefits

The amount of free assets required to maintain a deliberately mismatched policy is often too great for a company to consider ... [½]

... given the alternative uses of free assets, in particular financing new business growth. [½]

Therefore, in practice any guaranteed liability outgo is generally matched as closely as possible irrespective of the level of free assets. [½]

With no free assets, if the assets supporting guaranteed benefits were invested in the assets with the highest expected return, the risk of insolvency would be too great. [½]

If there are free assets they could be used as a cushion to reduce the probability of becoming insolvent. [½]

The extent to which free assets enable mismatching depends on:

- the size of the free assets [½]
- the volatility of returns on the assets held in respect of the guaranteed benefits [½]
- the attitude to risk of the policyholders / shareholders. [½]

Discretionary benefits

It could be argued that matching assets to liabilities is irrelevant where the discretionary benefits are concerned since a provider will want to invest in the assets with the highest expected return in order to maximise the discretionary benefits. [1]

On the other hand, although the benefits are discretionary, the company should seek to meet policyholders' expectations. [½]

So the company will want to make use of some of the free assets / surplus, or a limited matching strategy so as to ensure that the probability of the discretionary benefits falling below a particular level stays within acceptable limits. [½]

Unit-linked liabilities

Unit-linked policies give rise to investment-linked benefits. [½]

These are normally matched by investing in the same assets as used to determine the benefits and so the extent of the company's free assets is not usually relevant. [½]

A provider offering unit-linked policies is unlikely to want to take on investment risk. [½]

However, it could be argued that it is a reasonable use of the free assets to mismatch investment-linked benefits, if, by so doing, the company can expect to achieve a higher return. [½]

If this is done any return achieved above that on the matched assets will not accrue to the unit-linked policyholders but to the owners of the profits on this business. [½]

In many territories such mismatching of investment linked benefits is disallowed by law or regulation. [½]

[Maximum 10]

15.7 The following regulatory controls may be imposed:

- restrictions on the *types* of assets that a company can invest in, *eg* no fine wine or oil paintings.
- Such a restriction could be a direct prohibition, *ie* not allow their purchase ...
... or an indirect restriction, *ie* allow the purchase but treat them as *inadmissible* (give them zero value in the assessment of the company's solvency).
- restrictions on the *amount* of any particular type of asset that can be taken into account for the purpose of demonstrating solvency ...
... in order to reduce the concentration of risk
- a requirement to match assets and liabilities by currency
- restrictions on the maximum exposure to a single counterparty
- rules on the custodianship of assets
- requirement to hold a certain proportion of total assets in a particular class ...
... for example, cash to provide a certain level of liquidity
- a requirement to hold a *mismatching reserve* if the company chooses not to match its liabilities
- a limit on the extent to which mismatching is allowed at all.

15.8 (i) ***Liabilities of the scheme***

The liabilities consist of benefit payments and expenses less contributions. [½]

Nature

Active members' benefits will be real, linked to salary growth. [½]

Deferred members' benefits are likely to be real, linked to price inflation in deferment. [½]

The nature of current pensioners' benefits depends upon the level of price inflation:

- if inflation is always greater than 5% then benefits are guaranteed in money terms [½]
- if inflation is always less than 5% then benefits are real [½]
- if inflation is sometimes above and sometimes below 5% then benefits are part fixed, part real in nature. [½]

There may also be a practice of awarding discretionary pension increases. [½]

Expenses will be real, linked to salary growth and price inflation. [½]

Contributions are a negative liability, which are likely to be linked to salary growth (as they are typically expressed as a percentage of salary), *ie* guaranteed in terms of an index of salaries. [½]

Term

Active members' benefits may be very long term, (for example, for a young member, term could be up to 70 years). [½]

Deferred members' benefits may be medium to long term. [½]

Current pensioners' benefits are short to medium term. [½]

The term of the expenses will depend on the term of the benefit payments. [½]

Contributions are likely to be paid regularly through the lifetime of the scheme (probably monthly). [½]

Currency

Benefit payments, expenses and contributions are likely to be denominated in the domestic currency. [½]

Uncertainty

Active members' benefits are uncertain in terms of the amount (defined in terms of future salary) ... [½]

... and the term (dependent on the lifetime of the member). [½]

Deferred members' benefits are uncertain in amount (linked to price inflation) ... [½]

... and in timing as there is uncertainty over whether the member will remain in the scheme until retirement, eg may request a transfer value. [½]

Current pensioners' benefits are uncertain in amount (linked to price inflation) ... [½]

... but known in timing ... [½]

... but there is uncertainty over the total term (dependent on the lifetime of the member). [½]

Other benefits such as death benefits and retirement lump sums may be uncertain. [½]

Expenses are unknown in amount and linked to the benefit payments in timing / term. [½]

Contributions are unknown in advance (linked to salary) but are generally known in timing unless, for example, the sponsor defaults or makes one-off contributions. [½]

[Maximum 10]

(ii) ***Suitable matching assets***

Investments in the domestic currency form a good match by currency. [1]

Domestic equities: [½]

- a broad match for active members' salary linked benefits in the long term [½]
- a good match for any discretionary pension increases as they are expected to yield high returns in the long term. [½]

Domestic government index-linked bonds: [½]

- a good match for the nature of the deferred members' benefits and some expenses [½]
- a good match for current pensioners' benefits if inflation is less than 5% *pa*. [½]

Domestic government conventional bonds: [½]

- a good match for current pensioners' benefits if inflation is greater than 5% *pa*. [½]

Cash and money market instruments: [½]

- a good match for short-term cashflow requirements, *eg* immediate pension payments, expenses and transfer value payments [½]
- the need for cash is lessened if there is a steady stream of contributions, since contributions can be used to meet short-term outgo. [½]

Property:

- a real asset, so a broad match for real liabilities [½]
- rents can be used to pay for benefit outgo (as long as there are other liquid assets too) [½]
- offers diversification from equities. [½]

Derivatives for hedging: [½]

- derivatives may be used to aid matching of the pensions in payment increases if inflation is sometimes above 5% and sometimes below. [½]

Overseas assets: [½]

- can provide a reasonable match to long-term, real, domestic liabilities ... [½]
 ... due to the purchasing power parity path theory, which says that, in the long term, the exchange rate moves to offset differences in inflation. [½]

[Maximum 8]

(iii) **Factors affecting mismatching**

- the funding level of the scheme – the higher the funding level, the greater the scope to mismatch
- the size of the scheme – all else being equal a larger scheme can take more mismatching risk
- the objectives of the sponsor and the trustees
- the risk appetite of the sponsor and the trustees
- legislation affecting which asset classes can be held
- scheme rules affecting which asset classes can be held
- tax treatment of different assets
- the availability of assets, for example whether index-linked bonds are available
- the relative cheapness and dearness of different asset classes
- the extent to which benefits are insured, for example if the scheme has insured death-in-service benefits then there is greater scope to mismatch
- the dealing costs involved
- the scheme's investment expertise
- whether the scheme is expanding or contracting
- the approach taken by competitor schemes
- the need for diversification. [½ each, maximum 6]

15.9 The investment return assumptions in a deterministic model are based on estimates of the expected return from each asset class.

This fails to take into account the *variability* of asset returns ...

... and the correlations between investment returns on different asset classes and between the assets and liabilities.

Run a deterministic model a number of times considering different scenarios (*eg* low inflation, high inflation *etc*).

Scenario setting is, however, highly subjective ...

... and in practice only a limited number of runs will be feasible.

If there is a lot of variability in the parameters, even scenario testing may not identify the true extent of the risk of insolvency.

With a deterministic model, a problem will only be identified if the relevant scenario is actually modelled. Some apparently innocuous scenarios may in fact lead to financial difficulties.

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Investment management

Syllabus objectives

11.6.1 Discuss the principles and objectives of investment management and analyse the investment needs of an investor, taking into account liabilities, liquidity requirements and the risk appetite of the investor.

(Covered in part in this chapter.)

11.6.5 Discuss methods of quantifying the risk of investing in different classes and sub-classes of investment.

11.8.3 Describe the use of a risk budget for controlling risks in a portfolio.

11.8.4 Describe the techniques used to construct and monitor a specific asset portfolio.

11.8.5 Discuss the need to monitor investment performance and to review investment strategy.

12.2.2 Describe how a provider can analyse performance of an investment portfolio against a benchmark.

0 Introduction

In this chapter we explore:

- various approaches to setting an investment strategy
- how to monitor and analyse investment performance.

First we will look at two possible investment approaches that can be taken:

- an *active* approach
- a *passive* approach.

Then we will explore the factors to consider when making short-term tactical switches away from a long-term strategy.

We will also explore the idea of risk budgeting and constructing a portfolio, (*ie* deciding how much risk to take and where to take it).

Finally, we will cover the reasons for monitoring investment strategy, the different ways of measuring key investment risks and how to analyse investment performance against a benchmark, including the use of money-weighted and time-weighted rate of return.

1 Active and passive investment management

In managing investments, whether directly or through a specialist manager, there are two distinct approaches that can be adopted; active management and passive management.

1.1 Active investment management

Having identified the strategic asset allocation, an *active* approach involves actively seeking out under- or over-priced assets, which can then be traded in an attempt to enhance investment returns.

This involves making short-term tactical deviations away from the benchmark strategic position and is likely to involve switching between assets.

Active management is where the manager has few restrictions on the choice of investments, perhaps just a broad benchmark of asset classes.

This enables the manager to make judgements regarding the future performance of individual investments, both in the long term and the short term.

Active management could achieve higher returns by identifying:

- under- or over-priced sectors (eg banks or oil companies), to make *sector selection profits*
- individual stocks that are under- or over-priced, to make *stock selection profits*.

Active management is generally expected to produce greater returns due to the freedom to apply judgement.

However, this is likely to be offset by:

- the extra costs involved in more regular transactions, particularly when attempting to make short-term gains
- the risk that the manager's judgement is wrong and so the returns are lower.

Producing greater returns will not be possible if the investment market in question is *efficient*. Thus, active investment management is appropriate only if the investor believes that the investment market is in fact inefficient.



Question

Explain what is meant by an *efficient* investment market.

Solution

An efficient investment market is one in which asset prices accurately reflect all available and relevant information at all times.

1.2 Passive investment management

Passive management is the holding of assets that closely reflect those underlying a certain index or specific benchmark. The manager has little freedom to choose investments.

One important example of a passive approach is index tracking, whereby the investor selects investments to replicate the movements of a chosen index. The portfolio is then changed subsequently only in response to changes in the constituents of the index.



Question

Explain why might a passive approach to investment management might be suitable in an efficient investment market.

Solution

An efficient investment market is, by definition, one in which it is impossible to generate excess risk-adjusted returns by pursuing an active investment approach.

Thus, a passive approach might be more suitable, particularly if it is less expensive to adopt than an active strategy, which is likely to incur much greater dealing and research costs.

Passive investment is not entirely risk-free as the index may perform badly or there may be tracking errors.

In practice, the investor might choose to combine the active and passive approaches, managing assets actively within some asset classes and sectors and passively within others.

2 Tactical asset allocation

Tactical decisions involve short-term switching between investments in pursuit of higher returns. This contrasts with strategic investment decisions which involve setting the relatively long-term structure of a portfolio, *eg* deciding the percentage allocation between different asset classes.

An attempt to maximise return may involve tactical asset allocation, which is a departure from the benchmark position and hence conflicts with the minimisation of risk. The size of the assets relative to the liabilities will determine the risk involved in such an action.

Thus, the investor may make short-term tactical deviations away from the long-term strategic asset allocation in order to take advantage of the temporary under- or over-pricing of particular assets. This will be done if the extra expected returns from doing so outweigh the additional risk incurred.

Factors to be considered before making a tactical asset switch are

- **the expected extra returns to be made relative to the additional risk (if any)**
- **constraints on the changes that can be made to the portfolio**
- **the expenses of making the switch**
- **the problems of switching a large portfolio of assets ...**
... such as shifting market prices
- the tax liability arising if a capital gain is crystallised
- the difficulty of carrying out the switch at a good time.

The problems are particularly acute when unmarketable securities are involved.

In making the switch, there is a balance between:

- selling the asset at a bad time
- the switch taking a long time.

A partial solution to this problem is to use derivatives to gain the required exposure immediately and then to conduct a gradual sale of the portfolio. Institutions do use this technique in practice.

3 Risk budgeting

The term *risk budgeting* refers to the process of establishing how much risk should be taken and where it is most efficient to take the risk in order to maximise return.

The process of risk management for the organisation as a whole is described in Parts 7 and 8 of the Course Notes.

For investment risks, the risk budgeting process has two parts:

1. **deciding how to allocate the maximum permitted overall risk between total fund active risk and strategic risk**
ie how much risk in total the individual fund managers are allowed to take in order to out-perform their allocated benchmarks and how far to depart from the theoretically matched benchmark
2. **allocating the total fund active risk budget across the component portfolios**
eg how much risk the UK equity manager can take, the UK bond manager can take etc.

The key focus when setting the strategic asset allocation is the risk tolerance of the stakeholders in the fund.

This is the systematic risk they are prepared to take on in the attempt to enhance long-term returns.

The key question on active risk is whether it is believed that active management generates positive excess returns.



Question

- (i) Explain how you might test whether active management does generate positive returns.
- (ii) Outline reasons why this test may not give a true reflection of the merits of active management.

Solution

- (i) ***Testing whether generates positive returns***

The simplest method of testing this would be to compare the long-term performance of a selection of active funds against a number of index-trackers.

(ii) ***Why test may not be a true reflection***

- there may be different constraints on the active managers that affect their performance relative to the trackers
 - the amount of risk may be higher in the active managers' portfolios
 - there will be a *survivorship* issue whereby many poor performing active funds would cease to gain new business and be wound up – hence there will be a bias towards those active funds that have performed adequately
 - past performance does not act as a good guide to future performance
 - the objectives of the active and passive managers (*ie* the index) may be different.
-

Risk budgeting is, therefore, an investment style where asset allocations are based on an asset's risk contribution to the portfolio as well as on the asset's expected return.

A risk budgeting strategy can free the manager to look for alternative investments that might increase the expected return on the portfolio. Because the constraint is that the total risk of the portfolio must stay at or below a targeted level, increased attention is paid to low correlation investments. Allocations to such investments can reduce the total risk of the portfolio through diversification.

4 Portfolio construction and benchmarking

Earlier chapters have dealt with the strategic issues surrounding investment management, and the matching of assets to liabilities. We now turn to the management of a particular asset portfolio.

Strategic risk and active risk

In managing an investment fund, managers will often face two conflicting objectives:

1. to ensure security; and
2. to achieve high long-term investment returns.

The first objective encourages a cautious approach, where the assets chosen follow the benchmark or target, while the second encourages a move away from the benchmark into assets that are expected to generate higher returns, although with a higher associated risk.

The investment policy needs to reflect the extent to which the risks of lower stability and security are accepted in order to aim for higher returns.

This will typically involve a two-stage process:

1. Firstly, an appropriate asset mix must be established for the fund – the *strategic benchmark*.

This will be set taking into account the nature of the liabilities, and any representations about the structure or asset mix of the fund that have been made to investors. The tools described in this and the previous chapter can be used in setting the strategic benchmark.

The *strategic (or policy) risk* of the fund is the risk of poor performance of the strategic benchmark relative to the value of the liabilities.

If a fund's liabilities are thought to be best matched with an asset mix of 80% equities and 20% bonds, then a strategic benchmark might be set equal to 90% equities and 10% bonds if equities were thought to offer higher long-term returns.

Strategic risk reflects both the risk of the matched benchmark relative to the liabilities and the risk taken by the strategic benchmark relative to the matched benchmark.

2. Secondly, the strategy is implemented by the selection of one or more managers, and a decision on the appropriate level of risk that these managers should take relative to the strategic benchmark.

Within their guidelines, the investment managers have freedom over stock selection, and use their skills and research to maximise the return on the funds allocated to them.

The allocation of this part of the investment risk budget is known as the *active (or manager or implementation) risk*.

Each individual fund manager will be given a benchmark, which for domestic equities might be an appropriate equity index.

The zero-active-risk approach would be simply to track the index. However, the fund could allow an amount of active risk to be taken by the fund manager in an attempt to out-perform.

The return that an active investment manager achieves relative to his particular benchmark can be defined as *active return*.

If the active manager achieves a return of 4% compared with a benchmark return of 3%, then he has achieved an active return of +1%.

As the active returns achieved are uncertain and will vary between time periods, we can measure *active risk* as the *standard deviation of the active return*, although other measures of risk could also be used.

Generally, the more active the manager's approach – *ie* the greater the deviation from the benchmark – then the greater the active risk, and hopefully also the active return.

Structural risk

There may also be some structural risk associated with any mismatch between the aggregate of the portfolio benchmarks and the total fund benchmark.

A fund may have a total benchmark expressed in terms of an index or its peers' investments. But the investments in the index or peers may change and there may be some delay in understanding the new constituents, *eg* due to a time lag. If so, there is an element of structural risk.

Overall risk

The overall risk is the 'sum' of the active, strategic and structural risks.

5 Monitoring investment performance and strategy

In the remaining sections of this chapter we will explore the need to monitor investment strategy and how investment performance can be analysed.

It is necessary to review the continued appropriateness of any investment strategy at regular intervals because:

- **the liability structure may have changed significantly (for example, following the writing of a new class of business, a takeover, benefit improvements or legislation)**
- **the funding or free asset position may have changed significantly**

Funding position is terminology that is most commonly used when referring to a defined benefit scheme. When referring to an insurer it is more usual to refer to the *free assets* or *surplus* or the *solvency position*.

- **the manager's performance may be significantly out of line with that of other funds.**



Question

Explain who benefits if:

- the investments held in a defined benefit scheme achieve higher than expected returns
- a life insurance company achieves higher than expected investment returns.

Solution

(i) **Defined benefit pension scheme**

- current pensioners – who may receive enhanced benefits
- active members – who may benefit from reduced contributions
- active and deferred members – who may benefit from enhanced benefit entitlements
- the scheme sponsor – who may have lower contributions to make
- investment managers – who may receive higher performance-related fees
- tax authorities – who may receive more tax on the pensions in payment

(ii) **Life insurance company**

- policyholders with discretionary benefits – may receive higher benefits
- policyholders with variable premiums / charges – who may benefit from reductions in these
- policyholders with unit-linked contracts – may receive higher benefits
- shareholders through higher dividends
- directors whose remuneration may be dependent on the company's performance

Setting performance objectives

In some cases, an investment manager will work to a performance objective in which the return is judged relative to that achieved by other managers for similar funds.

The more severe the restrictions placed on the managers on the assets or asset classes that can be held, the less appropriate it is to set performance targets that relate directly to the generality of funds.

The target return should therefore be compared against that which will have been achieved by an index fund, which had maintained the asset allocation proportions set in the benchmark.

Some investment managers are given significant investment freedom and are briefed to perform both the asset allocation between the various major asset classes and, within this, stock selection.

Other schemes specify a strategic investment *norm*, or benchmark, and operating bands around this norm to allow investment managers to take tactical decisions in pursuit of greater investment performance.

Asset-liability modelling can help to set an appropriate strategic investment policy for the scheme and also to review the policy from time to time.

Constraints on the manager's performance

It is also important to note any other constraints that may have affected the manager's performance, such as a shortage of cashflow within the provider.

This may restrict the funds available for investment or lead to disinvestments that may not be timed as well as would otherwise be the case.

6 Measuring different investment risks

In this section we explore how some of the investment risks may be measured.

6.1 Tactical asset allocation risk

Tactical asset allocation risk is the risk of following an active investment strategy rather than tracking the benchmark index.

Historic tracking error

The most usual measure adopted is the retrospective or backwards-looking tracking error – the annualised standard deviation of the difference between portfolio return and benchmark return, based on observed relative performance.

This is generally the standard deviation of the *difference* between two returns, not the standard deviation of returns.

Forward-looking tracking error

The equivalent prospective measure is the forward-looking tracking error – an estimate of the standard deviation of returns (relative to the benchmark) that the portfolio might experience in the future if its current structure were to remain unaltered. This measure is derived by quantitative modelling techniques.

These forward predictions are generally based on volatility and correlation data that is derived from past performance. Hence there is an element of backward-looking here too. However, it does allow us to model the current portfolio going forward, rather than the historical portfolio, which might have changed considerably over time.

6.2 Strategic asset allocation risk

Where an overall portfolio is managed by a single manager, the manager will normally be given a target range of asset allocation as a percentage of the fund. For example: equities 40% to 60%, government bonds 10% to 50%, corporate bonds 20% to 50%, cash 0% to 25%. A target asset allocation which may not always be the centre point of the individual ranges will also be provided.

A strategic asset allocation risk can be measured using the forward and backward looking approaches as above, assuming that the relevant parts of the portfolio were invested in the appropriate benchmark indices, and the effects of the actual strategic allocation compared with the target allocation.

6.3 Duration risk

A portfolio that needs to closely match assets with liabilities will also have a target and an acceptable range for the duration of the fixed interest element.

Otherwise the investments may be:

- too long for the liabilities (leading to liquidity risk)
- too short for the liabilities (leading to reinvestment risk).

The above techniques can be used to measure the risk taken by departing from the target duration.

6.4 Counterparty, interest rate and equity market risk

Other investment risks are more difficult to quantify.

For example a reasonably large corporate bond portfolio might only expect one default every five years. The above techniques would suggest that if no default has occurred, then no risk has been taken.

The best proxy to quantify the risk being taken is to use the amount of capital that is necessary to hold against the risk.

This is relatively straightforward for financial product providers who have to carry out a capital requirements calculation. Firms subject to the European Solvency II regime can use their internal model or the standard formula, as appropriate.

We will cover capital management and the Solvency II regime in a later chapter. Solvency II capital requirements allow for credit, interest rate and market risk, *ie* a greater amount of capital needs to be held if the investments held are subject to default risk.

It is then possible to calculate the capital required for a target portfolio and the actual portfolio as measures of the risks taken.

6.5 Diversification benefits

When carrying out the above analysis of the costs of risk, it is also necessary to allow for the benefits of diversification, which can be assessed using similar techniques.



Question

Explain how diversification can be beneficial in reducing risk.

Solution

Diversification within and across asset classes reduces exposure to specific risk.

In theory a wholly diversified portfolio should have zero specific risk (and therefore only be subject to systematic risk).

7 Analysis of investment performance against a benchmark

7.1 Comparative performance

Traditionally there have been various formulae used to analyse the performance of a fund manager against the benchmark allocated. None of these are now used in practice. This is because the commonly used benchmarks are calculated at least daily, and for some major indices an index value is available at any time in the day.

The simplest way of comparing the actual performance of a fund against its benchmark is to input all the cashflows that went into or out of the fund onto a spreadsheet that also holds the daily values of the benchmark.

Therefore, it is possible to calculate readily the value of the fund over a period if it had been invested in the benchmark rather than in the actual assets held.

Care needs to be taken over the treatment of income; in particular whether a benchmark index includes reinvestment of income.

- If the index includes income reinvested, then dividends and interest on the actual portfolio are excluded as cashflows (but included in valuing the new end-period value of assets).
- If the benchmark is capital only then the actual income from the assets held needs to be included as cashflows.

The approach used will depend on whether the manager is assessed on capital or total investment performance.

The comparison must also allow for fees.

Alternatively, it may be possible to exclude fees out of both and look at fees separately.

A decision will be needed on how frequently performance is to be monitored. This should be regular enough to achieve the company's objectives, to be confident that it can monitor performance, but mindful of the expense of monitoring too frequently. Most investment mandates are designed for medium- to long-term performance, so care must be taken not to overstate the impact in the very short term of market fluctuations.

An analysis of reasons for departures from the benchmark performance could be sought from the manager.

This will be important to help understand how the investment strategy should be altered (if at all).

Performance of an overall investment strategy may also be monitored relative to a liability benchmark.

7.2 Time weighted and money weighted rates of return

Money-weighted and time-weighted rates of return are two methods of measuring the performance or the rate of return on an investment portfolio.

Each of these two approaches has particular instances where it is the preferred method.

Money-Weighted Rate of Return

A money-weighted rate of return (MWRR) is identical in concept to an internal rate of return: it is the discount rate at which the present value of inflows = present value of outflows in a portfolio. The MWRR allows for all cashflows and their timing, and is the same approach as described above.

The MWRR only takes account of new money into the fund or money disinvested by the fund. Any cashflows generated by the fund itself are ignored.



Question

Explain why cashflows such as interest, dividends and capital gains, which are generated by the fund itself, are ignored in the calculation, whereas cashflows in respect of new money into the fund or money disinvested from the fund must be included.

Solution

It is the interest, dividends and capital gains that lead to the growth in the value of the fund, which is what the MWRR, i is measuring. These payments are already 'absorbed' in the value of i . Including them as cashflows in the equation would result in double counting.

Investment income and capital gains aren't really 'cashflows' but increases to the value of the fund.

On the other hand, cashflows in respect of new money into the fund or disinvestment from the fund, are not reflected in the value of i , and so these must be included as extra terms in the calculation.

It is important to understand the main limitation of the MWRR as a tool for evaluating managers.

The MWRR factors in all cashflows, including contributions and withdrawals. Assuming a MWRR is calculated over many periods, the formula will tend to place a greater weight on the performance in periods when the account size is highest (hence the label *money-weighted*).

If a manager outperforms the benchmark for a long period when an account is small, and then (after the client deposits more funds) the manager has a short period of underperformance, the money-weighted measure may not treat the manager fairly over the whole period.

Time-Weighted Rate of Return

Deposits and withdrawals are usually outside a manager's control; thus, a better performance measurement tool (than MWRR) is needed to judge a manager more fairly and allow for comparisons with peers – a measurement tool that will isolate the investment actions, and not penalise for deposit / withdrawal activity.

The time-weighted rate of return (TWRR) is the preferred industry standard as it is not sensitive to contributions or withdrawals.

The rationale here is to calculate the 'growth factors' reflecting the change in the value of the fund between the times of consecutive cashflows (*ie* during periods when there was no investment of new money into the fund or disinvestment of money from the fund), then to combine these growth factors to come up with an overall rate of return for the whole period.

The time-weighted rate of return is found from the product of the growth factors between consecutive cashflows.

It is defined as the compounded growth rate of 1 over the period being measured. No account is taken of flows of money into or out of the portfolio.

Again, the cashflows in the formula for calculating the TWRR only include those relating to new money. Any cashflows generated by the fund itself must be taken into account in the figures for the fund value.

Dividend income can be assumed to be reinvested or not, as required. This is the same basis on which benchmark indices are calculated, so it has the advantage of comparing like with like.

Using the TWRR will not identify the manager who has a skill at managing small funds and is weak at managing large funds, or vice versa.

The MWRR places greater weighting on the periods when the fund size is largest.

It is important to understand the consequences of the assessment method used and to choose that most appropriate for the circumstances of the business and the purpose of the comparison.



Question

The market value of a small pension fund's assets was £3.3m on 1 January and £3.8m at the end of that year (31 December). During the year the only cashflows were:

- bank interest and dividends totalling £125,000 received on 30 June
 - a lump sum retirement benefit of £60,000 paid on 1 May
 - a contribution of £95,000 paid by the company on 31 December.
- (i) Show that the money-weighted rate of return is 14.25%.
- (ii) The fund value (including all accrued interest and capital gains) was £3.5m on the 30 April of that year. Calculate the time-weighted rate of return.

Solution

- (i) ***Money-weighted rate of return***

Only the last two payments represent new money. So the equation of value (working in £000s) is:

$$3,300(1+i) - 60(1+i)^{8/12} + 95 = 3,800$$

Evaluating the LHS at an interest rate of 14.25%, gives a result of 3,799.68 ~ RHS.

(ii) ***Time-weighted rate of return***

The progress of the fund (again working in £000s) was as follows:

<i>1 January to 30 April</i>	Fund value increased from £3,300 to £3,500
<i>1 May</i>	Cashflow of –£60
<i>1 May to 30 December</i>	Fund value increased from £3,440 to £3,705
<i>31 December</i>	Cashflow of +£95, taking fund value to £3,800

So, during the period from 1 January to 30 April, there were no cashflows and the fund value grew by a factor of:

$$\frac{3,500}{3,300} = 1.0606$$

During the period from 1 May to 30 December, the fund value grew by a factor of:

$$\frac{3,800 - 95}{3,500 - 60} = 1.077$$

So the growth factor for the whole year is $1.0606 \times 1.077 = 1.142$ and the TWRR is 14.2%.

7.3 Collective investment schemes

Let's finally consider analysing the performance of collective investment schemes such as investment trust companies.

Collective investment schemes have a daily (sometimes less frequent) pricing point. This is the time of day at which the values of the underlying assets in the scheme are captured. It is commonly noon or 3 *pm* and is rarely at market close. Published market indices are normally quoted at close of business.

Intra-day movements in certain markets can be material and so to make a fair assessment of the scheme manager it is necessary to capture the relevant benchmark indices at the same time of day as the pricing point.

Not all market indices are available publicly on a continuous basis.

The chapter summary starts on the next page so that you can keep all the chapter summaries together for revision purposes.

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Chapter 16 Summary

Active and passive investment management

Active – where the investment manager has few restrictions on investment choice within a broad remit. It is expected to produce greater returns despite extra dealing costs and risks of poor judgement.

Passive – involves holding assets closely reflecting those underlying an index or specified benchmark. The investment manager has little freedom of choice. There remains the risk of tracking errors and the index performing poorly.

Tactical asset allocation

Tactical asset allocation involves a short-term departure from the benchmark position in pursuit of higher returns. Before making a tactical switch consider:

- the expected extra returns compared with additional risk
- any constraints on changing the portfolio
- the expenses of making the switch
- any problems of switching a large amount of assets.

Risk budgeting

Risk budgeting is a process that establishes how much risk should be taken and where it is most efficient to take the risk (in order to maximise return).

With regard to investment risks, the risk budgeting process has two parts:

1. deciding how to allocate the maximum permitted overall risk between active risk and strategic risk
2. allocating the active risk budget across the component portfolios.

Portfolio construction

Portfolios are typically constructed to meet two (often conflicting) objectives of:

1. ensuring security
2. achieving high long-term returns.

The process of quantifying risk often involves dividing risk into:

- *strategic risk* – the risk that the strategic benchmark does not match the liabilities
- *active risk* – the risk taken by the individual investment managers relative to the given benchmarks
- *structural risk* – where the aggregate of the individual investment manager benchmarks does not equal the total benchmark for the fund.

Monitoring investment performance and strategy

It is necessary to review the continued appropriateness of any investment strategy at regular intervals because:

- the liability structure may have changed significantly
- the funding or free asset position may have changed significantly
- the manager's performance may be significantly out of line with that of other funds.

It is likely that an investment manager will work to a performance objective in which the return is judged relative to that achieved by other managers for similar funds.

It is also important to note any other constraints that may have affected the manager's performance, such as a shortage of cashflow within the provider.

Measuring investment risks

Historic tracking error is the annualised standard deviation of the difference between actual fund performance and benchmark performance.

Forward-looking tracking error involves modelling the future experience of the fund based on its current holdings and likely future volatility and correlations to other holdings.

Strategic risk can be measured using forward- and backward-looking approaches, assuming relevant parts of the portfolio were invested in the appropriate benchmark indices, and the effects of the actual strategic allocation compared with the target allocation.

A proxy of the amount of capital required to be held against the risk can be considered. Under Solvency II can base this assessment on the internal model or standard formulae.

When analysing investment risks, allowance needs to be made for diversification benefits.

Analysis of investment performance against a benchmark

The simplest approach is to input all cashflows into and out of a fund into a spreadsheet that also holds the daily values of the benchmark.

Care needs to be taken over the treatment of income. If the index includes income reinvested, then should ignore income as cashflow on the actual portfolio but include in valuing the new end-period value of assets. Decide how frequently to monitor, bearing in mind objectives and cost of monitoring.

Money-weighted rate of return (MWRR)

MWRR is the discount rate at which the present value of inflows = present value of outflows in a portfolio.

The formula places a greater weight on performance when the fund size is highest. Deposits and withdrawals are often outside a manager's control, therefore a fairer measure may be time-weighted rate of return.

Time-weighted rate of return (TWRR)

TWRR is defined as the compounded growth rate of 1 over the period being measured. No account is taken of flows of money into or out of the portfolio.

This is the same basis on which benchmark indices are calculated. TWRR will not identify managers with skill at managing only funds of a particular size.

Collective investment schemes

Usually priced daily or less frequently. Intra-day movements in certain markets can be material. Need to capture benchmark indices at same time of day.

The practice questions start on the next page so that you can keep the chapter summaries together for revision purposes.



Chapter 16 Practice Questions

- 16.1 (i) Explain the difference between an active and a passive investment management strategy.
- (ii) Outline under what circumstances a passive strategy might be most appropriate for a particular investor.
- 16.2 You have been asked to design a suitable portfolio for a charitable fund that awards bursaries each year to promising young actuarial students.
- (i) Describe how the process of risk budgeting could help you achieve this task.
- (ii) Explain the two key advantages of the risk budgeting approach to asset allocation.
- 16.3 List four factors to be considered before making a tactical asset switch.
- 16.4 A charity employs an investment manager to implement an investment strategy established by the charity's trustees. The trustees review the strategy at six-monthly intervals. Explain why it is important for the trustees to review the investment strategy. [5]

Exam style

The solutions start on the next page so that you can
separate the questions and solutions.



Chapter 16 Solutions

16.1 (i) ***Difference between an active and a passive investment management strategy***

Active management is where the manager has few restrictions on the choice of investments, perhaps just a broad benchmark of asset classes.

This enables the manager to make judgements as to the future performance of individual investments, both in the long term and the short term.

Active management may produce higher expected returns due to the freedom to apply judgement.

Passive management is the holding of assets that closely reflect those underlying a certain index or specific benchmark.

The manager therefore has little freedom to choose investments.

(ii) ***Circumstances under which a passive strategy is appropriate***

A passive strategy might be most appropriate for a particular investor when:

- the investment market is very efficient, so that there are unlikely to be any price inefficiencies to be exploited
- the portfolio consists of unmarketable assets, so that the high dealing expenses associated with active trading would eliminate any additional investment returns
- the investor has little information or expertise in a particular investment market, so may wish to simply track or match a particular benchmark or index, to reduce the possibility of underperformance
- the investor's stated investment objective is to pursue a particular form of passive strategy – *eg* track an index.

16.2 (i) ***Risk budgeting***

The term *risk budgeting* refers to the process of establishing how much risk should be taken and where it is most efficient to take the risk in order to maximise return.

The charity's liabilities will be the payments to students already granted bursaries plus cashflows arising from future intended awards.

The risk budgeting process has two parts:

1. Decide how to allocate the risk between strategic risk (*ie* the risk taken relative to the liabilities) ...
... and active risk (the extent to which individual portfolio investment managers are allowed to deviate from their benchmark portfolios).
2. Allocate the total fund active risk budget across the component portfolios.

The distribution of risk will depend on the risk attitude of the charity's sponsors ...

... they must consider how much systematic risk they are willing to take to achieve higher returns.

It will also depend on whether the sponsors believe that active management adds value or not.

Risk exposures will need to be monitored over time and rebalancing should be carried to keep the total risk within the tolerable limits.

(ii) **Key advantages of risk budgeting**

Firstly, risk budgeting bases asset allocations not purely on the asset's *expected return* but also on its *risk* contribution to the portfolio.

Secondly, risk budgeting increases the attention paid to low correlation investments.

Allocations to such investments can reduce the total risk of the portfolio through diversification.

16.3 Factors to be considered before making a tactical asset switch are:

- the expected extra returns to be made relative to the additional risk (if any)
- constraints on the changes that can be made to the portfolio
- the expenses of making the switch
- the problems of switching a large portfolio of assets.

16.4 *Matching liabilities*

It is likely that a key component of the strategy is to match assets and liabilities and these may have changed significantly within six months. [½]

For example:

- the level of donations may have changed [½]
- the charity may have received a grant or substantial donation, reducing its need for short-term liquid assets [½]
- the nature of the charity's projects may have changed, perhaps changing the term of the liabilities. [½]

There may have been a change in any relevant legislation changing the range of asset classes available or their relative attractiveness. [½]

Funding

The funding position of the charity may have changed significantly, for example after a large inflow of monies ... [½]

.. or a change in the tax position (*eg* in future the charity may be entitled to gross rather than net investment returns). [½]

The more well-funded the charity, the greater the extent to which it can depart from a matching strategy so as to improve the overall investment return. [½]

Management performance

The investment manager's performance may be significantly out of line with that of other managers. [½]

In particular, if the investment manager's performance lags behind other managers, the trustees should consider changing their manager. [½]

However, they should ensure that they are comparing performance with other managers subject to the same constraints as those imposed on the fund manager ... [½]

... and that they look over a long enough time period that the result is not just due to random fluctuations. [½]

[Maximum 5]

End of Part 4

What next?

1. Briefly **review** the key areas of Part 4 and/or re-read the **summaries** at the end of Chapters 13 to 16.
2. Ensure you have attempted some of the **Practice Questions** at the end of each chapter in Part 4. If you don't have time to do them all, you could save the remainder for use as part of your revision.
3. Attempt **Assignment X2**.

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Modelling

Syllabus objectives

11.1.1 Describe the approaches available to produce the solution to an actuarial or financial problem.

11.1.2 Describe the construction of actuarial models to produce solutions in terms of:

- the objectives of the model
- the operational issues that should be considered in designing and running models.

11.1.3 Describe the use of models for:

- pricing or setting future financing strategies
- risk management: assessing the capital requirements and the return on capital or the funding levels required
- assessing the provisions needed for existing commitments to provide benefits on contingent events
- pricing and valuing options and guarantees.

11.1.4 Describe how sensitivity analysis of the results of the models can be used to help decision making.

0 Introduction

In this chapter we look at approaches that can be used in developing the solution to actuarial problems. Much of the material covered in this chapter is generic and therefore applicable when solving any one of a wide range of problems that an actuary might encounter.

In Section 1 we consider why models are often used to arrive at a solution to an actuarial problem. We also consider the different options available to a company in terms of the source of the model.

Section 2 examines the key objective of a model and operational issues that need to be considered when models are being constructed. In addition, we address the important decision as to whether the model should be deterministic or stochastic in nature, and outline the steps that should be carried out in order to develop each of these two types of model.

In Section 3 we consider the use of models for pricing a life insurance company's business. In this section we will introduce:

- the idea of using model points, *ie* finding representative policies to use to try to mirror the key characteristics of all of the policies
- different approaches that can be used to determine a discount rate for discounting cashflows
- other factors that may influence the prices charged for products.

In Section 4 we consider the use of models for managing benefit schemes. The model can help determine the appropriate amount and timing of contributions.

In Section 5 we consider the use of models to aid in risk management.

In Section 6 we explain how liabilities are valued for regulatory purposes.

In Section 7 we discuss how options and guarantees can be modelled in order to assess their value.

In Section 8 we examine the benefits of carrying out sensitivity analyses to understand the potential variability of future experience.

In Section 9 we include a Core Reading question on modelling.

Modelling is central to many of the chapters that follow. In particular:

- *Data* is one of the key inputs into any model. By data we are referring to information regarding policyholders or members. In some cases data relating to each policyholder or member will be used; in other cases it will be necessary to create model points, *ie* summarise the data.
- *Assumptions* such as mortality and interest rates are another key input into the modelling process. They should be set so that they are appropriate for the purpose.
- Models may be used to project how *mortality and morbidity* rates could change in future.
- *Expense* assumptions are often needed as inputs into cashflow models. In addition, modelling can be used in order to allocate expenses between different classes of business and different policies.
- Two of the main uses of models in actuarial work are *pricing* new products (or repricing old ones) and *valuing liabilities*.

1 Producing a solution

1.1 Approaches to solving actuarial or financial problems

There are various approaches that can be taken to produce the solution to an actuarial or financial problem.

The approach taken will be strongly driven by the purpose of the exercise and the nature of the problem.

For example, a far more detailed approach will be required to determine the provisions for a life insurer's statutory returns than to provide an interim update to the provisioning level for internal management purposes during the year.

Simple problems can have a simple solution that is arrived at by some straightforward mathematics, for example calculating the yield on a fixed-interest asset, or the present value of a series of known cashflows.

In this case, all we need is a formula and an appropriate discount rate.

1.2 The need to develop a model

However, most problems that require actuarial skills involve taking a view on uncertain future events. It is possible to take a view on various parameters, such as future economic conditions, future mortality rates, or the amount of business that a provider might write in future, and produce a single answer that is appropriate in these best estimate conditions. If this is done then the communication of the solution to the client needs care, because of the uncertainties in the underlying assumptions.

In other words:

In these circumstances the client is likely to wish to know the variability of the answer provided, should circumstances not be as estimated. To assess the effects of varying the assumptions used in producing the answer, it is normally necessary to use an actuarial model of future events.

The variability of the answer might be assessed by carrying out:

- *sensitivity analysis* – varying individual assumptions and assessing the impact on the results
- *scenario testing* – changing many assumptions in combination, for example to look at the many assumptions that may change if the economy were to move into a recession.

We will discuss this topic in more detail in Section 8 of this chapter.



Question

List ten areas of a life insurance company's activities that involve taking a view on uncertain future events, and hence might require an actuarial model.

Solution

Life insurance company activities that might require a model include:

- calculating provisions
 - setting premium rates
 - assessing reinsurance requirements
 - estimating future investment returns
 - estimating future mortality improvements
 - estimating future discontinuance rates
 - estimating future expense levels
 - determining future capital requirements
 - estimating future new business levels
 - valuing guarantees and/or options.
-

1.3 What is a model?

A model can be defined as ‘a cut-down, simplified version of reality that captures the essential features of a problem and aids understanding’. The final phrase in this definition recognises the importance of being able to communicate the results effectively. Modelling requires a balance to be struck between realism (and hence complexity) and simplicity (for ease of application, verification and interpretation of results).

1.4 Finding a model

When faced with an actuarial or financial problem, there are various approaches to modelling:

- a commercial modelling product could be purchased
- an existing model could be reused, possibly after modification
- a new model could be developed.

The merits of each of these approaches will depend on the following:

- the level of accuracy required
- the ‘in-house’ expertise available
- the number of times the model is to be used
- the desired flexibility of the model
- the cost of each option.

1.5 Existing models

Existing deterministic or stochastic models may be used.

Stochastic models

There are now many stochastic asset models in existence, in both the public and private domains.

Some of these were referred to in the earlier subjects, including the continuous-time lognormal model of security prices.

Specific knowledge relating to such models is *not* required for the Subject CP1 exam. The material in Subject CP1 concentrates on the *general* characteristics of models.

There are fewer models available for other variables, such as mortality and voluntary discontinuance, but these are starting to be developed.

2 Construction of an actuarial model

2.1 Key objective

Any model should be fit for the purpose for which it is being used.

This is particularly relevant when a model is being purchased from an external provider or when an existing model is being reused for a different purpose, possibly after modification.

Even with new purpose-built models, the potential for model error remains – a model that replicates past results may still prove unreliable in projecting future results.

2.2 Operational issues

As well as the technical areas of model design, which are covered in the Core Practices subjects, there are several operational issues that need to be considered:

- **The model being used should be adequately documented.**
This is so that the key assumptions and approximations made are understood and so that it can be run by other members of staff and improvements introduced over time.
- **The workings of the model should be easy to appreciate and communicate. The results should be displayed clearly.**
- **The model should exhibit sensible joint behaviour of model variables.**
This means that the model needs to make an allowance for variables that are linked to each other: the relationship between them needs to have been modelled in an appropriate way. The assumptions should also be consistent, *eg* the assumed rate of investment return should be consistent with the assumed rate of inflation.
- **The outputs from the model should be capable of independent verification for reasonableness and should be communicable to those to whom advice will be given.**
- **The model, however, must not be overly complex so that either the results become difficult to interpret and communicate or the model becomes too long or expensive to run, unless this is required by the purpose of the model. It is important to avoid the impression that everything can be modelled.**
Therefore we might not attempt to model every small detail of a scenario if reasonable approximations can be used instead.
- **The model should be capable of development and refinement – nothing complex can be successfully designed and built in a single attempt.**
- **A range of methods of implementation should be available to facilitate testing, parameterisation and focus of results.**
- **The more frequently the cashflows are calculated the more reliable the output from the model, although there is a danger of spurious accuracy.**
- **The less frequently the cashflows are calculated the faster the model can be run and results obtained.**

The last two points refer to the chosen time period between projected cashflows, *eg* monthly, quarterly or annually.

There is an argument for having a shorter time period between cashflows in the early years given that the starting inputs for the model should be known with a fair degree of certainty and therefore the early results are most meaningful. Later on, the model may use longer time periods between cashflows to avoid spurious accuracy.

The time period must be chosen so that it captures key areas of experience. For example, if modelling a class of business where claims are seasonal (for example, more cold weather related claims in the winter under domestic household policies) then it makes sense to look at business monthly or quarterly.

A decision also needs to be made about the time horizon for the model, *ie* for how many years into the future we will project results.

2.3 A deterministic or a stochastic model?

It will be necessary to decide between deterministic and stochastic modelling processes.

A *deterministic model* is one where the parameter values are fixed at the outset of running the model and the result of running the model is a single outcome. Sensitivity analysis and scenario testing can then be carried out to assess the potential variability of the results.

A *stochastic model* estimates at least one of the parameters by assigning it a probability distribution. The model is run a large number of times, with the values of stochastic parameters being selected from their distributions on each run. The outcome is a range of values, giving an understanding of the likely distribution of outcomes.

Merits of a deterministic model

The advantages of a deterministic model are:

- **A deterministic model is more readily explicable to a non-technical audience, since the concept of variables as probability distributions is not easy to understand.**
- **It is clearer what economic scenarios have been tested.**
- **The model is usually cheaper and easier to design, and quicker to run.**

The disadvantages are:

- **It requires thought as to the range of economic scenarios that should be tested.**
Since only a limited number of economic scenarios will be tested, there is a danger that certain scenarios, which could be particularly detrimental to the company, are not identified.
- **Users can get 'blinded by science' by complex models, assuming they must be working correctly, but without verifying or testing this.**

Merits of a stochastic model

A stochastic model tests a wider range of economic scenarios. The programming is more complex and the run time longer, but the benefit is in the quality of the result. It does depend on the parameters that are used in any standard investment model.

The actuary needs to decide whether the increased amount of information that a stochastic valuation will provide justifies the significant additional computations needed. Other important considerations are the degree of spurious accuracy that may be introduced, the increased difficulty in interpreting and communicating the results, and the questionable accuracy of the distribution functions that are replacing the deterministic values.

Stochastic models are particularly important in assessing the impact of financial guarantees or to allow for investment mismatching risks.

This is because they are good at allowing for the uncertainty involved. We will look at modelling guarantees in more detail in Section 7.



Question

Give an example of a financial guarantee that might arise in each of the following areas:

- (i) life insurance
- (ii) pensions
- (iii) general insurance.

Solution

- (i) A life assurance contract that offers a guaranteed minimum amount on maturity.
 - (ii) A defined ambition scheme providing a money purchase benefit but with the promise that the pension will not be less than a pension of 1% of final salary for each year of service.
 - (iii) A motor policy that guarantees no increase in premium if the policyholder makes no claims.
-

2.4 A combination of deterministic and stochastic modelling

In many cases the problem can be solved by a combination of stochastic and deterministic modelling. Variables whose performance is unknown and where the risk associated with them is high might be modelled stochastically, while other variables can sensibly be modelled deterministically.

For these reasons, the stochastic approach is usually limited to the economic assumptions, with the demographic assumptions being modelled deterministically.

For example, a model for pricing an investment guarantee attached to a life insurance policy might use a stochastic investment model, but would be unlikely to model fluctuations in mortality rates other than deterministically. This is because it is normally self-evident which direction of movement in mortality rates would give rise to financial difficulties.

Another example relates to modelling general insurance claims experience. It is usual to model claim frequency and the average size of each claim separately. One approach would be to determine the number of claims stochastically and to use a deterministic average claim cost for each homogeneous group of policies. Another approach would be to determine the claims amounts stochastically for each of the deterministic expected number of claims.

2.5 Dynamism of the model

In all cases the dynamism of the model is vital.

By *dynamic* we mean that the asset and liability parts of the model and all the assumptions are programmed to interact as they would in 'real life', for example inflation and interest rates, are consistent.

Rules need to be determined as to how the various features would interact in different circumstances. For example, how life assurance bonus rates would vary with fixed-interest yields, how policy lapse rates would vary with economic conditions, or how unemployment rates would vary with economic conditions. These interactions are usually much more important than the type of model.



Question

List possible interactions that would need to be taken into account when modelling claims experience for domestic household contents insurance claims.

Solution

- Inflation of claims costs (likely to be linked to price inflation) will be correlated with interest rates.
 - Economic conditions associated with a recession may be linked to an increased number of claims being made (due to an increase in crime, an increase in fraudulent claims and policyholders being more likely to pursue small claims).
 - Economic conditions associated with a recession may be linked to an increase in average claim size, if policyholders try to inflate their claims.
-

Considerable actuarial judgement may be required in choosing and using the model and in setting the parameters and interactions between the different features.

Interactions are particularly important when the assets and the liabilities are being modelled together. For example, economic conditions can affect both the investment return achieved on the assets and the value of the liabilities.

2.6 Developing a deterministic model

Deterministic modelling could involve the following steps:

- specify the purpose of the investigation
- collect, group and modify data
- choose the form of the model, identifying its parameters or variables
- ascribe values to the parameters using past experience and appropriate estimation techniques

- construct a model based on the expected cashflows
- test the model in order to identify any build errors, and correct if necessary
- check that the goodness of fit is acceptable (and attempt to fit a different model if the first choice does not fit well)
- run the model using estimates of the values of variables in the future
- run the model several times to assess the sensitivity of the results to different parameter values.

The model might also be run under different scenarios to test the robustness of the results to many parameters changing at the same time.

2.7 Developing a stochastic model

Stochastic modelling would involve the same process as above, with the following additional or alternative steps:

- choose a suitable density function for each of the variables to be modelled stochastically
- specify correlation between variables
- run the model many times, each time using a random sample from the chosen density function(s)
- produce a summary of the results that shows the distribution of the modelled results after many simulations have been run, *eg* at various confidence levels.

3 The use of models for pricing

A model could be developed to determine a premium or charging structure for a new or existing product that will meet an insurance company's profit requirement.

A company will need a model to set the premiums when it first starts to sell a particular class of business. It will also use the model to monitor the appropriateness of premium rates at regular intervals, in order to:

- check that the business is profitable
- check that rates are appropriate for all groups, *ie* the rates are not inappropriately low or high for certain types of policyholder
- ensure the rates remain competitive.

3.1 The use of model points

The underlying business being modelled will typically comprise a very wide range of different policies, and these will need to be brought together into a manageable number of relatively homogeneous groups. The groupings need to be made in a way that each policy in a group is expected to produce similar results when the model is run. It is then sufficient for a representative single policy in each group to be run through the model, the result to be found, and for this result to be scaled up to give the result of the total set of policies in the group.

The representative single policy in a group is termed a 'model point' and a set of such model points can then be used to represent the whole of the underlying business.

A model point needs to capture the most important characteristics of the group of policies it represents.



Question

List the important characteristics that should be captured by the model points that would be used when modelling a without-profit term assurance product in order to set premiums.

Solution

- term of the policy
 - sum assured payable on death
 - claim basis of policy (single life, joint life, last survivor)
 - age of life / lives covered
 - gender of life / lives covered
 - smoker status of life / lives covered
 - health status of life / lives covered.
-

3.2 Choosing model points

A set of model points will be chosen to represent the expected new business under the product. In the case of an existing product, the profile of the existing business, modified to allow for any expected changes in future, can be used to obtain the model points. For a new product, the profile of any similar existing product combined with advice from the company's marketing department would be used.

The number of model points that are acceptable will depend primarily on the number of model points that can be handled by the model.

The number of model points used will depend on:

- the computing power available
- time constraints
- the heterogeneity of the class
- the sensitivity of the results to different choices of model points
- the purpose of the exercise.

3.3 Rate for discounting cashflows

For each model point, cashflows would be projected, allowing for reserving and solvency margin requirements, on the basis of a set of base values for the parameters in the model.

The net projected cashflows will then be discounted at a rate of interest, the risk discount rate.

This could be a rate that allows for:

- the return required by the company, and
- the level of statistical risk attaching to the cashflows under the particular contract, ie their variation about the mean as represented by the cashflows themselves.

Statistical risk here is intended to encompass all types of risk, and comprises the model risk, parameter risk and random fluctuation risk. Risk should be allowed for through the discount rate to the extent that allowance has not been made explicitly in valuing the cashflows, eg attaching to a cashflow the probability of that cashflow arising.

The level of statistical risk could be assessed:

- in some situations, analytically – by considering the variances of the individual parameter values used
- by using sensitivity analysis, as described below, with deterministically assessed variations in the parameter values
- by using stochastic models for some, or all, of the parameter values and simulation
- by comparison with any available market data.

The stochastic modelling approach could be achieved by varying the important parameter values in the model according to their assumed probability function and recalculating the rate of return for each new scenario. By running many simulations (say 1,000), a very good idea of the variance of the rate of return can be found. This method is the numerical equivalent of the first (analytical) approach.

Alternatively, a stochastic discount rate could be used.

In theory, a separate risk discount rate should be applied to each separate component of the cashflows, as the statistical risk associated with each component will be different.

In practice a single risk discount rate is commonly used, bearing in mind the 'average' risk of the product.

One reason for this is to keep it simple. Also, it is difficult, both in terms of time and data requirements, to analyse accurately the variability of the different cashflow components.

3.4 Meeting profit requirements

The premium or charges for the model point can then be set so as to produce the profit required by the company.

In practice this will be difficult to achieve for all model points, in particular for small policies. This is because an element of the expenses incurred in relation to each policy will be fixed. Allowing for these fixed costs makes it difficult to achieve adequate profitability on small policies.

Rather than focus on each individual model point satisfying the profit requirements, the company may instead focus on the total profitability resulting from a group of model points. This group is chosen to represent the expected new business mix and volume for the product, with an acceptance that there will be a degree of cross-subsidy within the group of model points. However, the insurer needs to be aware that introducing such cross-subsidies generates the risk that the actual business mix is not as assumed.

3.5 Competitive premiums

The premiums, or charges, produced need to be considered for marketability. This might lead to a reconsideration of:

- **the design of the product, so as either to remove features that increase the risks within the net cashflows, or to include features that will differentiate the product from those of competing companies**
- **the distribution channel to be used, if that would permit either a revision of the assumptions to be used in the model, or a higher premium or charges to be used without loss of marketability**
- **the company's profit requirement**
- **the size of the market**
- **whether to proceed with marketing the product.**

3.6 Business strategy

The net cashflows in respect of the model points, appropriately scaled up for the expected new business under the product, will be incorporated into a model of the business of the whole company.

Scaled up means multiplied up in order that the individual model point results represent the expected volume of new business.

It is possible for the desired level of profitability to be reached in aggregate, without requiring every single model point to be profitable in its own right. If certain model points are unprofitable, the aggregate profitability of the business is then exposed to changes in mix and volume of the contracts sold.

The actuary can assess the impact on capital management of writing the product, by observing the modelled amount and timing of cashflows. If capital is a problem, this may lead to a reconsideration of the design of the product to reduce or amend the timing of its financing requirement.

Once acceptable premiums or charges have been determined for the model points, premiums or charges for all contract variations can be determined.

This may be achieved by interpolating between the premiums for the various model points. As long as all model points satisfy the profit criterion, then these interpolated values should also satisfy the profit criterion.

3.7 Assessing the capital requirements and the return on capital

The net cashflows for the model points described in the section on pricing above can be grossed up for the expected new business and used to assess the amount of capital that will be required to write the product, either on a regulatory or an economic basis.

Any one-off development costs can be added, to the extent that they are not amortised and included in the cashflows used.

'Amortised' means spread over a period.

This gives the total capital requirement and can be compared with the profits expected to emerge from the product so as to determine the expected return on that capital.

The design of the product or the profit requirement may need to be amended to ensure the required return on capital is achieved.

4 The use of models for setting future financing strategies

We'll now look at the use of models in relation to benefit schemes.

For a benefit scheme, the equivalent to determining the price for a product is setting the future financing strategy, and similar modelling techniques can be used. The existing membership can be divided into categories and represented by a set of model points. Similar potential new members can be represented, perhaps by a single model point at the average entry age and salary.

For example, the existing membership might be divided into actives, deferreds and current pensioners.

A potential financing strategy is determined, in terms of both the amount and timing of future contributions. The cashflows from the existing assets and future contributions can be modelled, as can the liability cashflows, taking all the possible decrements into account.



Question

List possible decrements to be taken into account.

Solution

Possible decrements include:

- death before retirement
- death after retirement
- withdrawal from active service
- transfer out
- ill-health retirement
- normal / early / late retirement
- other options, *eg* exchanging some pension for a cash lump sum.

Unlike an insurance company, a benefit scheme can show a deficit at a point in time (*ie* the value of accumulated assets does not exceed the value of accrued liabilities), provided that there is a sponsor with a good enough covenant to make good the shortfall. However, the scheme does need to be solvent to the extent that it has sufficient assets to meet benefit outgo as it falls due. A well-designed model will check this feature as well as determining the discounted value of asset and liability cashflows.

By '*sponsor with a good enough covenant*' we mean that the sponsor (*eg* employer) has the financial means and willingness to make up the current shortfall over a time period acceptable to the scheme.

Considerations such as the choice of risk discount rate and the need to test sensitivities to changes in conditions are all similar to those in product pricing.

5 The use of models for risk management

Cashflow models are used in risk management to determine the amount of capital that it is necessary to hold to support the risks retained by a financial institution. The various modelling approaches are discussed in [Chapter 27](#).

As well as the full corporate model to assess capital requirements, models of specific risks can be used to determine the extent of a risk event that will occur at a given probability, even if a full stochastic model is too slow, too complex, or otherwise not used.

For example, a company that is targeting being able to withstand a 0.1% probability of ruin needs to know what equity market fall to test in a deterministic scenario.

A standard equity market stochastic model can be used and calibrated to historical performance of the market being considered. By running the model several thousand times and ranking the results, the equity fall that gives the one in a thousand worst result can be found.

6 Valuing provisions on an individual basis

The normal procedure for determining life assurance or pension scheme liabilities is to value the benefits for each policy or scheme member individually. In many territories this may be required by legislation or regulation.

This is because the regulators want assurance that the company has sufficient provisions to meet the claims of all of the *actual* policyholders and risks being covered – it is possible that an approximate approach using model points might lead to under-reserving.

Consequently, for published results there is little scope for using model points. However, before finalising a published basis, many ‘what if’ questions might be asked. These could be answered by running a model of the business.

‘What if’ questions might include:

- the impact on the ability to meet regulatory requirements of a fall in investment returns
- the impact on finances of changing mortality experience
- the implications of the failure of a reinsurer (for an insurer) or of an insurer (for a pension scheme).

For smaller schemes or sections of a company’s business it might be just as quick to run the whole data file to answer the question and eliminate the model risk, given the current speed of computers.

As well as preparing published reports and accounts, a company will want to do its own internal investigations into the provisions or reserves that it would need to hold in a variety of circumstances. These would be calculated on a more *realistic* basis than that used for the published results.

As part of assessing a realistic provision it is necessary to consider the effect of changes in economic scenarios.

For example, using a stochastic model of possible asset movements, a provision that would be adequate in all but a small proportion of scenarios can be determined.

7 Pricing and valuing options and guarantees

7.1 Investment-related options and guarantees

In most cases the options and guarantees that give a provider of benefits on future financial events cause for concern are those that are dependent on future investment returns, or an investment value (yield or capital value) at some future point in time.

Because of the uncertainty, a stochastic investment model should be used to assess the provisions necessary for such guarantees.

The stochastic model can provide information on the *likelihood* of the option or guarantee applying together with the associated cost.

Examples of guarantees include:

- a without-profit product promising an average future investment return of 4% per annum
- an annuity product providing annual increases at the lower of price inflation and 5%.

If future returns exceed a certain level, or if a value or index is above (or below) a fixed value at some future point, there will be no cost to the company. But if future returns are below that level, there will be a cost, which increases as returns reduce.

Similarly, if the value or index is below (or above) the fixed value at the future point, depending on the precise nature of the guarantee, there could be a cost.

Hence a range of future investment scenarios should be tested.

The example in the final section of this chapter considers the valuation of a financial guarantee.

7.2 Other options

Insurance products can also include options that are not dependent on investment outcomes, but instead relate to death or sickness cover. For example, a product might include an option to take out a new term assurance contract without providing further evidence of health. When modelling such products, the potential cashflows that would arise if the option was exercised and the take-up rate of the option both need to be allowed for.

8 Sensitivity analysis

8.1 Reliability of the results

The results from the model depend on the model itself and the values assigned to the parameters in the model. Models should not be treated as black boxes, the output of which is assumed to be correct.

8.2 Understanding potential variability of experience

The use of a stochastic model goes some way to illustrating the potential variability of the experience, but the results that it produces are still dependent on the accuracy of the model and its parameter values. In the case of a deterministic model, the potential uncertainty of the results is greater, because fewer scenarios are tested.

The re-running of a model (deterministic or stochastic) with different, but feasible, parameter values will produce alternative results and hence help to illustrate the potential deviations.

The re-running with a series of different sets of parameter values, perhaps chosen from a probability distribution for such values, will help to illustrate the likely range in which actual experience may lie, perhaps as far as creating a probability distribution for this experience.

The extent to which this can be achieved will depend upon the confidence with which probabilities can be assigned to the different sets of parameter values used, the time it takes to run the model and the associated costs.

For example, consideration of the effect of a change in the membership profile of a funded pension scheme may be needed to illustrate the extent of potential variability in future contributions if the model used is based on a stable membership profile.

Running a model on different sets of assumptions is also useful in highlighting errors in a model.

8.3 Model error

There is a possibility of model error if the model developed is not appropriate for the financial products, schemes, contracts or transactions being modelled.

Checks of goodness of fit will be needed to assess the suitability of the model, but taking account of expected changes in experience into the future.

8.4 Parameter error

The effect of mis-estimation of parameter values can also be investigated by carrying out a sensitivity analysis. This involves assessing the effect on the output of the model of varying each of the parameter values. When doing this, any correlation between different parameters should be allowed for.



Question

Describe two courses of action that the actuary may take, having identified an unacceptable potential impact of a certain assumption when designing and pricing a new product.

Solution

- Redesign the product – where an assumption is very uncertain and would have a material financial impact, the product may be redesigned to try to reduce the financial sensitivity to that assumption.
- Increase margins for prudence – if it were impossible to redesign the product in this way, then it may be appropriate to include higher margins for that assumption than for other, less uncertain, assumptions.

In the case of a model used for pricing, the results from the sensitivity analysis will help to assess the margins that need to be incorporated into the parameter values.

For example, let's consider the steps that an actuary might take if they identify that a product is unduly sensitive to withdrawal rates and mortality rates.

If the product profitability is overly sensitive to any factor, as noted above the results may indicate the need to redesign the product or increase the margins in the assumptions.

If the product is too sensitive to increasing withdrawal rates then a reduction in surrender values should be considered. If the product is too sensitive to mortality then the reinsurance programme could be revised. Alternatively, additional margins could be included in the pricing basis to reflect the increased risk.

In the case of models used to assess return on capital and profitability of existing business, the results will enable the actuary to quantify the effect of departures from the chosen parameter values when presenting the results of the model to the company.

8.5 Alternative ways of allowing for risk

The statistical risk associated with the parameter values can be allowed through the risk element of the risk discount rate.

Under this approach we would identify the risk-free return demanded by shareholders and then use the methodology outlined in Section 3.3 to quantify the variance of the rate of return, and to allow for it appropriately. This would give us a risk margin to add to the risk-free rate. The model can then be assessed using best estimate parameter values.

An alternative would be to use a predetermined discount rate and then assess the effect on the results of the models of statistical risk.

The phrase *pre-determined discount rates* means a discount rate arbitrarily set by the shareholders – perhaps based on the return on risk-free assets.

Under this second approach we discount the cashflows at the risk-free rate, but then rather than using best estimate parameter values we use more pessimistic parameter values. The degree of pessimism introduced into the parameter values should correspond to the risk margin introduced in the first approach.

Where a probability distribution can be assigned to a parameter, it may be possible to derive the variance of the profit or return on capital analytically.

The main problem with this is the difficulty in objectively assigning a probability distribution to the value of any parameter.

More generally, a sensitivity analysis, as described above, can be carried out. Whichever of these two is used, they will again help in assessing margins or in quantifying the effect of departures from the chosen parameter values when presenting the results of the model.

Using sensitivity analysis is a pragmatic, transparent and informative way of understanding the parameter risk, without the difficulty (and perhaps spurious accuracy) of deciding upon some arbitrary probability distribution to represent the uncertainty.

9 Core Reading example



Core Reading Question

A unit-linked life assurance policy guarantees to pay a maturity value equal to the sum of premiums on the chosen maturity date, or the value of units allocated if greater. At all other times the surrender value is based on the value of units.

Describe the steps involved in assessing the provision to be made for the cost of this guarantee.

The question involves assessing a guarantee – remember from earlier in the chapter that this means that a stochastic approach is most appropriate. This is because a stochastic model by its very nature will provide output to indicate the *likelihood* of the guarantee coming into effect and to estimate its cost.

The steps for the stochastic model development are set out in Sections 2.6 and 2.7 – these need to be tailored to reflect the specifics of the question.

Solution

The steps involved are:

- **Choose a stochastic asset model – a complex model gives better results but takes longer to run.**
- **Determine assumptions – particularly unit growth rate mean and volatility.**
It is not sufficient to simply say ‘determine assumptions’: we need to give examples of those that will have the greatest impact on whether the guarantee comes into effect or not. In this case it is the unit growth rate that is the primary driver.
- **Determine consistent deterministic assumptions for mortality and surrender rates and future expenses.**
- **Consider dynamic links between assumptions – eg lapse rates to unit values.**
- **Choose a time period – probably annual for efficient running.**
- **Determine appropriate model points for the portfolio.**

If there were sufficient marks on offer, we could expand to discuss how to choose model points – as was discussed earlier in this chapter.

- **The model will project the unit values to maturity, allowing for future premiums and all decrements.**
- **This will be done for a large number of randomly generated investment scenarios – say between 1,000 and 5,000.**
- **For each scenario and each model point, the projected unit value will be compared with the guaranteed maturity value, and the cost for that particular scenario and model point determined.**

- **The projected costs are discounted to the present, scaled up by the appropriate factors and summed across all model points.**

The scaling up is performed in order to represent the actual volume of business.

- **The average across all scenarios is the expected cost of the guarantee.**
 - **The variability should be assessed by looking at the quartiles and 5th/95th percentiles, when the results are ranked.**
 - **For reserving purposes, an appropriate ruin probability needs to be chosen. Perhaps 1 in 100, in which case the reserve is the 99th percentile.**
-

Chapter 17 Summary

Producing a solution

A model must capture the most important features of the actual situation.

The client must be made aware of the uncertainties underlying the model assumptions.

A model can be a:

- commercially produced product
- modified existing model
- new model.

Construction of an actuarial model

Any model should be fit for the purpose for which it is being used.

Operational issues that need to be considered include that the model should:

- be well documented
- be easily communicable, with clearly displayed results
- have sensible joint behaviour of variables
- be capable of independent verification
- not be overly complex or time-consuming to run
- be capable of development and refinement
- be capable of being implemented in a range of ways
- have an appropriate time period between projected cashflows, balancing the reliability of the output with the speed of running the model.

It is necessary to decide between deterministic and stochastic modelling processes, or a combination of the two. The decision should balance the practical advantages of running a deterministic model with the increased amount of information produced by a stochastic model.

It is important that the model is *dynamic*, ie that it allows for the interaction between the parameters and variables affecting the cashflows.

Developing a model

The key steps involved in developing and running a model are:

- specify the purpose and key features of the model
- obtain and adjust the data
- set the parameters / assumptions, including any dynamic links
- construct the model cashflows
- check the accuracy and fit of the model, and amend if necessary
- run the model as many times as required
- output and summarise the results.

Use of models for pricing

A model point is a representative policy. It is usual to identify model points, which represent relatively homogeneous underlying groups of policies.

The risk discount rate is used to discount the future net cashflows.

The risk discount rate could allow for:

- the return required by the company, and
- the level of statistical risk (assessed analytically, by sensitivity analysis, from a stochastic model or by comparison with market data).

Alternatively, a stochastic risk discount rate could be used.

In theory, a different rate could be used for each component of the net cashflows to allow for the different levels of risk in each cashflow. However, in practice, for simplicity, a single rate is used to reflect the average levels of risk.

The premiums / charges resulting from the model need to be considered relative to the market. This may require reconsideration of:

- the product design
- the distribution channel(s)
- the profit requirement
- the size of market
- whether to go ahead with the product.

The actuary should also consider the appropriateness of the premiums / charges given the company's business strategy and capital requirements.

Use of models for setting future financing strategies

Modelling techniques are used by benefit schemes to determine future financing strategies.

The results of the model give the amount and timing of future contributions.

It is acceptable for a scheme to have a deficit as long as the sponsor covenant is strong enough and there are sufficient assets to meet benefit outgo as it falls due.

Use of models for risk management

Models can be used to determine capital requirements to help support risks.

Use of models for assessing provisions

The valuation of a company's liabilities for regulatory purposes is likely to be carried out on each individual policy or member, rather than by using model points.

Use of models for pricing options and guarantees

Options and guarantees are likely to be priced using a stochastic model, particularly if linked to an investment outcome.

Model and parameter error

The results of a model are only as good as the model itself and the choice of the parameter values.

Sensitivity analysis is used to illustrate the potential variability of the results and to identify the impact of mis-estimation of the parameter values.

Scenario testing involves changing many parameters in combination.

Goodness of fit tests help to reduce model error.

Alternative ways of allowing for risk

Statistical risk associated with parameter values can be allowed for in the discount rate and/or by including margins in the parameter values.

The practice questions start on the next page so that you can keep the chapter summaries together for revision purposes.



Chapter 17 Practice Questions

17.1 Outline the important features that a model of a general insurer's private motor insurance claims should aim to capture.

17.2 A life insurance company is to start selling a unit-linked savings product. The company currently sells other life insurance products.

Exam style

Discuss the merits of the company adapting existing models compared with purchasing a new model from a commercial provider. [4]

17.3 List the advantages of a:

- (i) deterministic model
- (ii) stochastic model.

17.4 List the cashflows that would be expected to arise when modelling a final salary occupational pension scheme.

- 17.5
- (i) Define the term *model point*.
 - (ii) Explain why model points may be used.
 - (iii) Identify the important characteristics that should be captured by the model points for a without-profit critical illness insurance policy.

17.6 Define the following terms, including an outline of how they may be assessed:

- (i) model error
- (ii) parameter error.

17.7 A model is to be developed to price and monitor an insurer's with-profit endowment assurance business.

Exam style

Outline the key requirements that the model should satisfy, including the operational issues that need to be considered in relation to its construction. [8]

17.8 (i) Describe the limitations of actuarial models used in the management of benefit schemes. [3]

Exam style

(ii) Suggest ways in which these limitations can be minimised. [4]

[Total 7]

The solutions start on the next page so that you can
separate the questions and solutions.



Chapter 17 Solutions

17.1 A model of the private motor insurance claims should aim to capture:

- the characteristics of the different types of claim that arise, in particular property damage (eg shorter-tailed) and liability claims (eg longer-tailed)
- the size of claims and how claims may vary:
 - over time with inflation (inflation may vary by the type of claim)
 - during the year due to seasonal effects (ie expect more claims in the winter months)
- the number of claims and how these may vary over the year
- the likelihood and severity of any catastrophes, accumulations and large individual claims
- claim expenses
- the effect of any reinsurance recoveries.

17.2 ***Adapting existing models***

- The company may well already be selling other unit-linked products and hence models needing relatively little adaptation may be available.
- The company will not incur the cost of buying a new model, but will need to bear the costs of adapting existing models.
- Existing staff will have an understanding of the workings and limitations of the existing models (existing models should be well-documented).
- By adapting a model 'in-house', existing staff can ensure consistency of design with existing models.
- Existing staff will develop expertise in modelling, reducing future reliance on external providers for modifications.

Purchasing a new model

- The model should be well designed and validated, in order to be a successful commercial product.
- The model may be more flexible than existing models and therefore may be more useful in future for other purposes (eg valuation, ALM, projections).

[1 each, maximum 4]

17.3 (i) The advantages of a deterministic model are:

- simplicity
- relative cheapness
- clarity as to which economic scenarios have been tested
- speed of design
- speed of running
- ease of communication.

(ii) The advantages of a stochastic model are:

- it tests a wide range of economic scenarios, ...
- ... including scenarios that may not have been thought of under a deterministic model
- it allows better for the random nature of variables, ...
- ... and the correlations between them
- it is more useful for assessing the impact of financial guarantees and options, ...
- ... or to allow for investment mismatching risks.

17.4 Cashflows received by the scheme include:

- contributions made by the employer and possibly members
- investment income on assets
- capital gains on any assets redeemed
- transfer values into the scheme (where members transfer money in from other pension arrangements).

Cashflows paid out by the scheme include:

- pension payments (both guaranteed and discretionary)
- transfer values out of the scheme (for members leaving the scheme and transferring the value of their benefits to other arrangements)
- any other benefit payments (for example if the scheme provides benefits on death too)
- administration expenses
- tax if applicable, *eg* the scheme might be taxed on certain investments.

17.5 (i) **Model point**

A model point is a set of data representing a single policy or a group of policies. It captures the most important characteristics of the policies that it represents.

(ii) **The use of model points**

The insurer may have very many policies and it may not be practical to run all the individual policies through the model.

Instead these policies are arranged into groups of those that would give very similar results. Each group is represented by a single model point, thus reducing the number of data points that need to be run through the model.

(iii) **Important characteristics to be captured in the critical illness model points**

The model points should capture the:

- term of the policy
- duration in-force (or the date of issue)
- sum assured payable on occurrence of a critical illness
- claim basis of policy (single life, joint life, last survivor)
- age of life / lives covered
- gender of life / lives covered
- health status of life / lives covered (*ie* whether accepted on standard or rated terms)
- smoker status of life / lives covered.

17.6 (i) **Model error**

Model error means that a model is developed that is not appropriate to the task at hand.

Model error can be assessed by checking the goodness of fit of the model output against actual data, ...

... taking account of expected changes into the future.

(ii) **Parameter error**

Parameter error means incorrectly setting parameter values used when the model is run. It can involve individual parameters and/or correlation between parameters.

Parameter error can be assessed by carrying out sensitivity analysis to consider the effect of varying each of the parameter values.

When such sensitivity testing is carried out allowance must be made for any correlation between parameters.

- 17.7 The model should be fit for the purposes of pricing and monitoring. [½]
- The projected cashflows need to include premiums, expenses, investment returns ... [1]
- ... claims on death, surrender and maturity, ... [1]
- ... including discretionary benefits arising from bonus declarations. [1]
- The model also needs to project supervisory reserve requirements, to determine the profit arising in each time period. [1]
- The model should be adequately documented. [½]
- The workings of the model should be easy to appreciate and communicate. [½]
- The results should be displayed clearly and should be communicable to those to whom the results will be presented. [½]
- The model should exhibit sensible joint behaviour of model variables and assumptions should be consistent with each other, ... [1]
- ... for example investment returns and with-profit bonus rates. [½]
- The outputs from the model should be capable of independent verification for reasonableness. [½]
- The model must not be overly complex. [½]
- The model should be capable of development and refinement. [½]
- A range of methods of implementation should be available to facilitate testing, parameterisation and focus of results. [½]
- A decision needs to be made in relation to the projection time period. [½]
- The more frequently the cashflows are calculated the more reliable the output from the model, although there is a danger of spurious accuracy. [1]
- The less frequently the cashflows are calculated the faster the model can be run and results obtained. [1]
- The projection time horizon will be the term to maturity. [½]
- A decision needs to be made as to whether the model is deterministic or stochastic. [½]
- It may be stochastic in order to allow for guaranteed benefits. [½]
- Sample model points will be used for pricing, but actual policy data may be used for monitoring purposes. [1]
- The discount rate used for pricing needs to allow appropriately for the return required by the company, ... [½]
- ... and the level of statistical risk attaching to the cashflows. [½]
- [Maximum 8]

17.8 (i) **Limitations of models**

The results of a modelling exercise are only as good as the underlying model, *ie* prone to model error. [1]

The results of the exercise will depend upon the data used, *ie* there is a risk of data error if proper records of scheme members have not been maintained. [1]

The results depend upon the suitability of the assumptions used, *ie* prone to parameter error. [1]

The level and timing of cashflows is uncertain, *eg* dependent on longevity, and so actual experience will differ from the model result (*ie* prone to random error). [1]

[Maximum 3]

(ii) **Minimising the limitations****Model error**

Consider lots of potential models. [½]

Employ suitable expertise to identify the most appropriate model. [½]

Data error

Ensure data is regularly updated, ... [½]

... *eg* contact current pensioners and deferred members to check whether their details have changed. [½]

Perform data checks. [½]

Parameter error

Carry out lots of sensitivity testing to identify the key assumptions. [½]

Pay careful attention to the setting of those financial assumptions which are most important, ... [½]

... *ie* investment return and mortality rates. [1]

Random error

A stochastic model may be deemed appropriate in order to illustrate a wide range of potential outcomes, ... [1]

... particularly if options and guarantees arise in relation to the benefits. [½]

[Maximum 4]

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18

Data

Syllabus objectives

- 10.2.1 Explain the ethical and regulatory issues involved in working with personal data and extremely large data sets.
- 10.2.2 Explain the main issues to be addressed by a data governance policy and its importance for an organisation.
- 10.2.3 Explain the risks associated with use of data (including algorithmic decision making).
- 10.2.4 Discuss the data requirements for determining values for assets, future benefits and future funding requirements.
- 10.2.5 Describe the checks that can and should be made on data.
- 10.2.6 Describe the circumstances under which the ideal data required might not be available and discuss ways in which this problem may be overcome.
- 10.2.7 Describe how to determine the appropriate grouping of data to achieve the optimal level of homogeneity.

0 Introduction

In this chapter we look at the important area of data collection and validation.

We start by considering the use of personal data in general, by any type of organisation. Section 1 considers the ethical and legislative issues that can arise when working with personal data.

Section 2 introduces the concept of 'big data', and the issues that can arise from collecting and holding such data.

Section 3 considers the governance policies that should be in place in relation to data management, including the risks relating to the failure of such policies.

Section 4 covers the key risks that face an actuary when using data. It also introduces the concept of algorithmic decision making and the associated risks.

In Section 5 we look at the main uses of data within actuarial work and identify the two key sources of data – publicly available data and the organisation's own internal data.

The results of any investigation (*eg* a valuation exercise) can only ever be as good as the underlying data. It is, therefore, critical that we impose steps to ensure good quality data. In Section 6 we look at how we ensure that data collected by insurers from proposal forms and claims records is accurate.

Section 7 is devoted to the specific data collection issues that arise for employee benefit schemes.

In Section 8 we identify how data may be checked and the assertions an actuary might question when examining data, together with how they would check the data against these assertions.

The actuary will not always have access to full data when carrying out an investigation. In Section 9 we consider why there may be a lack of ideal data and the advantages and disadvantages of using summarised data instead.

An organisation's primary source of data is its own records. But often this information will be supplemented by industry-wide data. In Section 10 we examine the benefits and drawbacks of using such data.

In Section 11 we consider the concepts of classifying risk and reducing heterogeneity within data.

1 Personal data and data legislation

1.1 Personal data

Organisations often accumulate large amounts of information relating to individuals as part of their ongoing operations. The increasing use of technology has now made it possible to collect, store and use very large amounts of information about individuals in ever more diverse ways.

Organisations have particular responsibilities when acquiring and maintaining personal data. Personal data relates to information in respect of an individual where the individual can be identified, or where the data combined with other information could allow the individual to be identified.



Question

List data items that could be considered to be personal data.

Solution

Personal data could include a combination of some or all of the following:

- name
- address
- personal email address
- occupation
- date of birth
- health status
- race or ethnicity
- criminal record.

This list is not exhaustive – other examples are given later in this section.

Organisations have an ethical responsibility to deal responsibly with personal data. In particular, they need to balance the privacy of individuals with the need of the organisation to make fair and reasonable use of the personal data in their operations.

1.2 Data protection legislation

Many countries have data protection laws to safeguard the rights of individuals with regard to how organisations can process and maintain personal data.

While the relevant regulations vary by jurisdiction, the objectives and expected behaviour are often similar. Examples of legislation that are broadly similar include the Data Protection Act in the UK, Personal Information Protection and Electronic Documents Act in Canada, and Personal Data (Privacy) Ordinance in Hong Kong.

However, not all countries have equivalent data protection legislation. For example, the USA has much less stringent personal data / privacy laws or regulations than the UK. Organisations need to take extra care where data is being transferred between countries, even if the purpose is valid.

An example of common data protection principles is contained in the Data Protection Act in the UK, which has eight principles that must be followed when processing personal data.

Personal data must:

- **be processed fairly and lawfully**
- **be obtained and processed for specified purposes**
- **be adequate, relevant and not excessive for the purposes concerned**
- **be accurate and, where necessary, kept up to date**
- **not be kept longer than necessary for the purposes concerned**
- **be processed in accordance with the individual's rights under the Act**
- **be processed securely**
- **not be transferred to a country or territory outside the European Economic Area unless that country or territory ensures an adequate level of protection.**

The European Economic Area is a group of countries that extends beyond the European Union, operating as a single market under the same basic rules.

On 25 May 2018 the General Data Protection Regulation (GDPR) was introduced for all EU member States. The GDPR gives member States some limited flexibility to make provisions for how it is applied within a State, and the Data Protection Act gives details of these provisions.

The consequences of non-compliance with the relevant data protection laws when processing personal data can be significant.

For example:

- **Individuals who commit criminal offences may be prosecuted.**
- **Organisations can be fined for serious breaches. For example, in the UK, organisations can be fined up to £500,000.**

In recent years the number of such breaches, and consequent fines, has been increasing. This has largely been due to increases in cyber attacks (access to an organisation's electronic data by hackers from outside that organisation), particularly where there have been insufficient electronic data security measures in place.

In addition to prosecution and/or financial penalties, breaching data protection rules could lead to adverse publicity which can lead to significant reputational damage for an organisation.

The ability to identify the individual to whom the information relates is crucial to the definition of personal data. For anonymous data (ie where that individual cannot be identified) the obligations on an organisation are often considerably less. For example, in the UK anonymous data does not constitute personal data and the duties and obligations of the Data Protection Act do not apply.

1.3 Competition legislation

In addition to data protection laws, jurisdictions may also have competition laws which may also limit the uses to which data can be put.

For example, the following may be prohibited:

- **anti-competitive agreements – eg data could be shared among a small number of companies to fix prices in a particular market**
- **abuse of dominant market position – eg imposing unfair trading terms, such as exclusivity.**

Exclusivity means imposing restrictions on the customer's ability to obtain goods or services from other providers.

There can be significant consequences of non-compliance with competition laws, including:

- **fines**
- **awards for damages**
- **disqualification of company directors.**

1.4 Sensitive personal data

Broadly speaking, personal data is considered to be 'sensitive' if its disclosure to others without consent could cause the individual a high level of distress or damage.

Sensitive personal data can include information related to:

- **racial or ethnic origin**
- **political opinions**
- **religious or other similar beliefs**
- **membership of trade unions**
- **physical or mental health condition**
- **sexual life**
- **convictions, proceedings and criminal acts.**

Sensitive personal data is generally subject to much stricter regulation than ordinary personal data. For example, it may be the case that sensitive personal data can only be processed when one of the following conditions has been satisfied:

- **The data subject has given explicit consent.**
- **It is required by law for employment purposes.**
- **It is needed in order to protect the vital interests of the individual or another person.**

For example, if an individual with a medical condition has an accident at work, it would be in the individual's vital interest to disclose this condition to medical staff treating the individual.

- **It is needed in connection with the administration of justice or legal proceedings.**

2 Big data

2.1 Characteristics of big data

The increasing use of technology has now made it possible for the public and private sector to collect and analyse very large data sets of information. This is often referred to as 'big data'.

Big data can be characterised by:

- very large data sets
- data brought together from different sources
- data which can be analysed very quickly – such as in real time.

Big data can include personal data (such as data from social media or loyalty cards), but can include other data (such as climate change data).

2.2 Data protection considerations for big data

This section considers the situation where the underlying data set includes personal data.

If personal data is held by a company, then the company needs to comply with the relevant data protection rules. Given the large amount of information that could be held on an individual, privacy considerations are likely to be a concern for individuals whose data is held.

Anonymisation can potentially aid big data analytics, as it means that the information being analysed is no longer considered personal data.

'Big data analytics' is the process of analysing the large data sets to uncover patterns, trends, correlations and other details that can be used to inform decision-making within the organisation.



Question

Give an example of how big data analytics may be used in:

- motor insurance
- health insurance.

Solution

- Motor insurance – the analysis of data obtained from using telematics (*ie* monitoring driver behaviour through a device installed in the insured vehicle).
 - Health insurance – the analysis of data on diet (*eg* from supermarket purchases using a loyalty card) and exercise regime (*eg* from wearable fitness monitors).
-

Anonymisation can assist organisations to carry on research or develop products and services. It also enables these organisations to give an assurance to the people whose data was collected that the organisation is not using data that identifies them for big data analytics.

A key feature of big data is using ‘all’ the data, which contrasts with the concept of data minimisation in the data protection principles. This raises questions about whether big data is excessive, while the variety of data sources often used in big data analytics may also prompt questions over whether the personal information being used is relevant.

One of the principles mentioned in Section 1 in relation to the collection of personal data was that it should be ‘adequate, relevant and not excessive for the purposes concerned’.

Organisations need to be clear from the outset what they expect to learn or be able to achieve by processing the data, as well as satisfying themselves that the data is relevant and not excessive.

Organisations that hold big data also need to be transparent when they collect data, and explaining how the data will be used is an important element in complying with data protection principles. The complexity of big data analytics will not be an acceptable excuse for failing to obtain consent where it is required.

Regulators expect organisations that hold big data to be proactive in considering any information security risks posed by big data.

Data governance is becoming increasingly important for holders of big data. This must take account of data protection and privacy issues.

Data governance is considered further in the next section.

3 Data governance

3.1 Definition

Data governance is the term used to describe the overall management of the availability, usability, integrity and security of data employed in an organisation.

3.2 Data governance policy

A data governance policy is a documented set of guidelines for ensuring the proper management of an organisation's data.

A data governance policy will set out guidelines with regards to:

- **the specific roles and responsibilities of individuals in the organisation with regards to data**
- **how an organisation will capture, analyse and process data**
- **issues with respect to data security and privacy**
- **the controls that will be put in place to ensure that the required data standards are applied**
- **how the adequacy of the controls will be monitored on an ongoing basis with respect to data usability, accessibility, integrity and security.**

The data governance policy will also provide a mechanism for ensuring that the relevant legal and regulatory requirements in relation to data management are met by the organisation.

3.3 Data governance risks

Organisations that do not have adequate data governance procedures can be exposed to risks relating to:

- **legal and regulatory non-compliance**
- **inability to rely on data for decision making**
- **reputational issues**
- **incurring additional costs (for example fines and legal costs).**

Reputational issues can in turn lead to a loss of business, both in terms of existing customers moving to another provider and a compromised ability to attract new customers. Increased use of the internet and social media for the distribution of information about such cases has exacerbated this potential risk.

A sound data governance policy should therefore provide the organisation's stakeholders (staff, management, regulator, shareholders and policyholders, amongst others) with confidence that the organisation is dealing appropriately with the data it holds.

3.4 Mergers and acquisitions

An example of a scenario where having and following a strong data governance policy is particularly important is when two companies are joined together.

Where businesses are combined by merger or takeover, one of the key issues is whether the data for the two businesses should be combined onto one system and, if so, which.

The saving in overhead costs such as system maintenance and management is frequently cited as a justification for the transaction. In practice, the costs of converting the data from one working system to another are high. New developments are carried out on one system and the other is left to decline as a legacy system, often requiring proportionately higher maintenance costs. Thus the aim of cost saving is often not achieved.

There is a risk in aggregating data sourced from different systems and a data governance policy needs to address this risk.

The companies will each have their own pre-transaction data governance policy. If these differ, decisions will also have to be made as to which to adopt following the transaction. Ideally, it would be the more stringent and comprehensive of the two – or one which combines the strengths of each.

4 Risks associated with the use of data

4.1 Data risks

An actuary is faced with a range of possible risks when using data.

Examples of possible risks associated with using data are:

- The available data might contain errors or omissions, which could lead to erroneous results or conclusions.
- There may be insufficient historical data available to estimate credibly the extent of a risk, and the likelihood of the occurrence of that risk in future.
- Even where there is sufficient data to estimate credibly future experience in normal conditions, there may be insufficient data available to provide a credible estimate of a risk in very adverse circumstances, which may be necessary for some purposes (eg estimating the tails of a distribution).
- Where there is insufficient data it may be possible to use data from other sources (eg industry data, other countries, competitors), but there is a risk that data from other sources may not be a sufficiently good proxy for the risk being assessed.
- Historical data may not be a good reflection of future experience. This could be due to:
 - past abnormal events
 - significant random fluctuations
 - future trends not being reflected sufficiently in past data
 - changes in the way in which past data was recorded
 - changes in the balance of any homogeneous groups underlying the data
 - heterogeneity with the group to which the assumptions are to relate
 - the past data may not be sufficiently up to date
 - other changes – eg medical changes, social changes, economic changes etc.
- There are risks where an actuary attempts to group data into broadly homogenous groups. The risks associated with this are:
 - the individual data groups may be too small for a credible analysis
 - if data groups are merged so there is sufficient data in each group to be credible, the combined data set may not be sufficiently homogeneous.
- The available data may not be in a form that is appropriate for the purpose required.
- The available data may have been collected for a purpose, which means that it is not appropriate for a different purpose.
- A lack of confidence in the available data will reduce the confidence in an actuary's conclusions.

The key risks relating to data can therefore be summarised as:

- the data are inaccurate or incomplete
- the data are not credible due to being of insufficient volume, particularly for the estimation of extreme outcomes

- the data are not sufficiently relevant to the intended purpose
- past data may not reflect what will happen in the future
- chosen data groups may not be optimal
- the data are not available in an appropriate form for the intended purpose.

A lack of ideal data is considered in more detail later in this chapter.

4.2 Algorithmic decision making

Background

Algorithmic decision making refers to investment trading decisions that are automated, so that they take place without human intervention. The quality of these automated decisions depends on the robustness of the programmed trading rules, which in turn rely on the data used.

In the last few decades, the trading of financial assets has increasingly been carried out electronically. Advances in computer power, communication technology and programming capability have offered new tools for investment decisions, trading execution and risk management.

Electronic trading has the advantages of increased speed and efficiency of trading, and can result in lower dealing costs on trades. In addition, automated trading can potentially facilitate the execution of complex trading strategies that would not have previously been possible.

Algorithmic trading is a form of automated trading that involves buying or selling financial securities electronically to capitalise on price discrepancies for the same stock or asset in different markets.

Often many trades are carried out very quickly to take advantage of temporary price discrepancies, with the aim of making small profits on each trade. The trader will use a formula (or algorithm) to decide whether a financial asset should be bought or sold.

The parameters underlying the algorithm used to determine when assets would be bought or sold will need to be derived using data from an appropriate source(s).

Risks relating to algorithmic trading

The following risks are associated with algorithmic trading:

- **There could be an error in the algorithm or the data used to parameterise the model could be wrong, leading to potential losses on each trade, rather than the expected profits.**
This is an issue when a large number of trades could be completed very quickly.
- **The algorithm may not operate properly in adverse conditions.**
For example, the algorithm could stop trading an asset in turbulent markets, reducing liquidity of the asset and increasing volatility.
- **In very turbulent conditions, trading in individual stocks, or even entire markets, may be suspended before an algorithmic trade can be completed.**

- The main risk of algorithmic trading is the possible impact on the financial system.
An example of this was a 5%-6% plunge and rebound in major US equity indices within the span of a few minutes due to a large number of trades done at erroneous prices in May 2010.
The increasing integration between markets and asset classes means that a meltdown in one market could impact other markets and asset classes.

Example

Algorithmic trading looks at prices of stocks across all markets. An early development was known as programmed trading, which just considered automated rules for trading individual stocks on a single market. It gives a good example of the advantages and disadvantages of algorithmic trading.

You own 100 shares of a company, with each share currently equal to £1. The rules in place for buying / selling the stock require you to sell the stock when it falls in value by 5% from the starting point, and buy when the stock rises in value by 5% above its low point.

Say the share price falls from £1.00 to £0.93 on a given day and then bounces back to £1.05 before the end of the day.

Your cashflows would be:

- You sell your 100 shares when the price reaches £0.95 per share, and you realise £95 in cash ($100 \times £1.00 \times 0.95$).
- You then use the £95 in cash to rebuy the shares when the share price reaches £0.9765 ($£0.93 \times 1.05$).
- This gives you 97.28 shares ($£95 / £0.9765$), which rise in value to £102.15 ($97.28 \times £1.05$) by the end of the day.

Was it worth selling and re-purchasing the shares?

If you had done nothing at all, the value of your shares would have risen from £100 to £105 ($100 \times £1.05$) by the end of the day. You have therefore made a small loss of £2.85 (ie $£102.15 - £105$) by selling and buying when you did not need to.

In practice this loss would have been more as there would have been other frictional costs, such as trading costs, when you bought and sold the stock.

However, it is possible that the share price would not have bounced back, and possibly it could have fallen further. In this case, selling the stock before it fell further may have been a good strategy. The loss you made in the example above might be regarded as an acceptable insurance premium for the protection that the method gives against larger price falls.

The investor therefore needs to consider whether the potential for loss outweighs the possible benefits when designing a trading scheme which is based solely on numbers rather than on any research into the company involved.

5 Operational data requirements

5.1 Main uses of data

Actuaries use data in all their work.



Question

List the areas of work in which financial services organisations use data.

Hint: think about the different departments of such organisations.

Solution

The uses of data include for:

- administration
- marketing
- premium rating, product pricing, determining contributions
- setting provisions (*ie* setting aside reserves to meet future benefit payments and future expenses)
- experience analyses
- investment
- accounting
- risk management, including using underwriting and reinsurance
- management information.

Many of these activities (setting premiums / contributions, setting provisions, performing experience analyses and risk management) are described in more detail later in the course.

The interaction between the data requirements for the various tasks that actuaries carry out can be complex and will vary from organisation to organisation. Essentially, however, for a given type of work the underlying data requirements will normally be similar.

The overriding principle is that the data for all the tasks should be controlled through one single, integrated data system.

If data are controlled by one single, integrated system then:

- there is reduced chance of existing data being corrupted
- there is reduced chance of inconsistent treatment of information, between products or over time
- there is likely to be a better level of control over those who may enter information or amend information

- information will be easier to access, as it will not involve collating information from several systems
- time will not need to be spent reconciling data from different systems.

However, this ideal is not always achieved in practice. In a smaller organisation it is easier to ensure that the data used for different applications are consistent, because it is likely that the same small group of people will carry out the applications.

5.2 Sources of data

Publicly available data

For some purposes, data may only be required on a 'big picture' basis. Here, data will be publicly available from published company accounts and regulatory returns.



Question

A life insurer is examining the regulatory returns of other insurers to compare against the provisions it has set for its health insurance business.

Comment on the care the insurer needs to take when using such external data for comparative purposes.

Solution

When using competitor data for comparison, the company should consider differences in:

- the scope of the cover provided, *ie* types and levels of benefits
- the target market (expected claims experience may vary significantly by the types of policyholder targeted) of the company and its competitors
- business management actions taken such as underwriting levels and use of reinsurance
- the approach taken to valuation by the different companies, *eg* there may be a choice in how prudent the basis is
- the quantity of the data (*ie* number of policies) and hence how credible it is.

The company should also consider how reliable the source of data has proved to be in the past, and when the results were compiled (they may be out-of-date).

We will look at such industry-wide data in more detail later in this chapter.

Internal data

Product providers need data relating to the individual risks that they provide cover for. The quantity and quality of these data are both important. Without sufficient quantity, data groupings will either be non-homogeneous or lack credibility. However, even where there are plenty of data available, poor quality data will mean that any results produced are not reliable.

6 Data quality

6.1 Sources of data quality issues

Problems of data quality and quantity can be a result of:

- poor management control of data recording or its verification processes, or
- poor design of the data systems.

This may not necessarily be a reflection on the current management, as good quality data cannot necessarily be obtained quickly. After implementing a process for maintaining extensive records, it may take many years for enough data to be collected for analysis purposes.

The availability of data of good quality and quantity will vary greatly between organisations and, within organisations, between the different classes of business.

6.2 Ensuring good quality data – the proposal form

When placing a value on liabilities, for healthcare, life and general insurers, the prime information source will be the details given on the proposal form. It is therefore important that it produces relevant and reliable information for the system.

Questions need to be well-designed and unambiguous, so that the proposer will give the full, correct information and the underwriting department can process the application readily, adding any coding that is necessary.

The ideal is for the information to be quantitative in nature wherever possible, and the use of tick boxes on the proposal form can help ensure that clear and correct information is provided.

It is sensible that the computer system used by the administration team to process the proposal form inputs the information in the same order as the questions on the proposal form, and in such a way that limited interpretation of information is required by staff. As the information is input, it should be validated by the system. (Data checks are discussed further later in this chapter.)

In addition, the insurer may send the policyholder a copy of the key information and ask the policyholder to verify that the information is correct.

In particular, the result of any medical or occupational underwriting will need to be added. For general insurance personal lines, the composition of the final premium from various rating factors will be important.

Rating factors are the measurable characteristics of a particular risk that will affect the size and/or likelihood of a claim.



Question

List the important rating factors that would be stored by a general insurer for a private motor insurance policy. (*Hint: if you have motor insurance, think about the types of question insurers ask on the proposal form or over the telephone.*)

Solution

Principal rating factors for private motor insurance include:

- age
 - gender
 - details of any other drivers on the vehicle
 - how long a driving licence has been held
 - number of convictions for motoring offences
 - number of past motoring accidents (say in the last five years)
 - type of cover (*eg* third party only, comprehensive)
 - make and model of vehicle
 - age of vehicle
 - use of vehicle (business, pleasure)
 - postcode (location)
 - where the vehicle is stored overnight.
-

6.3 The use of proposal form information when assessing claims

The information from the proposal form (together with any subsequent changes) will need to be held for several purposes, including cross-checking against the claims information at the time of any claim.

Changes that are made to the policy are known as *endorsements*.

For example, if mid-way through the policy year a policyholder upgraded his private medical benefits policy from individual membership to cover his family, then this change (endorsement) would need to be captured by the data system.

The system still needs to retain the policy details relating to the first half of the year, because the policy data will be used for assessing claim experience. For each policy we need to know its exposure to risk during the year. This means we need to have recorded that this policy will have half a year's exposure to having a claim when providing individual policyholder cover, and half a year's exposure to having a claim when providing family cover.

Holding the basic policy information should enable the automatic checking of the validity of the claim and the updating of the policy information (*eg* termination of cover in the event of a total loss under a general insurance policy or death under a life insurance policy). The data requirements will depend on the type of benefits provided.

6.4 Ensuring good quality data – the claim form

Another important information source will be the details given on a claim form. Like the proposal form, it is important that this is designed with the aim of producing information that can be both analysed accurately and also transferred easily to the computer system.

The claim form will be used to produce (or update) the claim record for that policy.

6.5 Data to be captured



Question

Outline the data that would typically need to be captured by an insurance company in its policy and claim records.

Solution

The data requirements for each policy or claim record include:

- details of the risk or risks covered
- details of cover (*eg* level of any excess, maximum payout)
- details of claim (if a claim record)
- status of present record (for example if a claim is open, settled or has been reopened)
- control dates (start, end dates of each record, dates of claims, *etc*)
- relevant amounts (sums insured, premiums, claims payments, *etc*)
- administrative details.

As well as data relating to current risks covered, it is important to retain the history of past policy and claim records.

Past records must be held since future data analysis is likely to look at several years of records in order to have sufficient credible data.

7 Data issues for employee benefit schemes

7.1 Introduction

There are specific issues for consideration when looking at data for employee benefit schemes. In particular, the data required for a valuation will be provided by the scheme sponsor (typically the employer).

There may be occasions when the actuary does not have full control over the data available.

For example, when valuing benefits under an employee benefit scheme, the scheme sponsor will usually provide data on the operation of the scheme and the scheme membership.

In this instance it is important to emphasise to the sponsor the importance of good quality data, which means data that is:

- complete, *ie* no omissions
- accurate
- up-to-date
- consistent with previous data
- at the level of detail requested, *eg* employer and employee contributions split out.

It will be particularly important to validate data provided by the sponsor.

7.2 Data requirements

Data will be required to place a value on the benefit entitlements of individuals.

Data will be required in respect of:

- **individuals who have an entitlement to receive a benefit in the future**
This will consist of scheme members who are working for the employer and earning benefits (*active members*) and individuals who have stopped accruing benefits but are yet to retire (*deferred members*), for example individuals who have moved to another employer.
- **individuals who are currently receiving benefits ...**
... and for which future benefit payments may be required (*current pensioners*).

The data will need to be sufficiently detailed to provide all information that is likely to be financially significant to the level or timing of future benefits.

For example, if a pension is to be provided, the age of the individual will be significant.

However, if a pension were also to be paid to a spouse after the death of the member, the existence and age of a spouse of a young member may not be financially significant as the marital status of the member may change in the future.

8 Checks on data

Before data can be used for any valuation purpose, it must be checked in order to remove any errors or correct any omissions.

8.1 Verifying current data

Any equivalent data used when previously valuing benefits will be useful to the actuary as it will enable reconciliations to be performed that help to indicate the validity of the current data.

For example, for a benefit scheme the actuary will examine:

- the membership movements over the inter-valuation period – the number of members at the start plus the number joining less the number exiting must reconcile to the period end number
- changes in averages over the inter-valuation period – for example, the reasonableness of the change in the average age, salary and level of past service of the scheme over the period
- individual records (in particular for members with large pension liabilities, such as senior managers).

Equivalent reconciliations and investigations can be performed for insurance policies.

8.2 Use of accounting data

Accounting data may also help in this process.

Where reserves are built up for benefits, a balance sheet and income and expenditure statement may exist. This will provide information about the total value of the assets held and perhaps information relating to recent benefit outgo and premium / contribution income. This information will be useful in verifying other data or in considering the assumptions to be used.

If audited accounts exist, they will enable greater reliance to be placed on the figures when verifying the data.

The accounts are a useful document for verifying data provided from other sources.

For example, the accounts will include details of the financial position of an insurer or benefit scheme at the start and end of the accounting period. The assets held in the statement of financial position (or balance sheet) at the valuation date can be cross-checked against the asset data used for the benefit valuation.

The statement of profit / loss (or income and expenditure statement) will include details of cashflows during the accounting period. So, for example, the contributions paid into a benefit scheme can be cross-checked against pensionable payroll. Similarly, the amount of claims paid as shown in the accounts can be used to validate insurance company claims experience data.

8.3 Asset data

To place a value on assets that is reliable and consistent with a value placed on future benefits, it is necessary to obtain a full listing of the individual assets held. These individual holdings should then be checked to determine whether they are permitted or are subject to valuation restrictions imposed by regulation or legislation.

Asset information can also be cross-checked with investment management reports, and details of sales and purchases from the investment managers.

8.4 Assertions to be examined

Whether using data provided by their own organisation or a third party, an actuary will have to make and check certain assertions about that data. Such assertions include:

- that a liability or asset exists on a given date
- that a liability is held or an asset is owned on a given date
- that when an event is recorded, the time of the event and the associated income or expenditure are allocated to the correct accounting period
- that data is complete, *ie* there are no unrecorded liabilities, assets or events

It can be possible to overlook certain groups of members. For example, a pension scheme actuary will need to check that new entrants to the scheme since the last valuation have been included and that no categories of member (*eg* senior management) have been excluded from the data.

- that the appropriate value of an asset or liability has been recorded.

8.5 Checking the assertions

A decision will then have to be made as to how these assertions will be checked and the level of detail that will be appropriate in checking them.



Question

Outline the factors that will affect the level of investigation that is appropriate when checking these assertions.

Solution

The factors include:

- the purpose of the valuation, *eg* an interim update or a regulatory report
 - the significance of the assertion, *ie* the likely impact on the overall result if the data was incorrect for this reason
 - the extent to which there is other information to support or contradict the assertion.
-

Possible checks could include:

- **Reconciliation of the total number of members / policies and changes in membership / policies, using previous data and movement data.**
The reconciliation of movements of members / policies is useful in providing an early indicator of any trends occurring within the benefit / insurance arrangement.
- **Reconciliation of the total benefit amounts and premiums and changes in them, using previous data and movement data.**
- **The movement data should be checked against any appropriate accounting data, especially with regard to benefit payments.**
- **Checks should be made for any unusual values, such as impossible dates of birth, retirement ages or start dates.**

The data should also be checked against previous valuation records to ensure that dates that should have remained fixed (*eg* dates of birth) have not changed.

- **Consistency between salary-related contributions and in-payment benefit levels indicated by membership data and the corresponding figures in the accounts.**
- **Consistency between the average sum assured or premium for each class of business should be sensible, and consistent with the figure for the previous investigation.**
- **Consistency between investment income implied by the asset data and the corresponding totals in the accounts.**
- **Where assets are held by a third party, reconciliation between the beneficial owner's and the custodian's records.**
- **Full deed audit for certain assets, such as checking the title deeds to large real property assets.**

Such checks could include:

- the location and type of property
- whether it is freehold or leasehold
- the remaining term of lease, if it is leasehold
- the duties in respect of property management and maintenance
- any restrictions on the use of the property.
- **Consistency between shareholdings at the start and end of the period, adjusted for sales and purchases, and also bonus issues, etc.**
- **Random spot checks on data for individual members / policies or assets.**

It will be particularly important to check data for members who have significant liabilities – since errors in their data records will have a significant impact on the valuation result.

9 Lack of ideal data

9.1 When ideal data are not available

In an ideal world, data would be of sufficient quality and quantity to enable any actuarial investigation performed to be 100% reliable. However, this is rarely the case in practice.

The main circumstances where ideal data are not available are because:

- there is insufficient volume of relevant data to be credible
- there is insufficient detail captured within the data, *ie* the data available are not in an appropriate form for the intended purpose.

These issues are examples of data risks that were covered in Section 4.1.

Insufficient volume of data

There may be insufficient data to provide a credible result. A provider may have recently launched a new product, or branched out into a new target market. Alternatively, the provider may simply be too small to attach any credibility to its own experience. This is particularly the case with benefit schemes, where very few employers will be of sufficient size to have credible experience to assess mortality rates before retirement.

As mentioned in the earlier section on data risks, even if there is a reasonable amount of current data, there may be insufficient historical data available to credibly analyse trends or estimate a risk under adverse conditions.

Insufficient detail within data

Data may not have been captured at a sufficiently detailed level. For example, a benefit scheme may not analyse membership by whether the employee is a clerical or a manual worker. Changes in the structure of the membership may have a material effect on scheme benefits such as early death or accident benefits. Similarly, where life assurance premiums are collected at the door by an agent who calls, only limited data may be captured on the insurer's database.

9.2 The use of summarised data

When valuing benefits it may be appropriate to use summarised data instead of detailed membership data in some circumstances.

The same is true for policyholder data in relation to valuing insurance policies.

For example, insurance Company A is considering making a bid for insurance Company B. In valuing Company B prior to the takeover, Company A will not have full access to data.

However, it should be recognised that the reliability of the values will be reduced, as full validation of the data will be impossible.

Rigorous data validation will be impossible and this means that the actuary may not detect errors in the data.

Additionally, the summarised data may miss significant differences between the nature of benefits that have been grouped together.

The actuary will not have sufficient detail to be able to split the data into homogeneous groups.

It is also unlikely that summarised data could be used to value options or guarantees that may or may not apply on an individual basis.

For example, consider a benefit scheme that promises a payment which is the larger of two calculations. To assess this benefit accurately, individual calculations need to be carried out for each beneficiary. Otherwise, a member for whom one of the calculations 'bites' (ie is the larger) might be inadvertently summarised in a data group with members for whom the other calculation is larger. This could result in the potential cost of a guarantee being under-estimated.

Summarised data is therefore only suitable if such inaccuracy is recognised by the users of the results of the calculations.

The actuary should clarify the quality of the data upon which any advice is based, particularly if summarised data have been used because of time constraints. Ideally, such advice should be verified once full data are available.

The actuary should disclose the *source* of data in any advice.

If the actuary has any reservations regarding the accuracy of the data provided, this should be mentioned in the report.

10 Industry-wide data collection schemes

10.1 What are industry-wide data collection schemes?

In some countries there are organisations that collect data from their member offices and then make available summaries of all the data to their members. For example, in the UK, the Association of British Insurers collects and collates a wide variety of insurance data.

This cannot be used in place of policy data to establish provisions for a particular policy or scheme, but could be used to determine bases or be used in product pricing.

This will be of particular use to small insurers or insurers writing a new class of business, as in these cases their own data may be insufficient.

One of the best examples is the Continuous Mortality Investigation Bureau of the Institute and Faculty of Actuaries in the UK, which does a large amount of work on mortality and morbidity statistics.

The volume of data that can be collected from across a whole industry greatly improves the statistical significance of the resulting analysis.

10.2 Potential benefits from using industry-wide data collection schemes

An insurer participating in an industry-wide scheme has the prospect of being able to compare its own experience with that of the industry as a whole (or that part of it represented by the participating insurers) with regard to both the overall level and the pattern of the experience by the categories into which the data are classified. Any significant differences point to a need for explanation.

Since an insurer is likely to be seeking to expand by attracting business from its competitors, it may be important to have an indication of the ways in which the characteristics of the business it is seeking may differ from those of the business it already has.

10.3 Possible reasons for heterogeneity

When using industry-wide data, there is potential for distortions arising from heterogeneity.

This is because the data supplied by different organisations may not be precisely comparable because:

- companies operate in different geographical or socio-economic sections of the market
- the policies sold by different companies are not identical
- sales methods are not identical
- the companies will have different practices, eg underwriting or claim settlement standards
- the nature of the data stored by different companies will not always be the same
- the coding used for the risk factors may vary from organisation to organisation.

This means that we must be very careful when interpreting industry-wide data. It may well not be relevant for the company using it.

10.4 Other problems with industry-wide data

Other problems with using industry-wide data may be:

- **the data will usually be less detailed, or less flexible, than those available internally**
- **external data are often much more out-of-date than internal data**
- **the data quality will depend on the quality of the data systems of all of its contributors**

If one company makes a mistake (*eg* entering a figure in millions instead of thousands) then this invalidates the whole set of data. The more companies that contribute, the more likely that one will make a mistake.

- **not all organisations contribute, and the organisations that do contribute are not representative of the market as a whole.**

10.5 Other sources of data

It may also be possible to obtain data from a reinsurer.

Reinsurers will provide cover to many insurers in the market and often provide cover in many territories. Therefore they can provide useful data and information for insurers who wish to launch a new product or sell an existing product to a new target market.

For example, when critical illness cover was emerging as a product in the UK in the early nineties, reliance was placed on the experience and data that reinsurers had collected from reinsuring this type of business in South Africa, where the insurance coverage was already well-established.

Another source of data would be national statistics.

This refers to data collected in relation to the population of the country as a whole, for example by government bodies or national statistics offices.

11 Risk classification and reduction of heterogeneity

11.1 What is the aim of risk classification?

The in-force data of an insurer or other benefit provider will be analysed at regular intervals. For the purposes of such analyses sufficient data will be required to ensure the results are credible, but this needs to be balanced against not including so much data that heterogeneity is a significant issue.

The main aim of risk classification is to obtain homogeneous data. The reduction of heterogeneity within the data for a group of risks makes the experience in each group more stable and characteristic of that group. Furthermore, it enables the data to be used more appropriately for projection purposes.

This is important when monitoring claims and mortality experience. Any heterogeneity in data groups will serve to distort the results and can lead to setting provisions that are too big or too small and calculating premiums or contributions that are incorrect.

For example in private motor insurance, property damage and bodily injury claims are very different in their nature and terms. It is important, therefore, that they are treated separately when setting up provisions.



Question

Outline the problems that can result from setting up provisions that are too big or too small.

Solution

If the provisions are too big (*ie* the company sets aside unnecessarily large reserves):

- the funding / solvency level will appear to be lower than it actually is, resulting in interested parties, *eg* brokers, analysts, the regulator and shareholders, viewing the company as financially weaker than it is in reality
- capital may not be being used efficiently.

If the provisions are too small:

- over time it will become apparent that additional money is required
 - in the worst case scenario, insolvency could result
 - profits will be recognised earlier and the payment of tax will be accelerated
 - inappropriate business decisions may be made.
-

Ideally data to be analysed should be split into homogeneous groups, for example, by age and gender in a mortality investigation. However, where data is scarce, such as for numbers of deaths at young ages, splitting data into homogenous groups may result in data groups that are too small to enable any credible analysis to be carried out.

In such cases data may need to be combined into groups which are less homogeneous, but which are large enough to be credible. Whenever data is to be analysed there needs to be a balance between splitting the data into homogeneous groups and having sufficient data in each group to enable a credible analysis to be carried out.

There is also a need to carry out sensitivity testing to check that if the data are grouped in a different way, the same results are obtained.

The chapter summary starts on the next page so that you can keep all the chapter summaries together for revision purposes.

Chapter 18 Summary

Personal data

Personal data is information which would allow an individual to be identified, either on its own or when combined with other information. Organisations have ethical and legislative responsibilities when dealing with personal data.

Many countries have data protection laws to protect the rights of individuals in terms of how organisations process and maintain personal data. There may also be competition legislation that limits the uses to which data can be put. There can be serious consequences for failing to comply with data protection and competition legislation.

Sensitive personal data is information which is more private to the individual and is generally subject to much stricter regulation than other personal data.

Big data

Big data comprises very large data sets, often brought together from different sources, and which can be analysed very quickly.

It may or may not include personal data. Anonymisation can be used to avoid the data being classified as personal.

Organisations have to be careful to avoid big data being seen to be excessive or not relevant, and must be transparent when collecting big data.

Data governance

Data governance is the overall management of the availability, usability, integrity and security of data.

Organisations should have in place a robust data governance policy. Failure to do so can lead to legal, operational, reputational and expense risks.

Data governance is a key issue during a merger or acquisition.

Data risks

The key risks relating to data are:

- the data are inaccurate or incomplete
- the data are not credible due to being of insufficient volume, particularly for the estimation of extreme outcomes
- the data are not sufficiently relevant to the intended purpose
- past data may not reflect what will happen in the future
- chosen data groups may not be optimal
- the data are not available in an appropriate form for the intended purpose.

Algorithmic decision making

Automated asset-trading is an example of where data (and model) risk arises.

Data requirements

Actuaries use data for many tasks, including setting premiums / contributions, valuing provisions and experience analyses.

Ideally, the data should be controlled through one single, integrated data system.

The main sources of data are:

- publicly available data
- internal data.

Data quality

Poor data can be due to:

- poor management control of data recording or its verification processes
- poor design of the data systems.

A well-designed proposal form will contain unambiguous questions to help ensure correct answers are collected from policyholders.

For life insurance policies, the proposal form should capture the relevant underwriting information. For general insurance policies, it should capture the relevant rating factors.

The information on both the proposal and claim forms must be easy to enter into the system.

The system must be able to link across proposal and claims records.

Data issues for employee benefit schemes

The information is provided by the sponsor, rather than being under the direct control of the actuary.

Checks on data

Past data can be used to help verify current data.

Accounting data is useful to help verify income and outgo and the value of assets. Data on individual assets should also be checked.

The actuary will make assertions as to the quality of the data.

These assertions will be checked by looking at:

- reconciliations of member / policy numbers
- reconciliations of benefits and premiums
- movement data against accounts
- validity of dates
- consistency of contribution and benefit levels with the accounts
- consistency between average sum assured and premium for each class, and when compared with previous investigations
- consistency of asset income data and accounts
- the reconciliation of beneficial owner and custodian records where assets are owned by a third party
- full deed audit for certain assets, *eg* property
- consistency between start and end period shareholdings
- records picked at random for spot checks.

Lack of ideal data

The main circumstances under which ideal data are not available are because:

- there is insufficient volume to provide a credible result
- the data have not been captured at a sufficiently detailed level.

Sometimes the actuary only has summarised data. This is not suitable for all valuation purposes, *eg* valuing options and guarantees that apply on an individual basis.

Industry-wide data collection schemes

In some countries organisations collect data. Industry-wide data is suitable for setting bases, but not for valuing an individual policy.

Care needs to be taken as the data can be heterogeneous. This is because the data supplied by different companies may not be precisely comparable because:

- companies operate in different geographical or socio-economic sections of the market
- the policies sold by different companies are not identical
- sales methods are not identical
- the companies will have different practices, *eg* underwriting, claim settlement
- the nature of the data stored by different companies will not always be the same
- the coding used for the risk factors may vary from organisation to organisation.

In addition problems may arise as:

- the data may be less detailed / flexible
- the data may be more out-of-date
- the data quality may be poor
- not all organisations contribute and those that do may not be representative of the market as a whole.

Data may also be obtained from reinsurers or from national (population) statistics.

Risk classification and reduction of heterogeneity

The aim is to have homogeneous data, since heterogeneity distorts results.

The removal of heterogeneity needs to be balanced against having sufficient data in each group to ensure credibility.



Chapter 18 Practice Questions

- 18.1 List eight principles that must be followed when processing personal data, according to the UK Data Protection Act.
- 18.2 Comment on which of the following would be considered to comprise personal data, sensitive personal data or neither:
- (i) motor insurance proposal form
 - (ii) critical illness insurance proposal form
 - (iii) list of pension scheme members including only their employee reference number, current salary and date of birth.
- 18.3 (i) State whether sensitive personal data is typically subject to less strict, stricter or the same level of data protection legislation than ordinary personal data.
- (ii) Explain why this is the case.
- 18.4 (i) State the data protection principle which it can be difficult to meet when using 'big data'.
- (ii) Explain how companies can potentially avoid this issue.
- 18.5 An insurance company is in the process of writing its data governance policy.
- (i) List the key components that should be included in this data governance policy.
 - (ii) Outline the risks to which the company is exposed if the policy is inadequate.
- 18.6 List the main uses that actuaries make of data.
- 18.7 Discuss the likely quality and quantity of data that would be available in the following instances:
- Exam style**
- (i) a large life insurance company that predominantly writes term assurance business [3]
 - (ii) a medium-sized general insurance company that has sold employer's liability business over the past 25 years [3]
 - (iii) an actuary given the task of valuing the pension scheme of another company which may be purchased in the future. [2]
- [Total 8]
- 18.8 List the key data that would be required in respect of active members when valuing a defined benefit pension scheme that provides a pension linked to salary.
- 18.9 Explain how an actuary may use the following information to help validate data when valuing an employee benefit scheme:
- (i) accounting data
 - (ii) asset data.

- 18.10 A project team is responsible for ensuring that a newly-established general insurance company stores good quality data.

Exam style

Outline the key requirements to ensure this is achieved, including those relating to the design of the proposal and claims forms. [7]

- 18.11 A general insurance company is checking its policy data by performing consistency checks on the average sum assureds and premiums at the current valuation date relative to those at the previous valuation date.

Give reasons why the average sum assured or premium may have changed since the previous investigation for a domestic household buildings and contents product.

- 18.12 A UK life insurance company has just been established. The insurer will specialise in selling term assurance business.

List the sources of data that may be used in order to price the product.

- 18.13 List reasons why claims data might not be directly comparable between different general insurance companies.

- 18.14 In the USA there are many retirement communities. These provide different levels of continuing care (including housing) according to the levels of initial and annual contributions.

A private company wishes to assess the costs of setting up such a community in the UK.

List the sources of data that might be useful in carrying out this assessment.

- 18.15 A small pension scheme has decided to use data from an industry-wide collection of pensioner data in order to determine valuation assumptions.

Exam style

Describe the risks and issues arising from the use of this data. [10]



Chapter 18 Solutions

18.1 Personal data must:

- be processed fairly and lawfully
- be obtained and processed for specified purposes
- be adequate, relevant and not excessive for the purposes concerned
- be accurate and, where necessary, kept up-to-date
- not be kept longer than necessary for the purposes concerned
- be processed in accordance with the individual's rights under the Act
- be processed securely
- not be transferred to a country or territory outside the European Economic Area unless that country or territory ensures an adequate level of protection.

18.2 (i) This proposal form would contain a sufficient amount of information to allow the individual to be identified, *eg* name, address, age, and so comprises personal data.

It will potentially also contain sensitive personal data, *eg* criminal convictions relating to driving offences.

(ii) This proposal form will comprise personal data as above. It is also likely to contain sensitive personal data in relation to the individual's health status.

(iii) On its own, this list of information would not enable an individual to be identified directly and therefore would not comprise personal data. However, if it was accessed in conjunction with other data (*eg* a list mapping employee reference number to name) then it would.

18.3 (i) Sensitive personal data is normally subject to much stricter regulation than other personal data.

(ii) This is because sensitive personal data comprises information that is highly private to the individual and its disclosure could cause considerable distress or damage.

18.4 (i) Personal data must be adequate, relevant and not excessive for the purposes concerned.

(ii) Anonymisation can potentially be used in order to ensure that the data is not considered to be personal data.

For example, a large dataset of claims on household contents insurance could be anonymised by removing details of policy numbers, policyholder names and detailed address information (although a high level indication of location may be retained for analysis purposes).

18.5 (i) **Data governance policy**

The data governance policy should set out guidelines with regards to:

- the specific roles and responsibilities of individuals in the insurance company with regards to data
- how the insurer will capture, analyse and process data
- issues with respect to data security and privacy
- the controls that will be put in place to ensure that the required data standards are applied
- how the adequacy of the controls will be monitored on an ongoing basis with respect to data usability, accessibility, integrity and security.

The data governance policy will also provide a mechanism for ensuring that the relevant legal and regulatory requirements in relation to data management are met by the insurer.

(ii) **Risks relating to data governance failure**

If the company does not have adequate data governance procedures, it can be exposed to risks relating to:

- legal and regulatory non-compliance
- inability to rely on data for decision making, *eg* amending product prices
- reputational issues
- incurring additional costs (for example fines and legal costs).

Reputational issues can in turn lead to a loss of business:

- existing customers moving to another provider
- a compromised ability to attract new customers.

18.6 The main uses that actuaries make of data are:

- premium rating, product pricing, determining contributions
- setting provisions
- experience analyses
- risk management, including using underwriting and reinsurance.

Actuaries can also be involved in the use of data for:

- investment
- accounting
- management information
- marketing
- administration.

18.7 (i) ***Large life insurer selling mainly term assurance***

The company is large and this should mean that a significant amount of data is available at most ages. [1]

However, we also need to consider how long the company has been selling this business. [½]

The quality of data should be good, since the product is relatively simple ... [1]

... and data groups should be relatively homogeneous. [½]

Even though the company is large, there may be insufficient data at extreme ages. [½]

Since the company is large, there may be difficulties in ensuring that the data comes from one integrated system. [1]

[Maximum 3]

(ii) ***Medium-sized general insurer selling employers' liability for 25 years***

Employers' liability business is long-tailed. In other words, for business written many years in the past, claims may still be emerging. An example of this would be the large number of claims that emerged many years after the business was written for asbestos-related diseases. [1]

The company will need many years of data, therefore, in order to identify all types of claim. [½]

The fact that the company has been selling this business for a very long period of time is helpful in this respect. [½]

However, data from many years in the past may be heterogeneous. [½]

For example, policy conditions or the target market may have changed. [1]

Very old data may also be difficult to access, for example if it was stored on a different system or on paper records. [1]

Since employers can be very different in their characteristics, it may be difficult to group data homogeneously. [1]

[Maximum 3]

(iii) ***Acquisition target pension scheme***

Since it is the scheme of another company, access to data may be very limited. [1]

The data that is available may be out of date. [½]

At best summarised data is likely to be available. [½]

The actuary will need to point out the limitations of this data when providing any estimated costs. [½]

Once the purchase is under open negotiation, the actuary will have greater access to data and can provide revised figures. [½]

[Maximum 2]

18.8 Data in respect of each active member:

- membership number (or some other unique identifier)
- date of birth
- date joined employer
- date joined scheme
- date (or age) of proposed retirement
- current salary
- a salary scale or salary growth assumption
- category of membership (if the scheme provides different benefits for different workers; for example it is not uncommon for a scheme to provide higher benefits to executives)
- marital status
- date of birth of spouse
- other dependants' details (if benefits are provided for other dependants).

Data may also be required on any additional benefits, *eg* due to transfers in or additional contributions.

The actuary valuing the scheme will also request data on the active members at the previous valuation so that he/she can reconcile the data for members present at both valuations.

18.9 (i) **Accounting data**

The balance sheet (or statement of financial position) can be used to verify the value of the assets at the valuation date.

The income and expenditure (or profit / loss) statement will give cashflow information about contribution and investment income and benefit outgo that can be used to verify other data.

The validation data is particularly useful if the accounts have been audited.

(ii) **Asset data**

A full listing of assets can be obtained, which can be used to verify whether assets held:

- actually exist
- are permitted to be held for valuation purposes, or
- whether their inclusion in the valuation is restricted by regulation or legislation.

18.10 ***Proposal form***

The proposal form needs to be designed to:

- collect data at an appropriate level, including data that although not used currently may be needed in the future [1]
- be clear and unambiguous, so the proposer gives correct information [½]
- have inputs that are quantitative as far as possible. [½]

Input of data onto the system

The system should have inputs in the same order as the proposal form and such that the person inputting the information does not need to interpret the information. [1]

Staff inputting the information should be well trained. [½]

Financial incentives could perhaps be offered for accuracy of input. [½]

The data system should have validation checks, *eg* checks on:

- blank entry fields [½]
- sensible entry values, *eg* place sensible bounds on ages and sum insureds. [½]

The insurer may send the policyholder a copy of the key information and ask them to verify that it is correct. [1]

Claims form

The claims form should also be clear and unambiguous and link to the proposal form, so that cross-checking of information can be carried out. [1]

Other features of a good data system

The system should be capable (over time) of storing information, so that historical data is available for future pricing exercises. [1]

The system should be robust and flexible. [1]

The system should be secure, *ie* many staff can access the data but only certain (appropriately trained) individuals are allowed to amend the data on the system. [1]

At regular intervals checks of movement analyses should be carried out and checks of changes in policy details, *eg* considering how the average sum insured is changing from year to year. [1]

[Maximum 7]

- 18.11 The average sum assured may have changed due to inflationary effects. For example, it would be reasonable to expect the sum assured on a domestic household contents policy to increase annually with inflation.

The average premium may have increased as a result of the cover increasing (an increase in the value of the building covered or contents covered leading to an increase in premium) or may have changed due to a change in the premium rating basis.

The average sum assured and premium may have changed due to a change in the target market (and hence size / location of building insured) of the insurer, or due to the underwriting cycle.

- 18.12 The insurer may use:

- industry data, for example in the UK data collected by the:
 - Association of British Insurers
 - Continuous Mortality Investigation of the IFoA
- data from a reinsurer
- national statistics.

- 18.13 Claims data may not be precisely comparable between general insurance companies due to:

- organisations operating in different geographical or socio-economic sections of the market
- different policies being sold, *eg* different policy conditions or perils covered
- products being sold by different sales methods and/or to different target markets
- differing underwriting standards at the initial and claim stages
- different companies assessing risk differently, using different rating factors
- data being stored or recorded differently, or relating to different time periods.

- 18.14 Sources of information that would be useful include:

- scheme data on USA community schemes, since this data is most closely representative of the scheme to be offered (the company would then need to understand how the USA scheme differs from the proposed UK scheme)
- morbidity statistics from USA and UK insurers for medical insurance cover for older lives
- longevity statistics from USA and UK insurers
- healthcare statistics for the general population in the UK and USA
- mortality statistics for the general population in the UK and USA.

18.15 The risks and issues arising from the use of this data include:

Quality

The data supplied by contributors to the industry database may be inaccurate. [½]

It may be incomplete. [½]

The data quality will depend on the quality of the data systems of all of the contributors. [½]

The more companies that contribute, the more likely it is that one will make a mistake which could invalidate the whole set of data. [1]

The industry-wide data is likely to be out of date, due to the time taken to collect and process. [1]

Data quality could particularly be an issue where the data is provided by the scheme sponsor. [1]

Relevance

The data may not be sufficiently relevant to the intended purpose. [½]

The main reason for this is that the data and experience relating to other pension schemes may not be precisely comparable to this pension scheme. [½]

For example, because:

- the employer operates in a specific geographical area [½]
- the scheme has a different socio-economic mix of members than the pension industry average due to the specific nature of the company's activities, eg heavy industrial manufacturing [1]
- the nature of the scheme benefits is very different from the industry average [½]
- the extent to which membership of the scheme is voluntary or compulsory differs from that of the industry average. [½]

It may be the case that the industry-wide data includes only a sub-section of pension schemes and these may not be representative of the market as a whole. [1]

Format

The data may not be available in an appropriate form or format for the intended purpose. [½]

The nature of the data stored by different companies will not always be the same. [½]

Chosen data groups within the industry-wide data may not be optimal for this pension scheme. [½]

The coding used for the factors by which the data is split may vary between pension schemes. [½]

The pension schemes may use different definitions of benefits, eg differentiating between early retirement and ill-health retirement. [1]

The data is usually at a less detailed level than that available internally. [1]

For example, a benefit scheme may not analyse membership by whether the employee is a clerical or a manual worker. Changes in the structure of the membership may have a material effect on scheme benefits such as early death or accident benefits. [1]

The data available is also likely to be less flexible than internal data. [½]

Credibility

Despite the use of industry-wide data, the volume may still not be credible for some groups, *eg* high ages, ill-health retirement rates. [1]

This is particularly the case if the valuation requires assessment of outcomes under extreme conditions. [½]

Future

Even with good data, there is the risk that past data may not reflect what will happen in the future. [½]

This could be due to:

- past abnormal events
- significant random fluctuations
- future trends not being reflected sufficiently in past data
- changes in the way in which past data was recorded
- changes in the balance of any homogeneous groups underlying the data
- other changes – *eg* medical changes, social changes, economic changes *etc.*

[½ each]

Overall

There is a risk that a lack of confidence in the data will reduce the confidence in the valuation result. [½]

[Maximum 10]

19

Setting assumptions

Syllabus objectives

- 11.2 Describe the principles behind the determination of assumptions as input to a model relevant to producing a specific solution having regard to:
- the types of information that may be available to help in determining the assumptions to be used
 - the extent to which each type of information may be useful, and the other considerations that may be taken into account, in deciding the assumptions
 - the level of prudence in the assumptions required to meet the objectives of the client.

0 Introduction

A key part of actuarial work is the choice of assumptions appropriate to the model being used, eg to price a contract or to determine the provisions for a contract.

As in all actuarial work, when setting assumptions it is important to:

- **consider the use to which the assumptions will be put**
- **take care over the choice of the assumptions that will have the most financial significance**
- **achieve consistency between the various assumptions**
- **consider any legislative or regulatory constraints**
- **consider the needs of the client.**

The layout of this chapter is as follows:

Section 1 looks at different types of assumptions.

Section 2 outlines the various sources of information that could be used to help in setting assumptions.

Historical information is not *always* useful in setting assumptions for the future and Section 3 explores the reasons why.

Section 4 considers factors, other than the availability of appropriate information, to consider in determining assumptions. For example, we look at the purpose of the model in which the assumptions will be used.

Section 5 considers the need for margins and important factors to be considered when setting assumptions for pricing a contract.

1 Demographic vs economic assumptions

Demographic assumptions, *eg* mortality rates, relate to the size and distribution of the population. They generally affect the *timing* or *number* of the cashflows.

Economic assumptions, *eg* investment returns, relate to the level of income or outgo. They generally affect the *level* of the cashflows.



Question

An actuary is modelling a pension scheme that includes both individuals who have an entitlement to receive a benefit in the future and current pensioners.

List the assumptions that would be needed for this model, categorising each assumption as demographic or economic.

Solution

Assumptions needed for a model of a pension scheme might be:

- *demographic factors*
 - rates of retirement in good health (early, normal, late)
 - rates of ill-health retirement
 - rates of withdrawal (for reasons other than retirement or death)
 - new entrant rates
 - rates of mortality before and after retirement
 - proportion married
 - average age of spouses
 - spouses' mortality
 - salary scale (*ie* promotional increases).
- *economic factors*
 - investment returns, *eg* bond yields, equity returns
 - discount rate (for valuing liabilities)
 - earnings inflation
 - price inflation
 - pension increases
 - expenses.

(Salary scale constitutes a demographic assumption as it is specific to an individual's particular circumstances. General earnings inflation constitutes an economic assumption as it is generic.)

Whenever considering an overall basis or set of assumptions, it is important to consider both economic and demographic assumptions.

2 Information

2.1 Historical data

Historical data is likely to be a primary source of data used in determining assumptions about future experience.

However, we know that whatever happened in the past will not necessarily happen in the future. Therefore we can only use past data as a guide, together with an analysis of any recent trends and current forecasts for the future.

Historical data can be helpful when choosing demographic assumptions.

For example, historical levels of mortality in a country, industry or company may help with the choice of assumptions for the number of individuals who will survive to receive pensions, or for the extent to which contingent benefits will be payable. In many countries this data will have been analysed and used to produce a graduated decrement table. Past data can also be used to help project future improvements in mortality.

Similarly, past data can be used when determining the probability of individuals leaving employment, becoming ill, retiring, being married or other significant life events.



Question

List possible sources of historical data that could be used when setting demographic assumptions.

Solution

Historical data may be obtained from various sources, including:

- national statistics, published by government bodies and economists
 - industry data
 - tables compiled by actuaries
 - past information relating to the particular contract being considered.
-

Examples of where past data may form a useful starting point for *economic* assumptions are as follows:

- **In determining an assumption for future investment returns, past data on dividend yields on equities and on the total returns on relevant classes of investment may be useful. Where dividends are linked to an inflation index, past data on that index may be useful.**
- **Past data on salary levels in a particular country, industry or company may be useful when making an assumption about future levels of salary growth.**
- **The history of an inflation index may also be useful in determining an assumption for future benefit growth that is linked either fully or partially to that inflation index.**

2.2 Current data and forecasts

Current data may also be of use when determining assumptions. The relationship between current yields for fixed-interest and index-linked bonds may provide some indication of the market's view of future levels of the inflation index to which the bonds are related.

As explained earlier in the course, the nominal yield on conventional government bonds can be expressed as:

$$\begin{aligned}\text{nominal yield} &= \text{risk-free real yield (index-linked bond)} \\ &+ \text{expected future inflation} \\ &+ \text{inflation risk premium}\end{aligned}$$

Policy statements by governments or controlling banks may also be useful when making assumptions about economic factors.

There are many experts who provide alternative sources of estimates of future economic variables, most notably price inflation.

A scheme sponsor may be able to provide information on planned future salary increases or likely future rates of withdrawal.

In some instances, assumptions may be defined in regulations or legislation.

3 Extent to which the information may be useful

3.1 Relevance and credibility of past data

It is unlikely to be sensible to take an average rate from past data and assume that it will be appropriate for projecting future experience. Past data does not provide the answer as to what will happen in the future, but simply provides information that can be considered when determining the most likely future experience.

The social and economic conditions are likely to have changed over any period of history. The actuary therefore needs to consider the conditions that will apply in the future period to which the projections will relate and how those conditions will lead to differences from the past data that is being used.

Another change that might have an effect on past data for a benefit scheme is a change in benefits. For example, if the early retirement benefits under a pension scheme are improved, the number of members taking early retirement is likely to increase. Therefore, when considering the relevance of historical scheme data, we must take into account any benefit changes that might have affected that data.



Question

List conditions that could have changed that will lead to an insurance company's past term assurance data not reflecting its likely future experience.

Solution

Conditions that could have changed include:

- underwriting practices
- the distribution channels used
- the target market
- product design features, *eg* level of the sum assured, term of contract
- underlying mortality rates, *eg* due to medical advances or the onset of a disease or epidemic.

The relevance of past data to future projections must also be balanced against the need for sufficient data for its analysis to be statistically credible. In making a judgement about future experience, this conflict between credibility and relevance must be managed.

In the case of demographic data, the size of the exposure to risk is important in determining the credibility of the data. The expected number of exits from a particular decrement is also important. This varies depending on the parameter being determined.

For example, for an actuary to place any reliance on the actual mortality statistics, the past data set would have to be extremely large. On the other hand, an actuary might be able to determine discontinuance (*ie* withdrawal) rates from a smaller set of data, because withdrawal rates from a life, general or pensions contract tend to be much higher than death rates.

When using past data, it is necessary to consider how to deal with:

- **abnormal fluctuations**
- **changes in the experience with time**
- **random fluctuations**
- **changes in the way in which the data was recorded**
- **potential errors in the data**
- **changes in the mix of homogeneous groups within the past data**
- **changes in the mix of homogenous groups to which the assumptions apply.**

3.2 Fluctuations and changes over time

Changes affecting economic data

Economic data fluctuates with changes in economic and fiscal policy as well as with the general economic cycle. Past data for investment returns, salary levels and dividend yields in most countries fluctuates significantly over an extended time-frame.

It could be thought that economic and fiscal changes mean that most past data are irrelevant and so only data that relate to a period after any recent significant change can be used. However, this would reduce the credibility of the data and increase the effect of any random fluctuation.

It is necessary to use the earlier data and to try to strip out the fluctuations that relate to economic and fiscal conditions that differ from those that currently exist.

Price inflation

Past levels of an index to measure price inflation usually fluctuate significantly and are often a useful indicator of the economic conditions that existed. They are therefore unlikely to be very useful in determining an assumption for future levels of inflation.

Consequently, current index values may be a better guide to future levels of inflation. For example, government projections and the 'risk-free' real returns indicated by the current yields on long-term index-linked bonds could be used.

As mentioned earlier, it is the difference between the yields on fixed-interest and index-linked bonds (of similar quality) that gives an estimate of the index to which the linking is based.

Use of real values

Past data for price inflation can be very useful in determining other economic assumptions, as conversion of past economic data into real terms will often remove much of the fluctuation.

For this reason, actuaries often develop a set of assumptions in real terms. To the extent that all the factors affecting future cashflows can be determined relative to price inflation, real parameters are all that are required.

Other economic adjustments

Making any further adjustment for economic or fiscal changes is difficult to do other than subjectively. Dividend levels could be adjusted to allow for changes in taxation applying to those dividends. However, an explicit adjustment may be spurious, as there may be changes to the taxation of companies or individuals that have a more significant effect.

For example, at the start of the 1990s UK pension schemes were able to reclaim tax paid on UK dividends. The Government first reduced the amount of tax that could be reclaimed and then removed this preferential tax treatment altogether. As a result, many pensions actuaries changed their long-term assumptions by reducing the assumed dividend yield and total investment return.

Demographic changes

Much of the demographic data will also be affected by economic changes.

For example, withdrawal and new entrants rates for a benefit scheme are dependent on employee turnover. Staff turnover tends to be low in times of economic recession and high when the economy is buoyant.

Another example is more early retirements after a period of economic boom because members' finances will be healthy and so they may feel they can afford to retire early.

Similarly withdrawal rates tend to be higher for life insurance business during an economic recession, due to customers having to prioritise other outgo at a time when their finances are pressurised. General insurance companies may find that customers switch from more expensive to less expensive cover options, *eg* from comprehensive to third party.

Again, explicit adjustment is difficult and so judgement and analysis of fluctuations and trends will be important.

Mortality data is mainly affected by medical advances. Past data should be considered with this in mind. This is likely to result in significant emphasis being placed on the most recent data, with consideration of past trends and their underlying reasons being important in determining the extent of future change.

In the UK, the Continuous Mortality Investigation publishes results on a regular basis on the mortality and morbidity experience of policyholders. Recent annuity experience shows that the group of lives born in the five years surrounding 1926 has continuously shown greater improvements in mortality than the groups either side. Because the reasons for this are not completely understood, it makes it very difficult for life insurance companies and pension schemes to decide exactly how much future improvement in mortality to allow for in respect of this group of lives relative to other groups.

Where there is lots of past data, it may be possible to collect enough data to compile a specific table of experience (*eg* a life table), which can be used when setting the assumptions.



Question

Explain how a life insurance company could set mortality assumptions when there is little past data available for a particular contract.

Solution

Where there is little past data available, mortality assumptions could be set by using:

- data from a similar contract
- industry data
- reinsurers' data.

The above data is likely to be used to derive an adjustment to a standard mortality table.

One-off impacts

One-off impacts in the past data will also need to be considered to ensure that the assumptions are valid.

For example, significant returns in one year on a specific asset could be because of government intervention.

An example of this could be a material change in the value of fixed-interest assets as a result of the central bank or government changing short-term interest rates materially, or as a result of a change in the level of government bond issues.

High numbers of deaths could be due to an epidemic, meaning that mortality experience for that year is unusually high.

Historical data relating to exceptional or one-off events should be disregarded in an analysis of trends. Alternatively, the data might be adjusted to a more 'normal' value for that period.

3.3 Data recording

Changes in statistics recorded

Over time, statistics produced by the State or data recorded by companies may change. Such changes distort the past data and could lead to inappropriate assumptions unless these changes are recognised.

For example, suppose there is a change in the occupational or socio-economic groups into which people are classified for collection of data used to determine mortality rates. This might give rise to an apparent increase or decrease in the mortality for a particular class from one study to the next.

Errors in data recorded

Data errors will also cause distortions but may not be as easy to recognise as changes in the ways of recording the data. Generally, the management and verification of data recorded by companies has improved significantly as the capability of computers has improved. Older data may carry a greater risk of data error, perhaps to an extent that outweighs the usefulness of having more data.

Again the actuary needs to judge the correct balance of relevance and credibility.

3.4 Heterogeneity

Changes in the constituents of the population

In adjusting past data, it is important to recognise that the past data may give false results due to changes in the balance of homogeneous groups over time.

For example, past levels of salary growth may reflect a change in the overall composition of a workforce (for example production line workers being replaced by mechanisation) rather than just the changes in real salary levels for individuals.

Splitting the population into homogeneous groups

It is important that the past data used is relevant to the group of individuals about whom assumptions are to be made. Levels of salary growth and mortality, for example, usually differ by type of employment or social class. Ideally, the past data would be split into homogeneous groups to reflect such differences.

In practice the information necessary to split the data reliably is unlikely to be available, and splitting the data would result in a significant reduction in credibility. Therefore, past data will usually need to be adjusted in a subjective manner to allow for differences in the characteristics of the individuals concerned.

Example

When considering a company's pension scheme, its workforce might consist of manual labourers, clerical staff and management. These groups are likely to have different levels of mortality, staff turnover, salary growth, etc.

Even where the company as a whole is large enough to derive reasonably credible data, if the employees were to be split into homogeneous groups the size of each group would decrease and therefore the credibility of the data would be lower.

This is particularly likely to be the case for the management group, since it might consist of only a few senior employees.

3.5 Standard tables

In some countries past data has been analysed on a national or industry level. The most common data for such analyses relates to mortality and morbidity.

Countries may analyse the whole population's experience based on censuses. One disadvantage of census data is that it includes all lives, and not just the restricted population that effect insurance contracts. Thus census data generally includes lower socio-economic groups that distort the experience of lives effecting insurance contracts.

There is also an increased risk that the data is out of date by the time it is published.

As an example, in the UK the Institute and Faculty of Actuaries has established the Continuous Mortality Investigation Bureau (CMI), which produces mortality tables based on experience provided by participating insurance companies. The CMI Bureau conducts statistical analysis of the data including, for example, projecting mortality improvements for the experience of annuitants.

When using standard tables, the same considerations are needed as when using the company's own past experience data:

- whether the data is relevant to the intended population at which the product is marketed
- whether adjustments need to be made to the data to reflect continuation of past historical trends.

4 Other factors to consider when determining the assumptions

4.1 The need for accuracy and prudence

Purpose of the valuation

When considering the assumptions to use to project future experience, the actuary needs to consider the purpose for which the assumptions are to be used and the significance of each assumption in the overall result. This helps assess the degree of accuracy required and hence the extent to which it is necessary to try to remove distortions from data.

It also helps judge whether the assumption should reflect the best estimate of the future experience or whether it is appropriate to reflect any uncertainty about future experience by an overstatement or an understatement within the assumption.

The degree of prudence incorporated within the set of assumptions always depends on the objectives of the client for whom the model is being built.

Accuracy of assumptions

Where assumptions are used to place a capital value on future cashflows, it is usually unnecessary to make a judgement about the accuracy of each assumption. Instead it is necessary to determine that the overall value resulting from the combination of assumptions is appropriate. However, where the individual cashflows are important, it may be necessary for the accuracy of each assumption to be assessed.

For example, an asset-liability modelling study requires detailed assumptions relating to the incidence of future cashflows, whereas a model to determine the approximate cost of a proposed benefit improvement may only need very broad assumptions.

Significance of errors

Consideration of the potential financial significance of errors in the assumptions also helps assess the degree of accuracy required, the extent of margins necessary or the level of risk being taken.

The significance will depend on the potential effect on the decisions that will be made based on the results of the modelling exercise.

There will inevitably be some deviation in actual experience compared with the assumptions made. The actuary needs to be aware of which assumptions have a material effect on the result and communicate this information to decision-makers.



Question

State, with reasons, which assumption is likely to have the bigger impact on the premium charged for a term assurance contract: the investment return or the mortality rate.

Solution

The mortality assumption is more significant for a term assurance contract.

The benefit is only payable on death and the sum assured is high relative to the premium.

The investment return is less significant because the build-up of funds (or provisions) under a term assurance contract is small, especially for a regular premium contract.

4.2 Effect of assumptions on cash transactions

In many circumstances it is necessary to determine a sum of money that will be a one-off payment from one party to another, which cannot be corrected by adjustment to future payments.

For example, when acting as expert witness to determine a fair compensation settlement between two parties, it is important that the assumptions used are the actuary's best estimate of the future experience.

Under- or over-statement will give one party a direct financial advantage at the expense of the other. Consequently each party will have a preference for which side of 'best estimate' they would like to see each assumption.

An example of this situation is where a pension scheme winds up because the employer is no longer prepared to run the scheme, and the liabilities of the scheme are to be transferred to an insurance company. The insurance company has to charge the employer an amount X now that will be sufficient to cover all the future liabilities (deferred and immediate annuities). If the insurance company underestimates X , *ie* is too optimistic in its assumptions, it will make a loss in the future. If, however, it overestimates X , it may not get the business.

4.3 Implicit assumptions

It is necessary to be aware of implicit assumptions within a model and consider the effects of these. For example, the funding method for an occupational pension scheme may assume that:

- **new members continue to join or new policies continue to be written and therefore the age / sex distribution of a population will be maintained**
- **no new entrants will join or no new policies will be written and so the existing population should be treated as a closed group.**

Not all assumptions will involve parameters taking numerical values. Sometimes, as with the examples above, the assumptions are working away in the background but can still be critical to the credibility of the results.

In an insurance context, the assumption as to whether or not the insurance company is open or closed to new business is also critical. This is because it will affect the contribution that each policy must make to the fixed overheads of the business. It may also affect the nature and term of the investments held.

5 Assumptions used in pricing contracts

Having made assumptions as to what future experience is expected, there are three further factors for consideration:

- the extent to which margins against adverse future experience are required
- the risk discount rate to be used
- the profit criterion to apply.

5.1 Margins

The assumptions will be estimates of the expected values for the parameters.

Where a cashflow model is being used to price a product, the risk to the provider from adverse future experience could be allowed for by:

- **adjusting the risk element of the risk discount rate**
- **using a stochastic discount rate**
- **applying margins to the expected values.**

The important point from the above is that, by including a margin or margins somewhere in the basis, the risk from adverse future experience is reduced. The basis actually chosen for pricing, inclusive of margins, will fix the level of risk the company will be subject to once the contract is issued at that price.

Profit margins

In pricing a product, a profit requirement will need to be incorporated. This is because it is reasonable to suppose that the owners of the provider decide where to invest by comparing the returns offered by different projects, relative to the risks that are run.

For a proprietary life insurance company, the owners of the company are the shareholders. The shareholders want to make a profit on the investment in a life insurance company as they do on investments in any company. Therefore, the basis for pricing contracts should include a profit margin.

5.2 Risk discount rates

The rate that is used to discount the pricing cashflows may be set as the sum of:

- the risk-free rate of return or the shareholders' required rate of return
- a risk margin, which reflects the inherent risk within the cashflows of the product that is being priced.

Not all products are equally risky. The provider should view itself as an investor like any other when it considers the risks of a new product, as in the long run the profits emerging from the company are the profits emerging from the products that it sells. A change in the mix of business, for example away from old and safe contracts towards new and innovative contracts, would change the market's evaluation of the provider's risks.

The following features can increase the risks in a product design:

- **lack of historical data**
- **high guarantees**
- **policyholder options**
- **overhead costs**
- **complexity of design**
- **untested market.**

It is not easy to assess these risks, and it is even harder to say what effect they should have on the risk discount rate.

5.3 Profit criterion

A profit criterion is often a single figure that tries to summarise the relative efficiency of contracts. By applying a profit criterion to different contracts and then ranking the results in order, it may be possible to determine which contracts make most efficient use of a company's capital.

The methods of quantifying profitability include:

- **net present value**
- **internal rate of return**
- **discounted payback period.**

For example, a possible profit criterion for an insurer is that the net present value of profits emerging from each of its product lines is a predetermined proportion of the distribution costs. Such a criterion reduces the bias towards products with high commission rewards in the distribution system.

The profit criterion in the above paragraph states that we require the ratio:

$$\frac{\text{NPV cashflows}}{\text{Distribution costs}}$$

to be the same for all product lines. For this to be the case, we would therefore require high initial commission products to have high associated NPVs.

A distribution system may (wrongly) favour products that pay high initial commission over those that pay low initial commission. Higher initial commission would normally reduce the NPV of the cashflows under a product. Therefore, by setting a profit criterion such as the one above, this reduces the bias towards high commission rewards.

The overall level of margin within a contract, including the profit loading, needs to be balanced against how competitive the price needs to be in the market.

The chapter summary starts on the next page so that you can keep all the chapter summaries together for revision purposes.

Chapter 19 Summary

Assumptions

All actuarial models need assumptions. The key factors affecting the choice of assumptions are:

- the use to which the model will be put
- the financial significance of the assumptions
- consistency between assumptions
- legislative and regulatory requirements
- the needs of the client.

Historical and current data

The main sources of data used for determining assumptions are historical and current data. Sources include internal data, national statistics, industry data, actuarial tables and reinsurers' data.

The data may not be immediately relevant to future experience. The actuary needs to consider the social and economic conditions that will apply in the future period to which the projections will relate and how those conditions will be different from those that influenced the past data. The conflict between having relevant data and sufficient data for its analysis to be statistically credible must be managed by the actuary in making a judgement about future experience.

When using past data the actuary needs to consider how to deal with and make adjustments for:

- abnormal fluctuations (and one-off impacts)
- changes in the experience with time
- random fluctuations
- changes in the way in which the data has been recorded
- potential errors in the data
- changes in the mix of homogeneous groups within the past data
- changes in the mix of homogeneous groups to which the assumptions apply.

Current data is also likely to be useful in setting assumptions, such as statements by governments or controlling banks, industry forecasts and views of the company's directors *eg* about future salaries of the workforce.

The relationship between current yields on fixed-interest and index-linked bonds is a good indicator of future expected inflation.



Other factors to consider

The degree of accuracy required in an assumption will depend on the purpose to which it will be put and its relative significance for the result. These factors will also influence whether the assumption should reflect a best estimate or include a margin, and if the latter in which direction.

Accuracy is particularly important when determining a one-off payment from one party to another, which cannot be corrected by adjustment to future payments.

A model may contain implicit assumptions, eg the inclusion or not of new members or policyholders.

Standard tables

National statistics on, for example, mortality or morbidity are often available, but won't necessarily reflect the insured population.

Industry level data may also be provided. This should be used with care, checking whether it reflects the target market and adjusting for trends.

Assumptions for pricing

Margins

Margins will be necessary to guard against adverse future experience and to allow for profit.

Risk discount rate

The risk discount rate is used to discount the pricing cashflows. It will usually be set as the sum of either a risk-free rate of return or the shareholders' required rate of return, plus a risk premium.

The following features can make a contract design riskier:

- lack of historical data
- high guarantees
- policyholder options
- overhead costs
- complexity of design
- untested market.

Profit criterion

A profit criterion is a single figure that summarises the relative efficiency of a contract. Common profit criteria include NPV, IRR and discounted payback period.

However, competitive pressure prevents too much prudence.

Chapter 19 Practice Questions

19.1 State the five key considerations when setting assumptions in actuarial work.

19.2 It has been proposed that a life insurance company should use industry statistics to estimate withdrawal rates for pricing future product launches rather than analysing its own experience.

Exam style

Suggest reasons why this proposal may be inappropriate. [6]

19.3 (i) Explain why the past mortality experience of a company pension scheme would not necessarily be used to directly set future pre- and post-retirement mortality assumptions for the scheme. [5]

Exam style

(ii) Describe how the mortality assumptions would likely be set in practice. [3]

[Total 8]

19.4 Describe the factors that determine the degree of accuracy needed when determining assumptions.

19.5 (i) Outline the assumptions that will be financially significant in setting the premium rates for employers' liability insurance. [4]

Exam style

(ii) Describe how the values of these assumptions would be determined. [10]

[Total 14]

19.6 Outline three different ways of introducing margins for prudence into a best estimate basis that is being used to value provisions.

19.7 List six features that can increase the risks in a product design.

19.8 (i) Describe three different profit criteria that could be used to summarise the relative profitability of financial contracts. [3]

Exam style

(ii) Discuss the advantages and disadvantages of these profit criteria. [6]

[Total 9]

19.9 A member of a defined contribution pension scheme, where the member has a choice of investment funds, has requested an estimate of the pension that may be secured from the scheme at normal retirement age.

Exam style

(i) List the assumptions that need to be made in determining the estimate. [4]

A letter will be sent to the member with the result of the calculation, setting out key considerations in relation to the assumptions that have been used.

(ii) Outline the main points that should be made in this letter. [5]

[Total 9]

- 19.10 A life insurance company is one of the market leaders in term assurance in the country in which it operates.

Exam style

The existing policyholders are 80% male and 20% female and both genders comprise 90% non-smokers and 10% smokers. This mix has been fairly constant for many years.

In line with the other major companies in this market, a non-smoker is defined to be a person who has not smoked any tobacco product for a period of at least three years.

Due to the mix of business, the basic mortality assumption used to price the product is set to be applicable to male non-smokers. A female is assumed to have the same mortality as a male who is three years younger and a smoker is assumed to have the same mortality as a non-smoker who is five years older.

- (i) List the possible sources of data that could be used by the company to set its basic pricing mortality assumption. [2]
- (ii) Describe how the external data could be used. [5]

The company is considering altering its non-smoker definition by reducing the three-year period to one year.

- (iii) Discuss the differences this would make to the pricing basis by considering the following categories of people:

- non-smokers, including those who gave up smoking more than three years ago
- those who gave up smoking between three years and one year ago
- smokers, including those who gave up less than one year ago.

[Hint: Consider what would happen to the mortality rates, the premium charged and the ability of the company to attract each category listed above.] [6]

[Total 13]

- 19.11 Two years ago, a life insurance company launched a without-profit protection product. The contract has a sum assured payable on death within a specified term, or on the earlier diagnosis of one of a specified list of critical illnesses.

Exam style

The company is reviewing the premium rates for this contract.

Describe the key factors that would be taken into account when reviewing the mortality and morbidity assumptions used in determining the premium rates. [7]



Chapter 19 Solutions

19.1 The key considerations are to:

- consider the use to which the assumptions will be put (*eg* pricing or provisioning)
- take particular care over the choice of assumptions that will have the most financial significance
- achieve consistency between the various assumptions
- consider any legislative or regulatory constraints
- consider the needs of the client.

19.2 The company will not have the same experience as the industry average. [½]

This is due to differences in such things as:

- sales method
- target market
- products or product features
- underwriting
- withdrawal benefits
- quality of service
- past investment performance. [½ for each reasonable point, maximum 2]

It may not be possible to split the industry data into groups that match those to whom the pricing will apply. [½]

Industry statistics may be out of date. [½]

They will therefore represent historical data, which will likely need to be adjusted in order to be appropriate for the future. [1]

It may be more difficult to adjust industry data for abnormal fluctuations than internal data. [½]

There may be changes in how the industry data was recorded over time, which may not be apparent from the information provided. [1]

Industry statistics may be more likely to contain data recording errors. [½]

Industry statistics may not be presented in sufficient detail. [1]

For example, withdrawal rates may depend on the duration in-force (*eg* higher withdrawal rates in early years of the policy) and this level of detail may not be reflected in the industry data. [1]

The effect of heterogeneity in the industry data can give rise to spurious trends in experience observed over time. [1]

[Maximum 6]

19.3 (i) **Why past mortality experience is not relevant**

The quantity of mortality data from the scheme is unlikely to be sufficient to be credible, unless the scheme is very large. [1]

Even with a large scheme, once the data has been subdivided by sex and age bands, there may be insufficient data in each cell, or ... [½]

... there may still be too much heterogeneity within each cell (*eg* by socio-economic group). [½]

In particular, for the pre-retirement mortality assumption, past experience and hence data is likely to be limited (as mortality rates tend to be much lower pre-retirement than post-retirement). [1]

There may have been changes in the socio-economic profile of the membership since the data was collected (*eg* fewer production workers and more clerical / managerial workers in a company that has become increasingly automated). [1]

This means that the current membership will experience different mortality from that experienced by the membership to whom the data relates. [½]

Mortality may have improved over time. Additionally, we would need to allow for future expected improvements in mortality in the post-retirement assumption for the scheme, in order to reduce longevity risk. [1]

Random fluctuations could have a large impact on the results, particularly if a small scheme. [½]

There may also have been abnormal or one-off fluctuations in experience, *eg* due to an epidemic. [1]

There may be errors in the scheme's data. [½]

There may have been changes in the way that the data has been recorded. [½]
[Maximum 5]

(ii) **How the mortality assumptions would be set in practice**

The mortality assumptions are likely to be set based on an adjustment to a standard mortality table. [1]

The mortality table chosen should be appropriate to the category of lives being considered, *ie* retired individuals of a company pension scheme. [1]

If the scheme is large enough, the adjustment may be derived by comparing the mortality experience of the scheme with the rates in the table ... [½]

... but subject to the limitations discussed above. [½]

If the scheme does not have adequate data, the actuary may base the adjustment on that used for other similar schemes or on current industry practice. [1]
[Maximum 3]

19.4 The degree of accuracy required is determined primarily by the:

- financial significance of the assumption concerned
- purpose for which the assumptions are required.

In many cases where assumptions are required, it is the *overall* accuracy of the basis that should be considered rather than the accuracy of each *individual* parameter.

In certain circumstances, it is necessary to determine a sum of money that will be a one-off payment from one party to another. Once the payment has been made, it will be impossible to adjust it in light of future experience turning out to be different from that expected.

In such circumstances, the accuracy of the assumptions is important and the actuary should use a best estimate of the future experience.

19.5 (i) **Financially significant assumptions**

Assumptions relating to the distributions of both the claim amounts and claim numbers. [1]

Since employers' liability insurance is a relatively long-tailed class of general insurance business, significant provisions may build up prior to making claim payments, hence the investment return assumption is important. [1]

Expenses on this class of business will be significant, particularly claim expenses such as legal fees. [1]

Commission may or may not be significant, depending on the distribution method. [½]

Inflation assumptions will also be needed, for both claims and expenses. [1]

In particular, the claims inflation assumption will be significant because employers' liability insurance is a relatively long-tailed class of business and claims are subject to 'court award' inflation. [1]

Claims expenses will be subject to inflation of legal expenses. [½]
[Maximum 4]

(ii) **How to set the assumptions**

Claim amounts and numbers

Statistical methods could be used to fit a distribution to past claim amounts and numbers, and to solve for the parameters. [1]

Such distributions would need to be adjusted in light of any changes, eg in:

- policy cover – inclusions and exclusions, claim limits [½]
- underwriting [½]
- target market. [½]

If insufficient data exists then industry or reinsurers' data would be useful. [1]

Advice from reinsurers may be useful anyway, even if sufficient data does exist, as reinsurers may have a better understanding of the industry. [½]

Investment return

The investment return assumption will depend on the types of assets and the mix of assets in which the premiums will be invested. [1]

For example, if cash, bonds and equities are used, it will be necessary to project interest rates, bond yields, equity dividend yields and growth rates. [1]

Past data (*eg* from relevant indices) may be useful. [½]

However, economic conditions change over time and therefore consideration needs to be given to the investment environment that is expected to apply over the future term of the contracts. [1]

Therefore, if the past data is used, it will need to be modified, to strip out the fluctuations relating to the economic conditions of the time. [½]

The investment return may need to be 'netted down' for:

- tax [½]
- investment expenses. [½]

Expenses

Expenses could be set by looking at the results from a recent company expense analysis for this product. [1]

However, if insufficient data exists (*eg* if the product is new or not many contracts have been sold), it may be necessary to use other sources of data, for example:

- the company's expense data of a similar contract [½]
- industry data [½]
- reinsurers' data. [½]

Any past data will need to be modified for any aspects relating to the expenses which might be significantly different, ... [½]

... for example, underwriting or claims administration. [½]

Commission

The insurance company will need to set its rates in line with the market for this type of contract, then just assume these actual levels in the pricing basis. [1]

Inflation (claims and claims expenses)

Inflation assumptions are needed from the middle of the investigation period (from which any past data on claims and expenses has been taken) up to the middle of the period during which claims are expected to be paid. [1]

Industry inflation indices may exist for employers' liability claims and claims expenses. [½]

These would need to be extrapolated forwards. [½]

Speaking to industry experts and reinsurers may help. For example, they may be aware of any likely future court rulings / changes in legal fees which could affect the cost of claims and the associated expenses. [1]
[Maximum 10]

- 19.6 The actuary could start with best estimate assumptions and introduce explicit contingency margins into the experience assumptions in order to strengthen the basis.

The actuary could reduce the discount rate used to value the future cashflows.

The calculations can be carried out using a best estimate basis, and then the resulting liability value could be increased by a chosen percentage, *ie* a global contingency margin.

[Alternatively, the actuary could perform a stochastic calculation and take a higher confidence interval result than the mean or best estimate output.]

- 19.7 The features that can increase the risks in a product design are:

- lack of historical data
- high guarantees
- policyholder options
- overhead costs
- complexity of design
- untested market.

- 19.8 (i) ***Profit criteria***

Net present value (NPV) is the expected present value of the future cashflows under a contract, discounted at the risk discount rate. [1]

The internal rate of return (IRR) is the discount rate that would give a NPV of 0. [1]

The discounted payback period (DPP) is the earliest policy duration at which the accumulated value of profits is 0. [1]
[Total 3]

- (ii) ***Advantages and disadvantages***

Net present value

The main advantage of NPV is that, given a choice between two different sets of cashflows (*eg* relating to two different products), economic theory dictates that the investor should choose that with the higher net present value. [1]

However this assumes:

- a perfectly free and efficient capital market [½]
- that the NPV is calculated using a discount rate, which correctly reflects the inherent riskiness of the product. [½]

It is not a very simple measure to present to non-technical people. [½]

By itself it tells us very little – it would need to be expressed in terms of a ratio for it to be more meaningful. [½]

For example, NPV as a percentage of:

- expected present value of premiums [½]
- distribution costs / initial commission. [½]

Internal rate of return

It is a simple measure. [½]

It is compatible with shareholders saying that they want a return of at least x%. [½]

It is easily comparable with other forms of investment (*eg* other products, projects). [½]

However, it might not be unique. [½]

It might not exist. [½]

It is difficult to relate to other measures (*eg* premium income). [½]

Discounted payback period

It is a useful means of comparing products if capital is a particular problem. [½]

It is easy to explain as a 'break-even' point. [½]

However, it will often not *agree* with the net present value as a means of deciding between two different sets of cashflows because the discounted payback period ignores cashflows subsequent to the discounted payback period itself. [1]

[Maximum 6]

19.9 (i) ***Assumptions required to determine the estimate***

Assumptions about the development of the fund:

- the investment return on assets held
- any future changes in the split of assets held across investment funds
- the amounts of future contributions
- salary growth (if contributions are expressed as a % of salary)
- the expenses of the contract.

[The mortality rate pre-retirement is not required nor is any assumption on early withdrawal, as the calculation relates to one individual who is implicitly assumed to reach retirement.]

Assumptions about the pension that will be received:

- the proportion of fund that will be taken as cash at retirement
- the annuity rate that will apply at retirement.

The annuity rate will depend on the following assumptions:

- interest rates / bond yields at the expected retirement date
- post-retirement mortality rates
- inflation, if it is an escalating pension
- the form in which the pension will be taken (*eg* frequency, spouse's pension, guaranteed minimum period) if not known.

There may also be an assumption made that there are no legislative changes affecting the pension payable.

[½ each assumption, maximum 4]

(ii) ***Points to be covered in the letter***

Throughout the letter the uncertainty in the results of the calculation should be emphasised. [1]

Investment returns on the assets held

The investment return assumptions are critical. [½]

The return will depend on the class of assets in which the monies are invested, with a higher expected return from risky assets, *eg* equities, compared to lower risk assets such as bonds. [1]

The assumption chosen in the calculation is considered to be appropriate to the asset classes held under the contract, but there is no certainty that this return will be achieved. [½]

Information on the impact on the outcome of a change of 1% in either direction in the return each year in the period to retirement. [1]

Future contributions

A statement of what has been assumed about future contributions, *eg* that they will continue to be paid at the current level (in amount terms or as a percentage of salary) until the intended retirement date. [1]

Annuity rate

The pension conversion terms cannot be known in advance with any certainty, as they will probably depend both on the outlook for future life expectancy at the time and on the investment return available to insurers on a matching asset class, *ie* bonds. [1]

Information on the impact that a 1% difference in bond rates would have on annuity rates. [½]

Comments on the options relating to the form of the annuity payment. [½]

A statement that the calculation assumes that the individual will survive to retirement and details of the benefit that will be provided if they die before retirement. [1]

[Maximum 5]

19.10 (i) **Sources of data**

The main sources of data are as follows:

- the company's own internal data
- data from the company's reinsurers
- industry compiled data (if available)
- any national (population) statistics
- statistics from other countries, if there is not sufficient information in the home country. [½ each, maximum 2]

(ii) **Use of external data**

The insurance company is a market leader and the mix of the business has been fairly constant for many years, so it may have sufficiently credible and homogeneous internal data. [1]

However, this may not be the case for all pricing groups, *eg* older ages. [1]

The insurer may therefore choose to use an industry standard mortality table, if available, as the starting point. This also probably has the advantage of smoothing out spurious results. [1]

It would have to adjust the standard table to allow for differences between its own insured population and the industry average. [1]

For example, in relation to target market, underwriting, distribution channel *etc.* [1]

A national mortality table could alternatively be used, but this would require more adjustment. [½]

Similarly, data from other countries could require significant adjustment. [½]

The company may also use external data to investigate trends over time. [1]

In all the above, the advice of the company's reinsurers would be sought – particularly in relation to the adjustments that would need to be made. [1]

[Maximum 5]

(iii) ***Effect of change in non-smoker definition***

Considering the three categories, the level of mortality would be expected to increase when going down the list. [1]

The existing definition means that 'non-smoker' only contains the first category (A) and 'smoker' contains the second (B) and third (C). The proposed definition means that 'non-smoker' contains the first and second categories (A and B), whilst 'smoker' contains the third (C) only. [½]

'Non-smoker' mortality would, on average, be expected to worsen. [1]

This is because it now also includes those who gave up smoking between three years and one year ago, who are likely to experience higher mortality than those in category A. [½]

'Smoker' mortality would also be expected to worsen. [1]

This is because it now excludes those who gave up smoking between three years and one year ago, who are likely to experience lower mortality than those in category C. [½]

All else being equal, the new 'non-smoker' rates would worsen and so would not be attractive to category A. [1]

However, the rates would be attractive to category B people in the market. [½]

This would mean that the relative weights between A and B in the 'non-smoker' definition would move more towards B. [½]

Some existing policyholders in category B, currently on 'smoker' terms, might lapse their policies and take out new policies on the 'non-smoker' terms. [1]

Again, all else being equal, 'smoker' terms would worsen and so would be less attractive to category C people, for whom better rates could be gained elsewhere in the market. [1]

This would result in the company dominating the market for category B people. [½]

The company would therefore need to update its pricing basis to allow for these changes in business mix. [1]

[Maximum 6]

- 19.11 For a pricing review, the company will start with the existing assumptions and adjust them in the light of experience. [1]

However, the product was launched only two years ago, so the insurer's own experience of the product is limited, and is unlikely to provide sufficiently credible data on which to base decisions. [1]

This means the insurer still needs to rely on external sources of information, particularly standard tables. [½]

The relevance and suitability of the possible external sources should be reviewed. [½]

If the original pricing was done using industry sources, then it is possible that updated industry data will be available. [½]

The external sources will need to be amended as necessary to reflect the specifics of this product. [½]

The product is without-profit, so the choice of assumptions is critical, as the financial impact of experience being worse than expected will be borne by the insurer. [1]

Mortality and morbidity experience depends on the socio-economic group of the insured. Consequently it is important to determine whether the market in which the product is sold is consistent with the industry data, and make adjustments as necessary. [1]

Care needs to be taken not to double count claims from critical illness and death in the data, where they lead to only one claim. [½]

Similarly adjustments may need to be made to reflect the level of underwriting used. [½]

It also needs to be considered whether the target market actually achieved is the same as that anticipated in the pricing basis, as any difference would justify a change in the assumptions. [½]

It will also be necessary to take any revised rates from reinsurers into account. [½]

In particular, reinsurers are likely to have a view as to how the critical illness market is developing, and may have changed their outlook for future morbidity rates. [½]

The impact on the competitiveness of the premium rates as a result of the review should be considered. [1]

Any margins for risk or prudence in the original assumptions should also be considered. [1]

It may be possible to reduce these margins, now that some experience has been obtained, but this may not be appropriate after only two years. [½]

[Maximum 7]

End of Part 5

What next?

1. Briefly **review** the key areas of Part 5 and/or re-read the **summaries** at the end of Chapters 17 to 19.
2. Ensure you have attempted some of the **Practice Questions** at the end of each chapter in Part 5. If you don't have time to do them all, you could save the remainder for use as part of your revision.

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... 'revision' products

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Mortality and morbidity

Syllabus objectives

- 11.3.1. Describe the principal forms of heterogeneity within a population, the ways in which selection can occur, and how the use of risk classification can address the consequences of selection.
- 11.3.2. Explain why it is necessary to have different mortality tables for different classes of lives.
- 11.3.3. State the principal factors which contribute to the variation in mortality and morbidity by region and according to the social and economic environment, specifically:
 - occupation
 - nutrition
 - housing
 - climate / geography
 - education
 - genetics.
- 11.3.4. Explain how various types of selection (*eg* temporary initial selection, class selection) can be expected to occur among individuals or groups effecting financial products.
- 11.3.5. Explain the concept of mortality convergence.
- 11.3.6. Describe how decrements can have a selective effect on the remaining business.

0 Introduction

Apart from the variation in mortality rates between the sexes and between different ages, mortality rates vary both within a population and between different populations as a result of a number of other *risk factors*, *ie* influences that affect the mortality of individuals. Morbidity rates will also vary and you should note that the syllabus objectives include consideration of this.

In this chapter we consider the various risk factors which lead to heterogeneity within a population and the various types of selection that this can give rise to.

1 Risk classification in life insurance

1.1 Heterogeneity

The providers of financial products offer cover against risk events. Individuals or companies buying these products all have different features – no two people in the world are alike in every respect, not even identical twins. A product provider could assess each individual or company and determine the premium to charge and the cover to provide for each risk it considers.

This approach works when the risks are rare and large and it is very difficult to group them. Marine hull and cargo covers are a good example: not only are ships generally different from each other but the cargos they carry and the routes they travel accentuate the differences. It is appropriate and practical to assess each risk individually.

Other risks are smaller and individual assessment would be prohibitively expensive. For these risks the provider usually has access to a large amount of data concerning how the population behaves. If the population can be divided into relatively homogenous groups, a price can be determined that applies to all risks in that group.

If a product provider can pool independent homogenous risks, then as a result of the Central Limit Theorem the profit per policy will be a random variable that follows the normal distribution with a known mean and standard deviation. The company can use this result to set premium rates which ensure that the probability of a loss on a portfolio of policies is at an acceptable level.

The process by which potential insured lives are separated into different homogeneous groups for premium rating purposes, according to the risk they present, is called risk classification. It involves trying to identify any risk factors specific to the individual that might influence the likely risk of that individual.



Question

List eight risk factors the insurer would wish to identify when offering pet insurance.

Solution

- Type of pet
 - Breed
 - Gender
 - Age of pet
 - Location
 - Extent of cover chosen
 - Pre-existing medical conditions
 - Age of owner
-

1.2 Selection

Irrespective of how a provider constructs its homogenous risk pools, there will be a range of risks in the pool. In life assurance, mortality and morbidity risk increases rapidly at later ages. If the provider sets a rate for male lives aged 82 (presumably based on the expected experience of a life aged 82.5), then a person aged 82.9 will be getting better terms than appropriate given the risk that person poses. If everyone aged 82.9 realised this and took out policies, the pricing assumption of an average age of 82.5 would be wrong, and the company would incur a loss.

Selection (sometimes called anti-selection or adverse selection) is taking advantage of inefficiencies in a provider's pricing basis to secure better terms than might otherwise be justified, normally at the expense of the product provider. Selection is not a fraudulent, immoral, or illegal activity.

In other words, adverse selection can occur when a person buys a policy that they believe is a 'good deal' (and therefore a 'bad deal' for the provider). Policyholders with worse than average experience will be more likely to take out the contract.



Question

Suggest two examples of how anti-selection can arise within a life insurance company.

Solution

People who smoke will tend to seek life assurance from companies that charge identical premiums for smokers and non-smokers, whereas non-smokers will apply to companies that differentiate between them and therefore charge cheaper premiums to non-smokers. The first company will suffer from adverse selection, as the ratio of smoker to non-smoker lives that it takes on will increase.

Selective withdrawal (of healthy lives) worsens the company's average mortality experience from those policies that remain.

1.3 Risk grouping

Careful underwriting is the mechanism by which a provider ensures that its risk groups are homogeneous. The risk groups are defined using rating factors, eg age, gender, medical history, height / weight, lifestyle. In theory, a provider should continue to add rating factors to its underwriting system until the differences in risk between the different categories of the next rating factor are indistinguishable from the random variation between risks that remains after using the current list of rating factors.

Both the ability of prospective policyholders to provide accurate responses to questions and the cost of collecting information limit the extent to which rating factors can be used. In general a proposal form should not ask for information which requires specialist knowledge. For example, the cost of undertaking extensive blood tests has to be weighed against the expected cost of mortality or morbidity claims that will be 'saved' as a result of having this information.

From a marketing point of view, prospective policyholders will want the process of underwriting to be straightforward and quick.

In practice, rating factors will be included if they avoid any possibility of selection against the company, and satisfy the time and cost constraints of marketing. This decision is often driven by competitive pressures. If several companies introduce a new rating factor, which is a good descriptor of the underlying risk, then other companies will need to follow this lead or risk adverse selection against them.



Question

Outline the likely effect on a company's mortality experience if it issued assurance policies for the same rates of premium to smokers and non-smokers, when most of the other companies in the marketplace charged different rates for the two groups.

Solution

It is likely that the company's mortality experience would worsen substantially.

Assume that smoker mortality is higher than non-smoker mortality, and so premium rates for smokers would be higher than for non-smokers. An insurer that does not distinguish between the two groups will charge the same rates for both, and these rates will be in between the market rates of other companies, *ie* its rates for smokers will be cheap, and for non-smokers will be expensive.

The company will therefore attract large numbers of smokers. However, non-smokers will find its rates too expensive, and will therefore buy from other companies in the market place. Before long the company may find that its portfolio consists almost entirely of smokers, and its mortality experience will be heavier as a result.

2 Why it is necessary to have different mortality tables for different classes of lives

When a life table is constructed it is assumed to reflect the mortality experience of a homogeneous group of lives, ie all the lives to whom the table applies follow the same stochastic model of mortality represented by the rates in the table. This means that the table can be used to model the mortality experience of a homogeneous group of lives which is suspected to have a similar experience.

If a life table is constructed for a heterogeneous group, then the mortality experience will depend on the exact mixture of lives with different experiences that has been used to construct the table. Such a table could only be used to model mortality in a group with the same mixture. It would have very restricted uses.

For this reason, separate mortality tables are usually constructed for groups which are expected to be heterogeneous, for example separate tables for males and females.

Sometimes only parts of the mortality experience are heterogeneous, (eg the experience during the initial select period for life assurance policyholders), and the remainder are homogeneous (eg the experience after the end of the select period for life assurance policyholders). In such cases the tables are separate (different) during the select period, but combined after the end of the select period.

The 'select period' is the time horizon beyond which we assume no significant difference in mortality between two types of lives. You may remember this from your previous studies.



Question

A life insurance company wants to construct its own mortality tables and is considering how many data groupings to use.

- (i) Describe the risk to the company of using one mortality table for all classes of lives together.
- (ii) Describe the problem with producing tables for different classes of lives.

Solution

- (i) If the life insurer is using the same mortality table for all classes of lives together it will be charging the same premium to lives which present different risks. The premium will be based on the average risk. This practice leaves the company in a risky position because it could easily lose the low risk lives to a competitor who charges differential premium rates. High risks will be attracted to the company and it will be selected against.
- (ii) The problem with producing tables for different classes of lives is that whilst we would wish to subdivide the data into homogeneous groups as far as possible we cannot reduce the size of each group below the level at which observations may be statistically significant. It is also administratively inconvenient to use too many different tables.

3 Principal factors contributing to variation in mortality and morbidity

In addition to variation by age and sex, mortality and morbidity rates are observed to vary:

- between geographical areas, eg countries, regions of a country, urban and rural areas
- by social class, eg manual and non-manual workers
- over time, eg mortality rates usually decrease over time.

None of these categories provide a direct causal explanation of the observed differences. Rather they are proxies for the real factors that cause the observed differences. Such factors are:

- occupation
- nutrition
- housing
- climate / geography
- education
- genetics.

It is rare that observed differences in mortality can all be ascribed to a single factor. It is difficult to disentangle the effects of different factors because of the relationships between them. For example, mortality rates of those living in sub-standard housing are (usually) higher than those of people living in good quality housing. However, those living in sub-standard housing usually have less well-paid occupations and lower educational attainment than those living in good quality housing. Part or all of the observed difference may be due to these differences and not to housing differences.

It is important for governments to be able to identify risk factors in order to bring about improvements in public health, eg by means of appropriately targeted public health campaigns. They are very important in insurance, since identifying specific risk factors for an individual enables insurers to classify that individual's mortality or morbidity risk more precisely, thereby allowing more accurate calculation of premiums and reserves.

Most of the factors could be grouped under the general heading 'standard of living'. This makes it difficult to isolate the individual effects since they are correlated, with factors tending to operate together. However, it is possible by means of statistical studies to identify the dominant risk factors. So we have two problems. First, we want to identify the *real* factors and not be confused by *apparent* factors. Secondly, we then need to quantify the relative importance of these factors.



Question

Explain why you would expect mortality rates to decrease over time, and suggest occasions when this would not be the case.

Solution

Mortality rates tend to improve over time due to improvements in living standards and, in particular, as a result of improvements in medical care. Exceptions to this trend would occur at times of natural or man-made disasters such as epidemics or wars.

3.1 Occupation

Occupation can have several direct and indirect effects on mortality and morbidity. Occupation determines a person's environment for often 40 or more hours each week. The environment may be rural or urban, the occupation may involve exposure to harmful substances such as chemicals, or to potentially dangerous situations such as working at heights. Some occupational effects may be moderated by health and safety at work regulations.

Some occupations are naturally healthier, whereas some work environments give exposure to a less healthy lifestyle.

The nature of the work activity is clearly important. A sedentary job such as actuarial work is less healthy than being a fitness instructor! Publicans are typically quoted as an unhealthy lot, and they were observed to have unusually high mortality in UK occupational mortality investigations.

Some occupations by their very nature attract more healthy or unhealthy workers. This may be accentuated by health checks made on appointment or by the need to pass regular health checks, eg airline pilots. However, external factors can distort a presumed state of health, for example, former miners who have left the mining industry as a result of ill health and then chosen to sell newspapers will inflate the morbidity rates of newspaper sellers.

Selection of employees with respect to health both at entry to and exit from the occupation may lead to lighter morbidity and mortality among workers: *ie* a 'healthy worker' effect.

A person's occupation largely determines their income, and this permits them to access a particular lifestyle, content and pattern of diet, quality of housing and access to healthcare. The effect on mortality and morbidity can be positive or negative.

Unemployment has a particularly negative effect since it can lead to increased levels of stress and a lower income.

It is not always easy to obtain a reliable estimate of mortality rates for a particular occupation. The rates estimated will be unreliable if deaths are not recorded under the same category of occupation as are the lives in the exposed to risk. This can occur for the following reasons:

- Entries on the census returns, which are used to determine the exposed to risk, may not be specific enough. This may result in the wrong occupation being recorded.
- The families of individuals who die may unintentionally 'elevate' the occupation. For example, an electrician may be described as an 'electrical engineer'.
- Estimates may also be unreliable as a result of the factors considered below.

Previous occupations

Information from censuses and death certificates usually relates to the most recent occupation. A selective effect can occur when workers who become ill and cannot continue their usual job switch to 'light duties' (*eg* a factory worker taking up a 'desk job'). This can lead to artificially high rates of mortality rates being associated with certain jobs. Recording complete employment histories to eliminate this problem is not a practical solution.

Classification

In the past, wives were categorised under the same occupational group as their husbands. Of course this is no longer appropriate, now that most women follow their own occupations. There is, however, still a correlation between the occupation of husband and wife.

Lack of statistics

For occupations which have only a small number of participants (*eg* actuaries) there may not be sufficient data to provide meaningful statistics. Conversely, however, select occupations are more likely to maintain detailed records of members that can be used to provide accurate statistics.



Question

Suggest how the mortality rates for judges and divers might compare.

Solution

The crude mortality rate, *ie* number of deaths divided by the whole population, is likely to be higher for judges, because their average age is higher, even though it is inherently a less dangerous job than diving.

3.2 Nutrition

Good nutrition involves consuming the appropriate amounts of the right types of food.

Nutrition has an important influence on morbidity and in the longer term on mortality.

Poor nutrition can increase the risk of contracting many diseases and hinder recovery from sickness. In the longer term the burden of increased sickness can influence mortality.

In other words sick people are more likely to die prematurely.

Excessive or inappropriate eating can lead to obesity and an increased risk of associated diseases (heart disease, hypertension) leading to increased morbidity and mortality.

Inappropriate nutrition may be the result of economic factors – lack of income to buy appropriate foods or the result of a lack of health and personal education resulting in poor nutritional choices. There are also social and cultural factors which encourage or discourage the consumption of certain foods and drinks, such as alcohol.

Lack of sufficient food (*subnutrition*) can lead to a general weakening of the body and a reduction in resistance to disease.

Lack of essential vitamins and minerals can lead to *malnutrition*, which can induce certain medical conditions that can increase mortality rates.

Social factors have their influence on the nature of a society's diet; consider the prevalence of junk food and ready-processed meals with high sugar content in developed countries.



Question

Obese people in the UK tend to come from a 'rich' or a 'poor' background, rather than an 'average wealth' background. Suggest possible reasons for this.

Solution

Affluent individuals can afford to buy rich foods, *eg* steak and spirits. Some may overindulge and become overweight through eating too much.

Individuals with limited means may be forced to eat cheaper foods, *eg* chips and beer. This can lead to obesity through eating the 'wrong' foods.

3.3 Housing

The standard of housing encompasses not only all aspects of the physical quality of housing (state of repair, type of construction, heating, sanitation) but also the way in which the housing is used, such as overcrowding and shared cooking.

These factors have an important influence on morbidity, particularly that related to infectious diseases (from tuberculosis and cholera to colds and coughs) and thus on mortality in the longer term.

The effect of poor housing is often mixed up with the general effects of poverty.



Question

List four factors that could adversely affect the mortality of a homeless person in a developed country.

Solution

Homeless people who are forced to live outdoors will be subject to the effects of the weather, *eg* rain and cold nights.

Many homeless people do not have a reliable source of income and may not be able to afford to eat well.

Homeless people may have to wear the same clothes for prolonged periods, which will increase the likelihood of disease.

Some homeless people have psychiatric disorders or are drug addicts. So their mortality risk may be higher because of a selection effect. We will study selection in Section 4 of this chapter.

3.4 Climate and geographical location

Climate and geographical location are closely linked. Levels and patterns of rainfall and temperature lead to an environment which is amicable to certain kinds of diseases such as those associated with tropical regions.

Effects can also be observed within these broad categories – differences between rural and urban areas in a geographical region. Some effects may be accentuated or mitigated depending upon the development of an area, with industrial development leading to better roads and communications.

Natural disasters (such as tidal waves and famines) will also affect mortality and morbidity rates, and may be correlated to particular climates and geographical locations.

The following will also vary according to geographical location.

Access to medical care and transport

The availability of readily accessible, modern medical facilities nearby can reduce the delay in receiving effective medical treatment. Preventative screening can identify some conditions at an early stage. Immunisation programmes can control epidemics.

Road accidents

Individuals living in cities may be more likely to be involved in motor accidents, although the traffic speed may be lower, so that they are less likely to be fatally injured.

Natural disasters

Certain countries are known to be susceptible to natural disasters, such as tidal waves, earthquakes, hurricanes, floods, drought and famine. A topical issue is whether the apparent increase in the number of natural disasters in recent years can be attributed to global warming caused by increased levels of carbon dioxide in the atmosphere.

Political unrest

Mortality rates in countries at war or where there is a high level of violence and social unrest will be higher because:

- individuals may be required to take part in direct combat
- there will be an increased risk of injury to civilians
- food, clean water and medical facilities may be restricted in a war zone.

3.5 Education

Education influences the awareness of the components of a healthy lifestyle which reduces morbidity and lowers mortality rates. It encompasses both formal education and more general awareness resulting from public health and associated campaigns. This effect can be apparent in aspects such as:

- **increased income**
- **choice of a better diet**
- **the taking of exercise**
- **personal health care**
- **moderation in alcohol consumption and smoking**
- **awareness of the dangers of drug abuse**
- **awareness of a safe sexual lifestyle.**

Some of these are direct causes of increased morbidity such as smoking and excessive alcohol consumption, which lead to diseases such as lung and other forms of cancer, and strokes. A healthy lifestyle with improved fitness can lead to an enhanced ability to resist diseases.

Recent studies have emphasised the harmful effects of smoking. As a result, life offices have increased the differentials between premium rates for smokers and non-smokers. The degree of harm from passive smoking (inhaling other people's smoke) is not yet precisely understood.

Although education is believed to affect mortality in its own right, it is highly correlated with other risk factors, *eg* occupation, standard of living and social class.

Other aspects of lifestyle which can influence mortality and morbidity rates are listed below.

Dangerous activities

Individuals who take part in dangerous sports (*eg* motor racing, hang gliding) are more likely to be involved in serious and possibly fatal accidents.

Travel

Individuals who travel frequently are more likely to be involved in an accident and will be exposed to a wider range of infectious diseases.

Religious attitudes

Some religions do not permit the use of blood transfusions (increasing mortality very slightly). Others forbid the use of alcohol (potentially reducing mortality).

Marital status

We shall see later in this chapter that mortality rates are dependent on marital status.



Question

An actuarial student has noticed that mortality rates for people who drink a small amount of alcohol are lower than the mortality rates for people who drink no alcohol at all. The student has there concluded that a small intake of alcohol is good for you.

Suggest why this might be misleading.

Solution

One of the problems is that some people are teetotal *because* they are in poor health, *eg* they have had a heart attack and their doctor has told them to stop smoking and drinking. So it would hardly be surprising if people who didn't drink had higher mortality rates. A study that did not take this into account would simply be showing that people who are in poor health tend to drink less, which does not mean that drinking is good for you.

(In fact, the studies carried out recently have excluded people who do not drink 'for medical reasons', and they still appear to show the same effect, *ie* that a small intake of alcohol is beneficial. One possible explanation, in addition to the direct physical effects of alcohol consumption, is that a moderate consumption of alcohol reduces stress levels.)

3.6 Genetics

Genetics may give information about the likelihood of a person contracting certain diseases, and therefore may provide improved information about the chances of sickness or death. Such information may be used in isolation for the individual in question or, more usefully, by combining it with the life histories of the current and past generations of the family.

Genetics is a rapidly developing new area of study for the medical profession. There are increasing numbers of specific diseases being identified where genetic information provides firm predictive evidence of the chances of sickness or death relative to a person of average health.

4 Selection

In Section 1 of this chapter, we talk about 'selection' in the context of 'anti-selection'.

In actuarial practice, however, it has become customary to refer to the source of heterogeneity *itself* as 'selection'. Alternatively it can refer to the subdivision of heterogeneous data into homogeneous classes (so that all risks within a particular group have similar characteristics and can therefore be modelled together).

Hence the following descriptions of the various *types* of selection also, by definition, describe the various causes of heterogeneity that may exist in any population.

Commonly occurring kinds of selection are classified into categories.

We shall consider in detail the following types of selection:

- temporary initial selection
- class selection
- time selection
- adverse selection
- spurious selection.

4.1 Temporary initial selection

Each group is defined by a specified event (the select event) happening to all the members of the group at a particular age, eg buying a life assurance policy or retiring on ill-health grounds.

The mortality or morbidity is estimated for each group and for the population that is not exposed to the specified event. The mortality / morbidity patterns in each group are observed to differ only for the first s years after the select event. The length of select period is s years. The differences are temporary, producing the phenomenon called *temporary initial selection*.

Temporary initial selection occurs when heterogeneity is present in a group that was selected on the basis of a criterion whose effects wear off over time. The relative numbers at each duration since selection in the select group will affect the risk levels within the select group.

Temporary initial selection can arise as a result of the underwriting process, since the lives recently underwritten will tend to have better experience, this effect wearing off over time.

4.2 Class selection

The population can be divided into classes, for example gender with classes of male and female or occupation with classes of manual and non-manual employment. The stochastic models (life tables) are different for each class. There are no common features to the models, they are different for all ages. This is termed *class selection*.

Class selection refers to a factor which is *permanent* in its effect with respect to mortality, *ie* the source of the heterogeneity, in this case, is due to a permanent attribute of the individuals concerned.

Age is one such factor. It can be described as ‘permanent’ because lives subdivided by age will always be expected to show different mortality. Similarly lives (which are otherwise homogeneous) subdivided by sex will also always be expected to show different mortality.



Question

Suggest examples of class selection.

Solution

- Different races have different susceptibilities to disease.
 - Individuals who have lived abroad may have been exposed to tropical diseases.
 - More highly paid individuals have a higher standard of living and experience lower mortality rates.
-

4.3 Time selection

Within a population mortality and morbidity normally varies with calendar time, essentially due to medical advances. This effect is usually observed at all ages. The usual pattern is for mortality rates to become lighter (improve) over time, although there can be exceptions, for example, due to the increasing effect of AIDS in some countries.

A separate model or table will be produced for different calendar periods, eg English Life Table No 15 1990–92 and English Life Table No 16 2000–02. The difference between the tables is termed *time selection* and shows mortality improvements in the ten-year period.

A mortality investigation carried out over a number of years involves grouping together lives who attain the same age in different time periods. Where time selection is occurring (*ie* mortality varies between time periods) then the combined sample of data taken at different times will be heterogeneous with respect to the lives’ true underlying mortality rates. Hence the average rate will not reflect the true underlying rates for each life over the investigation period.



Question

Suggest examples of time selection.

Solution

- A group of males aged 40 – 60 years old, whose mortality is better than that of the proceeding cohort ...
... given individuals in that age bracket now, experience lighter mortality than individuals in that same age bracket 20 years ago.
 - Individuals with life assurance policies where the sum assured exceeds say £100,000, given the higher sum assured may suggest they are more likely to have taken out the policy recently.
-

4.4 Adverse selection

Adverse selection (or anti-selection) is characterised by the way in which the select groups are formed rather than by the characteristics of those groups. So, any of the previous forms of selection may also exhibit adverse selection. Adverse selection usually involves an element of self-selection, which acts to disrupt (act against) a controlled selection process which is being imposed on the lives. This adverse selection tends to reduce the effectiveness of the controlled selection.

For example, in deciding whether or not to purchase an immediate annuity with pension funds, those who decide to purchase an annuity usually experience lighter mortality than those who decide not to do so.

This is because individuals who purchase an annuity at retirement are more likely to be in good health than the general population. If these individuals thought that they were likely to die in the near future they would not convert a capital lump sum into a lifetime annuity as this would represent a poor investment.

Underwriting is the process by which life insurance companies divide lives into homogeneous risk groups by using the values of certain factors (rating factors) recorded for each life. If prospective policyholders know that a company does not use a particular rating factor, eg smoking status, then lives who smoke will opt to buy a policy from this company rather than a company that uses smoking status as a rating factor. The outcome will be to lessen the effect of the controlled selection being used by the company as part of the underwriting process. The effect of self-selection by smokers is adverse to the company's selection process. It is an example of adverse selection.

Note that the decision whether to join the select group need not always be a deliberate conscious decision on the part of the individual. It may be just a statistical effect that people with certain characteristics are more likely to join the group or a 'double negative' effect where people who do *not* have certain characteristics are *less* likely to join the group.

4.5 Spurious selection

When homogeneous groups are formed we usually assume that the factors used to define each group are the cause of the differences in mortality observed between the groups. However, there may be other differences in composition between the groups, and it is these differences that are the true cause of the observed mortality differences.

In other words, the groups are unlikely to be homogeneous. Within each group people will be affected to differing extents by a factor which has not been used in defining the group. Groups with different proportions of affected members will exhibit different mortality.

Ascribing mortality differences to groups formed by factors which are not the true causes of these differences is termed *spurious selection*. For example, when the population of England and Wales is divided by region of residence, some striking mortality differences are observed.

However, a large part of these differences can be explained by the different mix of occupations and standards of housing and nutrition in each region. Applying class selection to regions is spurious as the observed effects are due to different underlying causes.

Spurious selection can (theoretically) be removed by identifying all possible sources of heterogeneity within the parent population, *ie* by risk classification.

Even though a class selection is spurious, that doesn't prevent it being used as a good proxy rating factor for the underlying mortality / morbidity differences. For example, where a country has postal codes or ZIP codes, these can be used as an effective and easily assessed measure of the likely (but not certain) standards of occupation, housing and nutrition of people living in that area.



Question

Suggest examples of spurious selection.

Solution

Increasing the strictness of underwriting for life insurance products will lead to a lighter mortality experience. This will give the false impression that mortality is improving at a quicker rate than it really is.

The mortality of individuals of the same age tends to be higher in the North of England than in the South. This gives the impression that class selection is present in respect of regions. However, when the comparison is restricted to individuals in the same occupation, the apparent difference diminishes. This is explained by differences in the relative numbers in high and low risk occupations.

Withdrawal (in respect of life assurance products) often acts as a selective decrement in respect of mortality. Those withdrawing tend to have lighter mortality than those who keep their policies in force. This selective effect results in mortality rates that increase markedly with policy duration.

There are two reasons for the relatively heavy mortality of those who have had a policy for a while compared with new entrants. First, temporary initial selection at the underwriting stage should ensure that the new entrant will be relatively healthy. Secondly, the healthier lives are more likely to lapse their policies and so there will be an increasing concentration of impaired lives as time goes by.



Question

Explain why it might be necessary to subdivide policies by method of selling in order to obtain homogeneous lapse rates.

Solution

The rate at which people withdraw from a policy differs depending on the way in which the policy was sold. For example, people who are coerced into taking out policies (*eg* by 'pushy' sales staff) are more likely to withdraw than people who perceive that their policies meet an important financial need. Hence withdrawal rates vary with sales practices and by sales distribution channel.

5 Mortality convergence

The variations in mortality described in Section 3 are noted most strongly at working ages. These variations can be large and have a material financial impact on insurance companies.

These variations have been seen to continue after retirement but reduce at the very highest ages, although the evidence is disputed. This convergence of mortality between subgroups at higher ages is referred to as *mortality convergence*.

In other words, factors such as occupation / social class / geographic area *etc* have less of an effect on mortality for retired people than they do for people of working age.



Question

Suggest a reason for this.

Solution

As a person gets older their mortality will increase due to the natural ageing process, until, in extreme old age, the person's age is such a strong driver of mortality that other factors pale into insignificance.

For example, a person who is 108 years old is extremely likely to die within the next 12 months, regardless of their education / nutrition / marital status *etc*.

Detailed analysis of mortality convergence is complicated by the low volumes of data at the highest ages.

6 How decrements can have a selective effect

One way in which lives in a population can be grouped is by the operation of a decrement (other than death). This could be retiring on ill-health grounds, getting married or migrating to a new country. Those who do and do not experience this selective decrement will experience different levels of the primary decrement of interest, often mortality or morbidity.

Those getting married usually experience lighter mortality and morbidity than those of the same age who do not get married. Marriage is said to have a selective effect in respect of mortality and morbidity.

Part of the reason for the lighter mortality of married persons is that sick and disabled single people at any age are much less likely to marry than healthy individuals. So marriage is operating as a selective decrement, in effect, from the population of single lives (comprising bachelors and spinsters). However, the fact that divorced and widowed lives also show higher mortality than their married counterparts does indicate that there may be survival benefits to be obtained from marriage. For example, the relative stability of a family environment may reduce stress and if ill an individual has a spouse to look after them, both factors leading to lower mortality.

The chapter summary starts on the next page so that you can keep all the chapter summaries together for revision purposes.

Chapter 20 Summary

Risk classification

Providers use rating factors to identify the characteristics of the risks they underwrite, and to pool risks into homogenous groups. All risks in a group can then be charged the same premium. Anti-selection can arise when heterogeneity exists in a group of risks.

Principal factors contributing to variations in mortality and morbidity

Mortality and morbidity rates vary by age and sex but also vary due to heterogeneity in a population. Factors affecting heterogeneity of mortality /morbidity rates include:

- occupation
- nutrition
- housing
- climate / geography
- education
- genetics.

These risk factors become less significant in old age, leading to *mortality convergence*.

Selection

The process by which lives in a population are divided into separate homogenous groups is called selection.

There are five main forms of selection:

- *Temporary initial selection*, where the level of risk diminishes or increases since the occurrence of a selection process (or a discriminating event).
- *Class selection*, where a select group is taken from a population consisting of a mixture of different types ('classes') of individual with different characteristics.
- *Time selection*, where a select group is taken from a population of individuals from different calendar years.
- *Adverse selection*, where the individual's own choice influences the composition of a select group.
- *Spurious selection*, where the distorting effect of a confounding factor gives the false impression that one of the other forms of selection is present.

Examples of such selection can be found in both life assurance and pensions business.

Unless insurers classify risks accurately they cannot charge an appropriate premium to reflect the underlying risk. They will therefore be exposed to adverse selection because of differences in premiums charged by competitors. The existence of different mortality tables for different classes of lives enables the insurer to deal with heterogeneity.

Decrements and a selective effect

Decrements may be found to have a selective effect. A selective decrement will 'select' from the population lives whose rate of decrement from another cause differs from that of the whole population.



Chapter 20 Practice Questions

- 20.1 An actuarial student is preparing a mortality table based on data obtained by recording the ages at death on graves in a local cemetery. Suggest how the different forms of selection might be present.
- 20.2 Suggest why voluntary resignation tends to select those with lighter mortality and ill-health retirement rates.
- 20.3 Discuss the validity of the following statements, from the viewpoint of how selection might affect the assumed reality:
- (a) 'There were 1 million reported crimes in 1980 and 2 million in 1990. So the numbers of minor and serious crimes committed have doubled over the last decade.'
 - (b) '1% of the HIV tests carried out in a London clinic proved positive. So there are 500,000 HIV positive people in this country.'
 - (c) 'People who take out life assurance policies experience higher mortality rates than the general population because they believe they are likely to die sooner than other people.'
- 20.4 Classify the possible sources of selection that might arise in the following scenarios:
- (a) an option on a term assurance policy to extend the period of cover without requiring a medical examination (life insurance)
 - (b) a mortality study based on people earning over £50,000 per annum (life insurance)
 - (c) a mortality study based on doctors (population mortality)
 - (d) people being interviewed in the street (market research).
- 20.5 Discuss the factors that affect the stated rate of mortality for different occupations. You should consider the factors that affect both the real and apparent levels of mortality. [8]

Exam style

The solutions start on the next page so that you can
separate the questions and solutions.



Chapter 20 Solutions

20.1 Here are some possibilities:

Temporary initial selection: Not applicable, since we're not analysing by duration.

Class selection: Only people living in that area who had connections with that church and could afford a gravestone would be buried there. Only those whose precise age at death was known (*'Here lies X, lost at sea'*) would be recorded.

Self-selection: Only those individuals (or their families) who indicated a wish to have a grave with a gravestone will be there. There may have been special collections for people who died young in tragic circumstances (so such deaths might be over represented).

Time selection: Graves may cover several centuries, during which different general mortality rates and specific causes of death (epidemics *etc*) were in effect. Some of the older graves may have been ignored because it was difficult to read the writing or because they were overgrown by weeds. There may have been an increase in the number of cremations over time, and therefore fewer graves.

Spurious selection: Spurious selection may be present by chance, since there are a lot of possible risk factors that have not been taken into account. For example, the men may have all worked at the local mine, exaggerating the difference between the mortality rates for males and females.

20.2 People who are in ill health will not tend to move to a new job. This is partly because their health may mean that they would be screened out by any initial health checks carried out by a prospective employer and partly because they may not feel up to the stresses of a new job. In addition, pension benefits tend to improve with length of service. Hence people in ill health would be reluctant to move jobs and risk a lower pension benefit.

- 20.3 (a) Crimes reported may not reflect crimes committed. There are influences from *self-selection* (eg a lot of crimes are never reported), time selection (eg changes in procedures for recording and classifying crimes) and class selection (eg the relative proportions of minor and serious crimes may have changed over time).
- (b) The individuals tested are not representative of the general population. There are influences from self-selection (eg people are more likely to have a test if they consider they are at greater risk than the general population or if a sexual partner has been diagnosed as HIV positive) and class selection (eg only those who are prepared to undergo a medical test and can afford to pay for the cost of the test, if applicable). Extrapolating the experience in London to the rest of the country may also not be valid. London is likely to have a higher incidence of HIV than say Bournemouth where the population is older, ie there are influences from class selection.
- (c) This statement is not true because the temporary initial selection effect of underwriting outweighs any self-selection effect on the part of the proposer. Risk averse individuals who acknowledge the fact that they *might* die at an early age do not necessarily believe that they *will*.

- 20.4 (a) *Adverse selection*: Individuals who consider they are not in perfect health (and may have difficulty obtaining cover elsewhere) are more likely to take up the option.

Temporary initial selection: The effects of differences in state of health at the time of selection will wear off over time.

- (b) *Class selection*: People earning high salaries will have a different standard of living and lifestyle from other policyholders.

Time selection: If the study covers several years, this selection criterion will include a greater proportion of more recent policies due to the effect of inflation.

- (c) *Class selection*: Doctors form a distinct category with different mortality characteristics from the general population.

- (d) *Adverse selection*: The probability that an individual will take part in the survey will depend on the characteristics of the individual, *eg* outgoing people with time on their hands are more likely to take part.

Class selection: The interviewer may have specific instructions only to interview a certain category (*eg* women with children). Also, the interviewer may unconsciously introduce a bias when selecting interviewees, *eg* a non-smoking interviewer may prefer not to interview people who are smoking.

20.5 Factors include:

- the difficulty of recording the *independent* effect of the occupation on mortality ... [1]
... for example, the level of intelligence largely dictates type of job and thus it is often the intelligence rather than the occupation that affects the mortality [1]
- the actual effect of occupation, for example: [½]
 - some occupations require you to work in an unhealthy environment, *eg* coal miner [½]
 - others increase risk of accidental death, *eg* oil rig worker [½]
 - others are very stressful, *eg* football club manager [½]
- possible non-correspondence in the calculation, *ie* where the deaths and exposed to risk do not correspond [1]
- vagueness in census returns may result in the wrong occupation being recorded [½]
- a widow or widower may elevate the occupation of their spouse so that it sounds as if they had achieved higher office than they actually had ... [1]
... *eg* an electrician may be flatteringly described as an electrical engineer [½]
- lives' previous occupations, since information from censuses and at death usually relates to the most immediate past or present occupation [½]

- an occupation may be selected against ... [1]
... for example, higher mortality might appear to be associated with certain light occupations because they are often taken up following chronic illness or disability emerging during a former occupation [1]
 - lack of statistics, for example: [½]
 - for a relatively rare occupation (*eg* a jockey) there may not be sufficient data to provide a meaningful statistic [½]
 - conversely, a small occupation is more likely to maintain detailed records of members and thus be able to provide accurate statistics. [½]
 - standardised mortality rates should be used, *ie* to avoid distortions caused by the age and sex distributions. [1]
- [Maximum 8]

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Expenses

Syllabus objectives

- 11.4.1 Describe the types of expenses that the providers of benefits on contingent events must meet.
- 11.4.2 Describe how expenses might be allocated when pricing financial products.
- 13.1 Describe how the actual experience can be monitored and assessed, in terms of:
 - the reasons for monitoring experience
 - the data required
 - the process of analysis of the various factors affecting the experience
 - the use of the results to revise models and assumptions.

(Covered in part in this chapter.)

0 Introduction

In order for a financial services provider to set the premium or contribution for a financial contract or to establish provisions for existing contracts, it is necessary for it to understand the nature and the timing of the expenses.

For example, do the expenses vary with the amount of business written or are they fixed? Do they relate to a particular product, a group of products or no products at all? Do they relate to the writing of new business, the maintenance of existing business or the termination of business?

Once these questions are answered, the provider can decide on the most suitable way of loading for expenses in the premium, contribution or provision. Expense allocation is not an exact science. In particular, it is important to find the correct balance between pragmatism and accuracy.

Section 1 of this chapter looks at the different types of expenses typically incurred by a financial services provider.

Section 2 looks at the principles of expense allocation.

1 Types of expense

For most financial services providers, the expenses, in roughly descending order of amount, might be:

- staff salaries, pensions contributions, national insurance contributions, *etc*
- commission payments
- office rent and related expenses
- office equipment (*eg* computers)
- investment costs
- office consumables (*eg* stationery).

The expenses incurred by an organisation providing benefits on future financial events can be divided between:

- ***fixed and variable expenses*** – some expenses (such as building maintenance) may remain broadly fixed in real terms. Others will vary directly according to the level of business being handled at that time. These may be linked to the number of policies or claims or the amount of premiums or claims.
- ***direct and indirect expenses*** – some expenses can be identified directly as belonging to a particular class of business. Others do not have a direct relationship to any one class of business. These need to be apportioned between the appropriate classes.

1.1 Fixed vs variable expenses

In practice, all expenses can vary *in the long term*, so the concept of fixed expenses makes most sense if we confine it to the short term.

For example, property costs do not, in the short term, generally vary with the amount of business.

Insurance company expenses

Examples of variable expenses that might be related to one or more different measures of the amount of business are:

- commission – related to the amount of premium income
- postal costs for sending contract documents and claim forms – related to the number of contracts sold and the number of claims
- legal expenses – related to the claim amount.

There is no fixed rule as to the boundary between fixed and variable expenses. Some expenses could easily fall into either category.

For example, the expense of processing a new contract might be described as a fixed expense because the company would not pay higher salaries as a result of the new contract. On the other hand, if marginal sales of contracts meant paying staff bigger bonuses or making overtime payments, then the expense of processing a new contract is a variable expense.

There is a third category of expenses that is essentially fixed, but that can vary in large amounts from time to time. Within this category would be a senior management team that would normally be a relatively fixed expense, but would be changed if the structure or business of the company changed significantly.

Similarly, a declining operation might be able to sub-let a whole floor of its office premises, when it becomes small enough.

Staff-related expenses might remain fixed in real terms in the short term. In the longer term, staff costs (and accommodation costs) will vary to meet:

- changing levels of new and existing business
- changes in services provided, and
- the degree of automation used to provide those services.

Isolating variable expenses is particularly important in assessing the contributions needed to provide benefits on future financial events.

Once the variable expenses have been isolated, we are left with the fixed expenses. The spreading of fixed expenses between contracts will depend crucially on the estimates of the amount of new business to be written or handled. Indirect fixed expenses are sometimes referred to as the *overheads* of the business.

Benefit scheme expenses

The expenses incurred by a benefit scheme may differ from those described above, as the scheme may have none of the fixed overheads such as building maintenance or rent. It is possible that much of the work of the scheme, such as administration, legal advice, actuarial advice or investment management is delegated to third parties who charge a fee for the service. Where such services are provided in-house, this may be done by the sponsor's employees and so the costs will form part of the sponsor's total overheads.

1.2 Direct vs indirect expenses

Direct expenses are those that relate specifically to a particular class or classes of business.

For example, the direct expenses relating to term assurance contracts may include underwriting costs, commission, contract administration and claims settlement expenses.

Indirect costs relate to the support functions such as:

- computing
- human resources
- general management.

The distinction between direct and indirect can be a little blurred, but don't get too worried by this. There is no hard and fast rule that states that expense X is always classified as either direct or indirect. So just deal with each situation on its own merits.



Question

Give an example of a direct fixed expense in the context of an insurance contract.

Solution

Examples of direct fixed expenses include:

- the salaries of:
 - underwriters
 - claims handlers
 - administrators
- product development costs.



Question

Explain why almost all direct expenses other than commission are fixed for a financial services provider that is running below full capacity.

Solution

If the provider is running below full capacity then, in order to write more business, it does not need to increase capacity, eg by taking on extra administration staff, and so will not incur extra expenses.

In principle, therefore, it should have very few truly direct variable expenses, other than say commission and postal costs.

2 Expense allocation – principles

This section provides an overview of the principles of *expense allocation*. Expenses need to be allocated between:

- classes of business, and
- functions.

By 'function' we mean 'activity' or 'operation'. For example, the expense might relate to the activity of underwriting or the operation of administering the contract.

One of the main reasons that expenses need to be allocated in this way is so that they can be loaded into premiums. This will mean that each policy contributes an appropriate amount to the total level of expenses. We discuss how we might go about loading expenses into premiums later in this section.



Question

Outline the other purposes for which expenses need to be allocated, *ie* other than determining the expense loading for premiums.

Solution

Other reasons for carrying out expense analyses include:

- determining the expense loading for calculating provisions
- understanding the profitability of a particular product
- analysing sources of surplus (deviations of actual from expected expenses)
- analysing areas of inefficiency within the organisation
- financial planning (expense budgeting)
- cashflow management (to ensure that liquid funds are available to pay the expenses).

Expenses form an important component of the total outgo analysed in internal management accounts and financial plans. Hence, expenses need to be allocated to different types of business in as realistic a manner as possible.

However, the approach should be pragmatic as well as realistic.

2.1 Allocating expenses by class of business

Allocating direct expenses

Direct expenses may arise from a department dealing purely with one class of business, in which case the expenses relating to that department can immediately be allocated to the relevant class. If direct expenses arise from areas dealing with more than one class of business then timesheets can be kept (either for a period or permanently) to help split costs between classes.

For example, staff in an underwriting department may deal with several classes of business (eg term assurance, whole life assurance and endowment assurances). Their costs can be allocated to each of these classes based on the time that was recorded as being spent underwriting each of them. Staff timesheets can be used to collect this information.

Allocating indirect expenses

The indirect expenses are harder to allocate. By definition, the departments concerned are not related directly to any particular class of business, but form a support function for the provider. In this case, it is necessary to find a sensible apportionment of the expenses across direct business activities.

We must allocate indirect expenses to the different classes of business. There is no single correct approach for this, but it may help to allocate the expenses to different departments (*ie* business activities) first, as an intermediate step.

Finally, we must allocate expenses according to when the expenses were incurred (*ie* by function). We discuss this in more depth in Section 2.2 below.

Example 1

For some costs a 'charging out' basis could be used – computer time and related staff resources could be charged to the direct function departments based on actual use.

Computer usage

Some computer usage will be readily identifiable as belonging to one product line and one function. For instance, valuation runs would be a renewal expense while quote calculations would be new business, and both can be readily allocated to the relevant class of business.

However, some expenses, eg a company's internal electronic mail system, would not be readily identifiable as belonging to any one department or product. They could first be allocated to each department pragmatically – perhaps in proportion to the other (known) computer costs, or in proportion to staff numbers. They could then be allocated to class of business in the same proportion as the salary allocation of the employees in each department, *ie* according to a timesheet analysis.

IT staff

For IT staff, where tasks can be readily identified as contributing to a particular function and product line, salaries could be allocated according to the time spent on each task.

For other tasks, eg fixing a server problem, it may not be so easy to decide how to allocate the salary cost. Different companies will take different approaches to allocating these remaining staff costs. One approach may be to allocate them to product line (and function) in the same proportions as for the costs that have already been identified.

This example talks exclusively about IT staff and computer usage. However, parallel arguments could apply to other indirect costs, eg the salaries of actuarial staff.

Example 2

Premises' costs can be allocated by floor space taken up by a department.

If a company owns a property, then this is an asset to the company and ought to be earning a return (rental income) from its tenant. However, since the company is occupying its own property, no such rent is forthcoming. In effect, this is a cost to the company. Therefore, a notional rent needs to be charged to the departments who occupy the building.

This notional rent, plus property taxes, heating costs *etc*, can be split, for example, by floor space occupied, between departments.

Thereafter, property costs can be allocated to a class or classes of business in proportion to the allocation of the salaries of the employees of that department (which should already have been done using, for example, timesheet analysis).

Example 3

For other costs such as statutory fees or senior management costs, a more arbitrary basis may be required. These costs could simply be added at the end of the analysis as a percentage loading to all the other attributed costs.

We have mentioned that a pragmatic approach may be necessary. This is because, in practice, many companies will not keep detailed enough records of timesheets or computer logs to be able to use the methods above. Instead, a simplified approach may be used, *eg* costs may be allocated to product line in proportion to the number of policies in force, or the number of new policies written.

2.2 Allocating expenses by function

As well as apportioning expenses to a line of business, costs need to be apportioned by function, so that they can be allowed for in determining product pricing or the provisions for future liabilities.

Function relates to the *timing* of expenses, and was discussed briefly in our examples above. We now discuss this in more depth, considering first the high level division of expenses by function.

For most types of business the high level division is into the costs of:

- **securing new business**
- **maintaining existing business (policy renewal administration and investment expenses)**
- **terminating business (including claims).**



Question

Explain why one of the above three divisions would not be allowed for in determining provisions.

Solution

The costs of securing new business would not be allowed for in determining provisions. This is because provisions are established in respect of *future* liabilities once a contract has been sold. Therefore, the costs of securing new business will already have been incurred and will not be included in provisions for *future* liabilities.

Depending on the purpose of the expense analysis, these items may be sub-divided.

For example, new business costs might be split into:

- **marketing**
- **sales and commissions**
- **processing and policy issue, and**
- **underwriting.**

The functional analysis of expenses is important in determining which expenses are charged to which contracts. For example, in a life insurance company the costs of regular premium collection would not be charged to single premium or paid-up policies.

2.3 Determining appropriate expense loadings

An important element of a product pricing process or a process that establishes provisions for future liabilities is the determination of loadings for expenses. These are required to ensure that sufficient premiums are charged or adequate provisions established to cover not only the expected claim costs, but also the costs of expenses related to administration and claims handling for the business written, including a contribution to the general fixed costs of the provider.

The expense loading could be expressed as a:

- **percentage of premium or sum assured**
- **percentage of funds under management**
- **fixed amount per contract**
- **fixed amount per claim or percentage of claim amount**
- **combination of the above.**

The following sets out some examples of these approaches.

Percentage of premium or sum assured

In most cases commissions paid to third parties and to employed sales staff for securing business will be proportional to the size of the contract and will usually be expressed as a percentage of premium.

These costs can be allowed for by incorporating the commission rates directly into a formula calculation or a cashflow model.

Underwriting is an example of an expense that might vary according to sum assured, since policies with high sums assured are likely to need more detailed and expensive underwriting than those for smaller amounts.

Percentage of funds under management

Similarly, investment expenses would normally be expressed as a percentage of funds under management and these can be allowed for directly by a deduction from the investment return assumed.

Fixed amount per contract

In most cases, office administration expenses relate to activities that are independent of the size of the contract. For example, the cost of collecting a contribution is largely the same no matter the size of the contribution.

These expenses would normally be expressed as a monetary amount (with an allowance for future expense inflation) per new contract issued or per contract in force, as appropriate.

Fixed amount per claim or percentage of claim amount

The treatment of claims expenses differs by the type of business.

In general, for claims that depend on death or survival of lives, the claim expense is often likely to be independent of claim size and expressed as an amount per claim.

For general insurance business, the expenditure on claims administration will be proportionate to the size of claim, with small claims being accepted (especially if there is the loss of a no-claims discount) with minimal evidence, larger claims requiring assessment of multiple estimates, and the largest claims involving appointment of firms of loss adjusters.

Therefore for life insurance business, claim (or termination) expenses are typically allowed for through a fixed expense loading per claim (allowing for inflation). For general insurance business, claims expense loadings are often expressed as a percentage of the claim amount.

2.4 Adjustments to expense loadings for pricing purposes

Having determined appropriate expense loadings for each policy based on past data, it may be necessary to make some adjustments for pricing purposes. For example:

- to reflect cross-subsidies
- for past and future expense inflation
- due to competition considerations.

Cross-subsidies

An example occurs in general insurance where the same premium (and therefore expense loading) may be charged for both new business and renewal business, even though renewal cases are cheaper to administer.

The expense loading in the renewal business premium may be higher than the actual expenses of renewing the policy, whereas the expense loading in the new business premium may be lower than the actual expenses of writing new business.

To this end, renewals are subsidising new business. In this case, the assumption regarding the proportion of policies expected to renew will be crucial.

Life insurance companies have to consider the extent to which larger policies should cross-subsidise smaller policies. For example, if expense loadings are weighted more towards a percentage of premium (or sum assured) rather than a fixed per policy amount, larger policies will be making a higher contribution towards fixed costs. Hence there is a cross-subsidy benefit being given to smaller policies.

Inflation

The actual expense loading used in the premium rates will need to take into account expense inflation. The allocation of expenses described above will be based on historical data, whereas the expense loadings in the premium rates will need to reflect the level of expenses occurring while such business is in force.



Question

Describe the two elements of the inflation adjustment needed to determine an appropriate expense loading for premium rating.

Solution

The two elements to the inflation adjustment are:

- historic (to bring the expense data up-to-date)
- prospective (to inflate the expense data to the time when the expenses are expected to be incurred).

Competition

The final amount and form of the expense loadings in the premiums charged may be modified from the theoretical values to ensure marketability and competitiveness.

This is discussed further in [Chapter 22](#).

The chapter summary starts on the next page so that you can keep all the chapter summaries together for revision purposes.

Chapter 21 Summary

Types of expenses

Expenses can be split between *fixed and variable*, and *direct and indirect*.

Fixed expenses remain relatively constant in the short term. Variable expenses vary by the amount of business (new business written or existing business handled). Some expenses fall into a third category in between, where they are essentially fixed but can vary in large amounts from time to time, *eg* senior management costs.

Direct expenses can be identified as belonging to a particular class or classes of business. Indirect expenses cannot.

Expense allocation

Expense allocations take place for many different purposes including pricing, provisioning, profitability investigations (*eg* analysis of surplus) and financial planning.

Expenses need to be allocated by:

- class of business
- function.

Allocation to class of business

Direct expenses are often allocated to class of business using staff timesheets.

Indirect expenses (or overheads) can be allocated to class of business in several different ways. For example, premises' costs can be allocated by floor space occupied by staff and computing costs can be allocated using a 'charge out' basis. Other indirect expenses may be excluded until the end of the allocation and then allocated in proportion to all other expenses.

Allocation to function

The (non-commission) expenses can be split into:

- initial expenses
- maintenance expenses, including:
 - renewal expenses
 - investment expenses
- termination expenses.

This functional allocation helps to determine which expenses are charged to which contracts, *eg* regular premium vs single premium or paid-up policies.

Expense allocation

Premiums and provisions should be adequate to cover administration costs, claims handling costs and the fixed expenses of the provider as well as the expected claims or benefits arising under the contract.

The expense loading could be expressed as a:

- percentage of premium (*eg* commission) or sum assured (*eg* underwriting)
- percentage of funds under management (*eg* investment expenses)
- fixed amount per contract (*eg* administration expenses)
- fixed amount per claim or percentage of claim amount (*eg* termination or claim expenses)
- combination of these methods.

Adjustments to pricing expense loadings

Adjustments may be made in relation to:

- cross-subsidies
- inflation
- competition.



Chapter 21 Practice Questions

21.1 Define the following categories of expenses:

- variable
- fixed
- direct
- indirect.

21.2 'No expenses are truly fixed'.

Discuss this statement.

21.3 Explain what is meant by the statement: 'all variable expenses are direct, but fixed expenses can be direct or indirect'.

21.4 Explain why it is necessary to 'sub-divide' the function of the expenses for the purpose of premium rating.

21.5 A general insurance company writes only personal motor and health insurance.

Exam style

The health insurance policies provide money for medical treatment. Varying degrees of cover are offered. The premium rates for the health insurance contract are due to be reviewed.

All aspects of new business processing are performed in a single department. It has therefore been suggested that the total loading for initial expenses, other than commission, should be derived by dividing the total expenses incurred by the department over the preceding three months by the total number of motor and health insurance policies processed over this period.

Explain why this might not be appropriate. [5]

21.6 Describe how the following expenses would be allocated in an insurance company's expense analysis:

Exam style

- (i) salaries of actuarial department staff
- (ii) costs of running the investment department
- (iii) costs associated with a computer model purchased from a third party
- (iv) costs of property owned by the policyholders' fund. [8]

21.7 Explain why it is important to reflect the results of an expense analysis in the premiums charged for life insurance contracts.

21.8 Outline which method would be appropriate for loading each of the following types of expense into an insurance company's premium basis:

- (i) commission paid to a sales intermediary
- (ii) underwriting costs
- (iii) administration costs of setting up customer records
- (iv) investment management costs
- (v) long-term care claim costs
- (vi) overheads.

- 21.9 (i) List the different ways in which expenses could be categorised (*ie* split) for a general insurance company when undertaking an expense analysis for product pricing purposes. [3]
- (ii) Outline how the results of such an expense analysis would be included in premium rates. [3]
- (iii) Explain why it is important to reflect the latest expense analysis in premium rates. [2]
- [Total 8]

21.10 The expense loadings in a life insurance company's annuity pricing basis consist of:

- a percentage of single premium
- a one-off initial monetary deduction from the single premium
- regular deductions from the annuity payments.

The company has recently carried out an expense analysis. The results of the analysis have been published in a format that breaks down the expenses of the whole company into the following:

- staff costs, split by sales and marketing, underwriting, new business processing and existing business servicing and support function departments (*eg* human resources, finance, compliance, senior management)
- buildings' rental costs
- computer costs.

The pricing actuary wants to be able to use the results of the expense analysis to check whether the existing expense loadings in the annuity pricing basis are adequate.

Describe how the actuary could derive expense loadings for the annuity pricing basis from these results, in order to perform the required check. [9]



Chapter 21 Solutions

- 21.1 *Variable expenses* are those that vary directly according to the level of business being handled and may be linked to the number of policies or claims or the amount of premiums or claims.

Fixed expenses are those that, in the short to medium term, do not vary according to the level of business being handled.

Direct expenses are those that have a direct relationship to a particular class of business.

Indirect expenses are those that do not have a direct relationship to any one class of business (so they need to be apportioned between the appropriate classes using some appropriate method).

- 21.2 Fixed (variable) expenses are those expenses that do not (do) vary with the amount of business being written / handled.

The biggest source of expense for a financial services provider will almost certainly be the salaries payable to its employees.

These salaries will be fixed in the *short term* as it is not possible to hire and fire staff immediately.

However, if volumes of business increase or decrease, then in the *longer term* changes can be made to the number of staff working for the provider.

Even the senior management team could be changed if the structure of business of the provider changes significantly.

Similarly, with property expenses, in the long term an expanding operation can obtain additional premises, whereas a declining operation might be able to sub-let a whole floor of its premises when it becomes small enough.

It is difficult to find good examples of 'truly fixed' expenses.

However, one such example may include those expenses relating to satisfying regulatory requirements, *eg* fees payable to regulators.

- 21.3 A variable expense is an expense that increases with the volume of business written or handled.

Therefore, by definition, it must be associated with a particular class or classes of business. It is therefore a direct expense.

A fixed expense is an expense that stays relatively constant in the short term, irrespective of the amount of business written or handled.

An example of a direct fixed expense is the design and launch of a new product. The expense can clearly be linked to a particular class of business, but is fixed because it would have been incurred regardless of how much business is subsequently written.

An example of an indirect fixed expense is the provider's human resources director. They cannot be linked to any particular class(es) of business and their salary will not vary, in the short term, with the amount of business written (other than any company performance bonuses).

- 21.4 It is necessary to split expenses first by function and then into further sub-divisions because they will need to be allowed for in different ways when determining expense loadings for use in premium rating.

For example, in terms of new business costs:

- marketing, sales and commission costs are likely to be expressed as a percentage of premiums or of the number of policies sold
- processing and policy issue costs are likely to be a fixed amount per policy
- underwriting costs may be proportional to the amount of benefit or sum assured, or fixed per policy.

Additionally, a more detailed breakdown of the new business costs helps with analysis of expenses by targeting sources of profits or inefficiencies.

Knowing whether the function of a particular expense relates to securing new business, maintaining existing business or terminating business gives information as to the *timing* of the occurrence of the expense. This subsequently helps the provider in deciding whether the expense should be loaded for as an initial, renewal or termination expense, when pricing a contract.

Sub-dividing such expenses further can ensure that costs which are only incurred by regular premium business (*eg* premium collection expenses) are not included in expense loadings for single premium and paid-up policies.

- 21.5 Expenses are likely to be different for motor insurance and health insurance. [½]

For example, health insurance contracts may have higher underwriting costs. [½]

Not all expenses are *per policy*. [½]

For example, underwriting expenses may be more closely linked to the level of benefit / cover required by the policyholder ... [1]

... and marketing expenses (advertising, product launch and development) may be more closely linked to the size of premium or commission. [1]

The period of three months may not be typical or long enough, *eg* as new business sales often vary by time of year. Hence it may not reflect what we expect in the future, especially with regard to business volumes. [1]

The historical initial expenses would also have to be adjusted for inflation from the middle of the three-month period up to the middle of the period for which the premium rates are expected to be in force. [1]

New business *processing* is not the only aspect of initial expenses, so just using processing expenses could seriously understate the total initial expenses. [1]

For example, there will be marketing expenses to cover. [½]

Equally, the department may not exclusively be concerned with new business. [½]

[Maximum 5]

21.6 (i) **Actuarial staff salaries**

Work of these staff will be split between that which can be attributed to initial expenses (*eg* producing figures for sales literature) and to renewal expenses. [1]

The work is also likely to cover both direct expenses, *ie* those associated with particular product lines (*eg* premium rating of a particular product) and indirect expenses, *ie* those that cannot be associated with particular product lines (*eg* performing the supervisory valuation). [1]

Staff timesheets could be used to determine a split of salaries between the functions and between direct and indirect activities. [1]

Timesheets can also be used to split direct expenses between products. [½]

The allocation of indirect expenses is likely to be made pragmatically, *eg* in the same proportions as direct expenses already allocated. [1]

(ii) **Costs of running the investment department**

These would be directly allocated to investment (maintenance) expenses. [½]

The costs of running the investment department will depend upon the level of funds under management. [½]

(iii) **Costs associated with a computer model purchased from a third party**

The cost of purchasing a computer model from a third party could be amortised over the model's estimated useful lifetime and then added to the ongoing computer costs. [1]

These can then be allocated according to computer usage, *eg* by product and by initial, maintenance and termination-related activities. [1]

Any annual costs (*eg* for ongoing support, licensing fee) would be allocated by taking one year's cost and allocating this across the products and adding the loading to initial, maintenance or termination expenses as appropriate. [1]

The split across product and by function might be available from computer logs. [½]

(iv) **Costs of property owned by the policyholders' fund**

The property will be an asset of the fund, but will contribute no rental income as the company occupies it. This expense (of loss of rental) has to be covered by policy expense loadings. So we need to determine a notional rent for the property. [1]

The notional rent would be divided among departments according to property usage, probably based upon the floor space occupied or on number of staff. [1]

This rental income (plus property taxes, heating costs *etc*) would then be allocated to products and then allocated to new business, renewals or terminations. [1]

This would probably be done in the same proportion as each department's salary costs are allocated to product and function (based on timesheet analysis). [1]
[Maximum 8]

- 21.7 It is important to reflect the results of an expense analysis in the premiums charged for life insurance business in order to:
- charge premiums that will cover the expected level of initial and ongoing expenses associated with writing and subsequently servicing the contracts
 - understand the levels of cross-subsidy in the premiums, for example, between large and small contracts
 - understand the actual costs of writing and servicing contracts and how these may vary, for example, by:
 - distribution channel
 - regular and single premium contracts
 - without-profit, with-profit and unit-linked contracts.
- 21.8 (i) Commission paid to a sales intermediary – percentage of premium (if this is how the provider's actual commission scale works).
- (ii) Underwriting costs – fixed per contract or percentage of benefits or combination of both.
- (iii) Administration costs of setting up customer records – fixed per contract.
- (iv) Investment management costs – usually a percentage of funds under management.
- (v) Long-term care claim costs – fixed per claim or benefit payment.
- (vi) Overheads – typically allocated in proportion to the rest of the expenses.

21.9 (i) ***Expense categorisation***

The following splits could be performed:

- between fixed and variable
 - between direct and indirect
 - by product / class of business
 - by function (type or timing of expense: initial, renewal, termination)
 - further sub-division (eg initial between sales / marketing and administration)
 - by what the expense is most closely linked to (or type of expense loading).
- [½ each, total 3]

(ii) ***Inclusion of expense analysis results in premium rates***

Expenses would be allocated in the same way as the premium rates will be split, so at least by product and possibly by type of cover. [1]

Expenses will be separated in line with the categories listed in part (i). [½]

Expenses related to the number of policies or claims would need to be divided by an average policy or claim size before being loaded into the premium rates. [1]

Fixed expenses would have to be divided amongst an assumed volume of business before being allocated. [1]

Indirect expenses would be apportioned across classes. [½]

In theory new business and renewal expenses should be separated, although this does not always happen in practice. [1]

[Maximum 3]

(iii) ***Importance of inclusion in premium rates***

To allow the company to charge premium rates that will allow for the expenses of management to be recouped in the product price. [1]

To help the company to understand the levels of cross-subsidy in the rates. For example, renewals subsidise new business unless there are different premium rates for each with the expenses split appropriately. [1]

To understand the cost of writing business even if it is not sold at the theoretically correct rate. [1]

We will examine the issues of 'cost' vs 'price' in the chapter on Pricing and financing strategies.
[Maximum 2]

21.10 We consider the different types of expenses (as per the analysis) in turn.

Staff costs

The various departments are likely to deal with several classes of business and so we need a method of allocating their expenses between classes, in order to isolate those expenses that relate specifically to annuity business. [1]

For example, staff timesheets with activities split between classes could be used for all departments other than the support function departments. [1]

Support function department staff costs could be allocated between classes in proportion to the overall allocation of the other departments. [½]

Once the annuity-related expenses for each department have been isolated, we need to decide on how to load for them in the annuity premium basis. [½]

For example:

- sales and marketing – percentage of single premium [½]
- underwriting – one-off initial per policy expense or percentage of premium if the level of underwriting varies with the size of the policy [½]
- new business processing – one-off initial per policy expense [½]
- existing business servicing – regular per policy deduction from the annuity payments. [½]

The support function expenses could be allocated between the three categories of loadings in proportion to the overall allocation of the other departments. [½]

The next task is to determine the size of the loadings. [½]

To determine a loading as a percentage of single premium, we would need to divide the total annuity 'percentage of single premium' expenses by the total annuity new business single premium written over the period of investigation. [1]

To determine a loading as a one-off initial monetary deduction from the premium, we would need to divide the total annuity 'one-off initial per policy' expenses by the total number of new business annuity policies written over the period of investigation. [1]

To determine a loading as a regular monetary deduction from the annuity payments, we would need to divide the total annuity 'regular per policy deduction' expenses by the total number of existing annuity policies being handled during the period of investigation. [1]

Buildings' and computing costs

The buildings' rental costs could be allocated by charging a notional rent (determined based on market levels) to each department, based on floor space occupied. [1]

For ongoing computing costs, a charging out basis could be used by charging out computer time by departments. [½]

One-off computing costs, such as purchasing new systems, could be converted into more regular costs by spreading the cost of the system over its estimated working lifetime. (This is called amortisation.) [1]

The buildings and computing costs for each department could then be split between classes of business in the same proportion as for the salaries of the employees of each department, ... [½]

... and converted into an expense loading by using the split used for staff costs. [½]

Alternatively, we may decide to take a more pragmatic approach and just allocate all of these costs to one of the three types of loading. [½]

[Maximum 9]

22

Contract design

Syllabus objectives

10.1 Discuss the factors to be considered in determining a suitable design for financial products that will provide benefits on contingent events in relation to:

- the characteristics of the parties involved
- the risk appetite or risk aversion of the parties involved
- the regulatory environment
- the market for the product
- competitive pressures
- the level and form of benefits to be provided
- any options or guarantees that may be included
- the benefits payable on discontinuance or transfer of rights
- the method of financing the benefits to be provided
- the choice of assets when benefits are funded
- administrative issues
- the charges that will be levied
- the capital requirements.

12.5 Discuss the issues surrounding the management of options and guarantees.

(Covered in part in this chapter.)

0 Introduction

The following factors are likely to be important when designing a contract, although not all of them will necessarily apply in every situation:

- customer needs and interests
- the characteristics of other stakeholders involved in contract design
- risk appetite of the parties involved
- the regulatory environment
- profitability
- the market for the product
- competitive pressures
- the level and form of the benefits
- options or guarantees
- discretionary benefits
- benefits offered on discontinuance
- contract terms and conditions
- capital requirements
- method of financing the benefits
- premium / contribution pattern
- charges vs expenses
- extent of cross-subsidies
- consistency with other contracts
- administration systems
- accounting implications.

In this chapter we will consider each of these design factors above in turn.

Some of the factors will be more relevant to life or general insurance products, others to pension schemes, and others to financial transactions. Throughout this chapter, we use the word *contract* as a generic term to encompass product, scheme, and transaction.

The factors that apply to a completely new contract will be equally relevant in assessing both the continuing validity of an existing contract and the appropriateness of any proposed modification of existing contracts.

Exam Tip

This is an important chapter and has been tested several times in past examinations. Sometimes it may be obvious that it is being tested – *ie* the question explicitly asks for contract design factors. At other times, it is tested indirectly.

Indications in questions that contract design is being tested include phrases such as:

- ‘launching a contract’
- ‘setting up a new scheme’
- ‘changing a feature of a product from X to Y, *eg* upfront charges to regular charges’.

1 The parties involved in contract design

We now look in more detail at the factors listed in the previous section. We start with the people involved in the contract design process.

The parties involved are:

- the providers
- the providers' customers
- actuaries
- lawyers
- accountants
- financial backers
- administrators.

Another key party, which is instrumental to contract design, is *sales and marketing*.

1.1 The needs and interests of providers and the providers' customers

The providers and their customers will want financial structures that meet their needs in a cost-effective manner.

The provider's needs will be influenced by:

- the chosen market
- the capital available
- the expertise available.



Question

Explain what is meant by the *chosen market* in the list above.

Solution

The *chosen market* may relate to the demographic and economic composition of the customers (eg age, gender, wealth). It may also refer to several factors, all relating to the *General Economic and Commercial Environment*, for example:

- legislation
- taxation
- accountancy standards
- assets available – investment and risk characteristics
- State provision of benefits
- competition from other financial services providers ...

... in the market of the country / countries concerned.

The capital available will affect the type of contract that can be designed and the features offered. The level of expertise that the client has will affect the need to obtain expertise from external sources and hence the ultimate cost of providing the benefits.

The provider's customers' needs will be influenced by:

- **capacity to pay**
- **the risks to be covered**
- **the benefits that are needed at different times in the future**
- **attitude to financial risk.**

1.2 Other stakeholders involved in contract design

Actuaries

Actuaries will be involved in the initial costing of the financial structures and the subsequent determination of the provisions that will need to be held to meet future liabilities.

They will also be involved in the ongoing design process through assessing the impact on both the cost and the provisioning implications of modifications to the benefit design.

In both life and general insurance, the task of the initial costing of financial contracts is known as *pricing* or *rating*. The subsequent determination of how much money to hold back to meet future liabilities is known as *provisioning* or *reserving*.

For defined benefit pension schemes, the initial costing refers to determining an appropriate initial level of contributions. Subsequent determination of the provisions that will need to be held to meet future liabilities will be done as part of the *funding valuation*.

Lawyers

Lawyers will be involved in the drafting of the contracts supporting the financial structures to ensure that the provider is not exposed to the risk of providing more benefits or entering into greater risks than intended.

Accountants

Accountants will be involved in ensuring that the provider of the financial structures properly accounts for the income and outgo.

Financial backers

The financial backers will want regular reports demonstrating proper stewardship of the finance provided.

Administrators

Administrators will need to administer the financial structures. The more complex the financial structures are, the greater the cost of administration. This should be reflected in the amounts paid by the customers.

In addition, the more complex the structure, the greater the risk of error, *ie* of operational risk. Therefore, costs might arise from complexity both in terms of administration time and error correction.

Sales and Marketing

Sales people need training on the financial structures. The more complex the financial structures are, the greater the cost of training and the harder the contracts may be to sell.

Marketing teams can provide important information on the characteristics of the target market as part of the design process.

2 Risk appetite – risk aversion

It is important that the financial structure as designed meets the risk profile of the intended customer, and that the risks involved in the product are clearly explained to the customer. The different risk appetites of different stakeholders were covered in [Chapter 4](#).

Sales of a financial product will be optimised if the product can be designed to be suitable for customers with a wide range of risk appetites. For savings products, whether insurance contracts or benefit schemes, this can be achieved by offering a range of investment choices. Having a range of funds available means that the contract can allow for any change in the customer's risk appetite during the term of the policy.



Question

Give an example of a customer who is likely to be prepared to accept risk and one who is very risk averse in the context of making savings through a personal pension plan.

Solution

A risk-seeking customer might have the following characteristics:

- young (long time to retirement to correct any adverse experience)
- no dependants
- pension benefits available from other sources (State and employer)
- other wealth (eg equity in large home).

A risk-averse customer might have the opposite characteristics:

- close to retirement
- family to support
- limited or no other sources of pension provision
- limited wealth.

The risk averse investor can select investment funds that are designed for the cautious investor. These funds might have a significant percentage in cash or high quality short-dated bonds, with a relatively small equity content. The equity content might be restricted to invest only in 'blue-chip' companies.

'Blue-chip' companies are generally the larger public companies. They are usually characterised by having established company and financial structures and strong management and so offer safer investment opportunities.

The speculative investor can choose a fund with a low or zero fixed-interest content, and where the equity content is unconstrained. Equity investments might include unquoted companies, emerging markets, and high-risk industries.

We will learn more about the risk characteristics of different investment classes in later chapters.

General insurance products normally allow for differences in customers' risk appetite through the range of risks that can be insured.

For example, motor insurance is commonly written on three bases:

- **third party only**
- **third party, fire and theft**
- **fully comprehensive.**

Thought should also be given to the risk appetite of the provider. For example, many providers have had to confront risks in developing critical illness contracts when they first appeared in a particular market as there was very little relevant, available data available. Risks were reduced by:

- offering the contract in unit-linked form to avoid a long-term guarantee
- reinsuring a large part of the risk
- incorporating ample margins in the premium rates
- offering the contract as a *rider benefit* rather than stand alone.



Question

Explain why offering critical illness as a rider benefit that accelerates the death benefit rather than as a stand alone contract would reduce the level of risk.

Solution

Offering critical illness as a rider benefit to a term assurance contract would represent an *acceleration* of the death benefit that would be payable under the term assurance contract. Therefore, it just represents the amendment to an existing, tried and tested contract design, rather than a completely new contract design.

Additionally, incorporating the critical illness benefit as a rider benefit may reduce the risk of not selling adequate volumes of the contract, relative to if the contract was stand alone. This stems from the fact that it is often easier to sell an 'optional extra' than to sell a completely new contract.

3 The regulatory environment

It is essential that the design of a financial product is consistent with any legal or regulatory requirements that apply to the provider or to the particular type of product. For example, in most developed countries motor vehicle insurance must include third party liability cover.

Where such requirements exist they will also stipulate a minimum level of cover that must be provided.

Legislation or regulation may provide a more attractive financial or taxation regime if the policy meets certain conditions. For example, there may be tax advantages that apply to a life insurance product as long as the sum assured on death is a minimum of a specified multiple of the premiums paid. A government might impose this to ensure that products provide a minimum level of protection cover and are not just savings plans.

Where these regimes are optional, the provider needs to decide whether the contract will be designed to be inside or outside the regime. In either case the position needs to be made clear to the customer at the point of sale to avoid misleading them.

Many regulatory regimes impose a 'cooling-off period' for financial products where the customer can cancel and get a full refund within an initial period, perhaps 14 days. For policies that are cancelled in this way, the provider will have incurred initial set up expenses and will make a loss on the policy. It is important that such expenses are recouped. The normal way of doing this is to set initial charges by dividing the total expenses of the new business operation, including dealing with policy cancellations, by the number of policies that go into force, ie are not cancelled.

This results in policies which do continue covering the costs of those that are cancelled in the cooling-off period.

In some countries there may be requirements on providers to present certain information to potential customers. This may include illustrations of discontinuance terms. If these disclosures are thought to be a feature of a customer's decision to take the policy then the provider may wish to show attractive figures.

Such illustrations must then be borne in mind when actually determining the surrender value. Although the company is not offering a guarantee, it could be embarrassing for the company if discontinuance terms quoted in its literature (or in the financial press) conflicted with figures actually quoted to policyholders.

Disclosure requirements may also set out the discontinuance basis to be used and hence influence the extent to which policies terminating later, or remaining to maturity, subsidise the benefits offered on short duration discontinuance.

Benefits offered on discontinuance will be discussed in more detail in Sections 8 to 10.

4 Profitability

There are a number of commercial considerations associated with the design of a contract. These include:

- profitability
- marketability
- competitiveness.

We cover profitability in this section and the other two areas in the next two sections.

Profitability is a key issue in designing *insurance* contracts.

The important variables that might impinge on the profitability of an insurance contract are:

- claims experience (including mortality and morbidity experience)
 - claims frequency
 - claims severity (*ie* claim amount)
 - claims inflation
 - options and guarantees
- expenses and expense inflation
- investment returns
- withdrawal experience
- new business sales volumes and mix.

5 The market for the product

The intended target market will affect the design of a financial product.

The design will need to be attractive to the target market and appropriate for the sales method.



Question

Outline the other aspects of a contract's design that will make the contract marketable.

Solution

Other aspects of a contract's design that improve marketability include:

- having innovative design features such as options and guarantees
- simplicity – easy to understand
- transparency – good disclosure of information to the customer
- low charges.

Products directed at lower income individuals are likely to be simple contracts with a clear insured event. Such simplicity reduces cost and the product is more likely to be affordable and comprehensible to the target market.

At the other extreme, high net worth individuals are likely to favour flexible products that can be adjusted as their financial circumstances change. The provision of options and guarantees is likely to be attractive to this group. These features add cost, but the target market would normally understand the cost of flexibility and guarantees and be prepared to pay it.

The same applies when products are being designed for advisers to sell to their customers – it is the needs of the advisers' customers that should be considered.

6 Competitive pressures

There are two main types of competitive pressure:

- price
- product features.

6.1 The importance of price

The simpler the product, the more price sensitive the product is likely to be.

Some products are designed to cover basic insurance needs where the risk is well defined: term life insurance, annuities, private motor insurance, employer's liability insurance. These products tend to be sold on price and the provider with the lowest price is likely to get the greatest volume of business. Pricing issues are covered in [Chapter 23](#).



Question

Give examples of contracts for which the premium rate:

- is crucial to competitiveness
- is not crucial to competitiveness.

Solution

(a) ***Crucial to competitiveness***

The premium rate tends to be crucial to competitiveness for contracts that are easily comparable between providers (*ie* contracts that are simple or standardised). Examples of such contracts include:

- personal car / house insurance
- term assurance / whole life assurance
- annuities.

(b) ***Not crucial to competitiveness***

The premium rate tends not to be crucial to competitiveness for contracts that are more complicated and are less easily comparable between providers and/or where the benefits are contingent on some other factor, *eg* investment performance. Examples of such contracts include:

- with-profit savings contracts
 - unit-linked savings contracts
 - long-term care contracts (as likely to be chosen on the basis of the level of care / conditions for payment rather than premium).
-

6.2 The importance of product features

Other products cannot be directly compared on price and instead the risks covered, the administrative systems and the claims process all feature in the customer's decision. For example, motor breakdown cover may or may not cover breakdown at the driver's home, may provide a guarantee of attending a claim within a specified time, may offer different options if the vehicle cannot be repaired at the roadside. All these items feature in the decision to purchase as well as the price.

There is a risk to a provider of offering terms that are very different from the rest of the market. Customers may assume that the terms are consistent with the rest of the market and be disappointed if they don't receive what they expect, even if they receive the benefits specified by the policy. A provider who offers different terms from the market may attract selective business (this is covered in [Chapter 20](#)) which means that the product mix is not as expected. However, differentiation can be a positive sales point, as it can offset a less price competitive product.

The idea of selective business is illustrated by the following real-life example.

In some cases being different from the market can force the market to catch up with the innovators. Because there are more non-smokers than smokers in the UK, the first provider to offer lower life assurance premium rates for non-smokers (and higher rates for smokers) than the rest of the market secured a lot of business. Providers that did not discriminate attracted smokers who benefited from a mixed aggregate premium rate, and therefore those providers' mortality experience was worse than expected. This soon forced the whole market to change to differentiating by smoking status.

How competitive a product is will also depend upon how the product is sold. For example, selling through independent intermediaries tends to result in more competitive pricing than selling through an insurance company's own sales force. This is because the former seek out the best contract terms for their customers from across the market, whereas the latter only sell contracts from that particular insurance company.

The desire to be competitive often conflicts with the profitability of the design.

7 Deciding on the benefits to offer

7.1 The level and form of benefits

When considering the benefits that are needed at different times in the future, both the *level* of benefits and the *form* of benefits need to be taken into account. The *level* of benefits refers to the amount of the benefit. The *form* of benefits refers to whether they are regular or one-off in nature, and monetary or non-monetary, *eg* goods or services.

The level and form of benefits to be provided under any specific financial structure may vary according to the:

- **customer's needs**
- **risks to be covered**
- **customer's ability to pay.**

For example, some car owners may want full cover against damage to or theft of their car, combined with legal protection and an additional premium to protect any no-claims bonus they have accumulated. Other car owners may just want the minimum cover to enable them to drive legally.



Question

Give examples of how the level and form of benefits may vary according to the customer's needs in relation to a term assurance contract.

Solution

Variations in the level and form of the benefits relating to a term assurance contract may include:

- the amount of the sum assured
 - whether the benefit is decreasing or level
 - additional rider benefits such as critical illness
 - waiver of premium benefit, *eg* in the case of sickness, accident, unemployment
 - whether or not premiums can be reviewed
 - a renewal option at the end of the term, with or without further underwriting.
-

7.2 Options and guarantees

Options

Options in financial products reflect the use of the word option in its normal English sense, *ie* a choice. One party to a contract has a choice to do something, and the other party cannot prevent the action. However, often the other party can set the conditions under which the option can be exercised.

The approach taken may vary depending on the type of contract:

- For example, on early termination of some types of insurance policy there may be no value. Policies such as term assurances can be terminated by the policyholder stopping premiums. Life cover ceases and there is no surrender payment made to the policyholder ...
 ... other policies may have a value on termination, and the policyholder may receive a payment if they choose to surrender the policy.
- For a motor insurance policy, the contract may state a formula for a partial refund of the premium if the policy is cancelled early.
- For a with-profits life assurance a surrender value is paid but there is no guarantee of the amount, which is at the discretion of the company. The surrender value can be set to recover:
 - the expenses which have been incurred (including actual costs of processing the surrender).
 - the expected profit on the contract. The insurer could choose to recover a proportion of the expected profit, based on the duration in force, or it could choose to recover all the profit that was expected to be earned if the policy remained in force.
 - a penalty charge for breaking the contract.
 - the cost of any life cover provided up to the point of surrender.

Some policies give the policyholder the option to convert from one type of policy to another.



Question

Give other examples of options that might be offered on an insurance contract.

Solution

Examples of options include:

Payment of premiums

- waiver of premium – where the customer has the option to stop paying premiums, *eg* in the case of sickness, accident, unemployment
- the option to increase or reduce the level of premiums
- payment frequency, *eg* monthly, annual, single premium

Benefits

- lump sum vs regular income
- protected no claims discount
- option to add rider benefits, eg critical illness to a term assurance contract

Use of the contract proceeds

- option to choose between a number of hospitals for treatment under a medical expenses (health) insurance contract

Other items

- option to renew term assurance without further health checks

Policies may give the insurer the option to increase charges, usually subject to a cap.

Regulations may impose restrictions on the exercise of options that are deemed to be unfair to the consumer.

Guarantees

The most common guarantee in financial products is the basic sum assured under a life insurance policy, or the sum assured plus bonuses under a with-profits policy. Other products are written with a conditional guarantee: the maturity value under a unit-linked assurance might be the value of units with a monetary minimum – the guarantee is in the money when unit prices are low. A more complex guarantee might be where a contract's value depends on the growth in a specified equity index (such as the FTSE 100) with a guaranteed minimum growth rate.



Question

Give examples of guarantees that might be offered under the following contracts:

- an immediate annuity
- household property insurance
- a defined benefit pension scheme.

Solution

(i) ***Immediate annuity***

- annuity payments guaranteed not to fall or guaranteed to increase in line with a fixed amount or with an index, eg RPI in the UK
- benefits paid for life but subject to minimum guaranteed period, eg 5 years

(ii) Household property insurance

- guarantee of payment of benefits upon proof of occurrence of an event that is covered by the contract

(iii) Defined benefit pension scheme

- guaranteed retirement pension, *eg* a proportion of final salary for each full year worked subject to a maximum of X years
- guaranteed death-in-service lump-sum benefit or dependant's pension

Product providers' systems should be designed to pay out the guaranteed amount when a guarantee is in the money. A more difficult issue is whether to tell a customer that a forthcoming guarantee is in the money if the customer seeks, for example, to surrender the policy a few months before the guarantee date.

Guaranteed options

Guarantees and options are frequently combined. A policyholder may have a choice whether to take a guaranteed surrender value on a specified date, or to continue the policy in the hope of a better return at some later date.

Life insurance policies designed to provide a pension, but which fund for a cash sum at retirement, sometimes have an option to use the cash available at retirement to purchase a pension at a guaranteed rate that is substantially better than the current rates available in the market. Sometimes these policies also have an option to take the proceeds in a lump sum, part of which may be tax free to the recipient. This gives the customer a difficult choice.

Where there are guaranteed options, giving a clear explanation to the customer becomes increasingly necessary. For example, some older pension policies written in the UK provide very attractive in-the-money guaranteed annuity rates for a single life pension payable monthly. The provider has two choices:

- Extend the guarantee voluntarily and generate annuity option rates for other frequencies of pension payment and for joint life annuities, using the same actuarial basis as in the policy guaranteed rates. Then all options can be offered to the customer fairly, but at an increased cost to the insurance company.
- Require that joint life and other frequencies of annuity are purchased at non-guaranteed current rates. This will be less costly for the company. However, it will need to ensure that the existence of better rates for monthly single life is made clear, including the financial benefit of selecting the guaranteed option. This approach would also expose the company to reputational risk if it were to be accused of unfair treatment of customers.

Pricing options and guarantees

Any options or guarantees that are included in the financial structure will need to be charged for. Ideally this should be a charge included in the premiums paid. The alternative is to charge for guarantees through a reduction in the amount paid when the benefits fall due.

While not charging for options and guarantees from the outset may aid sales, the adverse reaction of customers whose benefits are unexpectedly reduced on payment is likely to outweigh the earlier benefit. Imposing a charge for a guaranteed benefit at the time the benefit is paid – presumably by a deduction from the benefit, means that the benefit doesn't have the guarantee the customer is expecting.

The regulatory capital requirements are also likely to be more onerous if options or guarantees are offered.

7.3 Discretionary benefits

A decision needs to be made as to the extent to which surplus arising may be shared with the client.

For example:

- For a life insurance contract – the level of bonuses to be provided under a with-profits contract.
- For a general insurance contract – the scales for a no-claim discount experience rating system for private motor business.
- For a defined benefit pension scheme – the level of discretionary pension increases to be awarded in a final salary scheme.



Question

If a contract offers *discretionary* benefits, what should be a primary consideration in deciding what level of discretionary benefits to offer?

Solution

If discretionary benefits are offered, a primary consideration is PRE (Policyholders' Reasonable Expectations).

8 Benefits offered on discontinuance – life insurance contracts

A decision needs to be made as to the benefits that will be offered to policyholders discontinuing their life insurance contract. By 'discontinuing' we mean voluntarily deciding to stop paying any more premiums.

Offering the option to take benefits early makes contracts more marketable, but more complex and hence harder to administer. Actuaries would be involved in setting the terms on which the above options should be granted.

The principles underlying the determination of the benefits payable on discontinuance or transfer of rights are broadly the same for insurance contracts and benefit schemes in that the amount offered on discontinuance should be fair to:

- the policyholder or scheme member
- other policyholders and scheme members
- the provider of the benefits.

8.1 Discontinuance and life insurance contracts

When setting the discontinuance terms for life insurance contracts, the insurance company should consider:

- *which* contracts to offer discontinuance terms on
- the *form* of the benefits being offered
- *how* it goes about setting the discontinuance terms
- any *practical considerations* relating to the discontinuance.

We look at these factors below.

8.2 Determining the contracts for which to offer discontinuance terms

An insurance company needs to decide the contracts for which it will offer discontinuance terms. These may be governed by:

- market practice
- regulatory requirements
- the likelihood of selective withdrawals
- or simply the difficulty of assessing suitable terms, such as the lump sum to pay on the discontinuance of an immediate annuity.

Selective withdrawals is the idea that policyholders anticipated to have better than expected experience (from the viewpoint of the insurance company) withdraw, leaving a pool of policyholders who are anticipated to have worse than expected experience.



Question

Explain why assessing lump sum discontinuance terms for an immediate annuity is difficult.

Solution

It is the risk of selective withdrawals that makes it difficult to set discontinuance terms for an immediate annuity.

For example, annuitants may decide to discontinue their annuity because they believe they are not going to survive for much longer. In the discontinuance benefit calculation, we would have to make an assumption regarding future life expectancy of annuitants. The longer that we assume the annuitant will live for, the higher the benefit.

Therefore, there is a risk that we are too optimistic in our assumptions and pay out a lump sum that is greater than the true present value of the actual annuity payments that would be made to such individuals if the contracts were not to be discontinued.

In practice, it is rare for such contracts to offer a discontinuance benefit.

8.3 Administration costs

The provider will also consider the cost involved in determining and implementing the terms compared with the benefit available on discontinuance.



Question

Set out the components of this 'cost'.

Solution

The costs of determining and implementing discontinuance terms include the:

- cost of determining a calculation basis
 - computer systems development and maintenance costs
 - costs of employing and training staff to deal with discontinuance quotations and subsequent queries / complaints
 - marketing literature costs
 - losses incurred due to providing overly generous discontinuance terms or due to errors in calculations
 - cost of reviewing the discontinuance terms.
-

It is likely that any payment made to the policyholder on discontinuance will be reduced for the expenses associated with calculating and administering the discontinuance payment.

8.4 The form of the benefits offered

Where discontinuance terms are offered, these could take the form of a payment of a lump sum, or a conversion of the contract to a paid-up status with no more premiums being payable.

In a life insurance context, discontinuance may mean:

- *Surrender* – the policy stops, there is no further cover and the policyholder receives a lump sum payment (the surrender value) from the insurance company.
- *Lapse* – the policy stops, there is no further cover and no payment is made to the policyholder by the insurance company.
- *Paid-up* – here the policyholder ceases to pay premiums but the policy continues to offer the policyholder some cover. In this case the benefit is reduced to reflect that there are no more premiums and is called the paid-up value.

Another term frequently used is *withdrawal*. Withdrawal encompasses the first two bullets above – surrender and lapse. The implication is that, in both cases, the policy does not stay in force and therefore it has been *withdrawn*.

For some types of contract the discontinuance terms, or the method of calculating them, may be guaranteed as part of the contract.

For example, for unit-linked contracts in the UK, it is common for the benefit to be provided on surrender of the contract to be specified in terms of the *bid value of the units*. The bid value of units is the number of units held by the policyholder in the fund multiplied by the bid price of the units. The bid price of the units is the price at which the insurance company redeems the units allocated to the contract.

8.5 Setting the discontinuance benefits

Fairness is the key concern when setting discontinuance terms; however, determining what is fair is not always straightforward.

The key principles and factors to consider in determining discontinuance terms for life insurance contracts are:

- what the policy is 'worth'
- policyholder expectations
- competitive considerations.

These aspects are considered in detail below.

What the policy is “worth”

A starting point for calculating the surrender payment that can be made, if any, is to consider what has happened to the policy to date to assess its current value. In other words to calculate the retrospective reserve, which we might alternatively call the *asset share*.

Policyholder expectations – discontinuance at short duration

It is natural for a policyholder to compare the lump-sum discontinuance benefit after a few years' duration with the premiums paid, or even premiums plus some interest. However, the discontinuance benefit at such a stage will often, if not usually, be less than the sum of premiums, or even negative, as significant initial expenses will have been incurred.



Question

This means the retrospective reserve is likely to be negative in the early years. List the common initial expenses that arise and are likely to lead to this negative reserve.

Solution

The common initial expenses are:

- initial commission
 - underwriting
 - policy administration.
-

If expenses exceed premiums, then clearly the company cannot avoid making a loss. However, it may feel obliged to accept a loss, or at the least a reduced profit, on discontinuance up to several years into the contract so that the lump sum paid does not appear too low compared to premiums paid.

One way of coping with this situation is to try to recoup the loss from later surrenders, *ie* penalise later surrenders in order to pay early surrenders more than they warrant.

Policyholder expectations – discontinuance close to maturity

Where a benefit will become payable on the maturity of a contract, the policyholder will expect that a lump sum payable on discontinuance just prior to maturity will be consistent with it.

That is, the surrender values payable at late durations should progress smoothly into the maturity value at the end of the contract.

Competitive considerations

It is quite reasonable for a company to want to be seen to offer competitive surrender values as well as competitive maturity terms.

8.6 Practical considerations

Whilst fairness is the key concern, other practical issues can get in the way of achieving this, including:

- the ease of calculation of the discontinuance benefits
- the frequency of change of the discontinuance terms.

These issues are considered below.

Ease of calculation

Discontinuance terms will often consist of a simple formula, or table of applicable factors, which will allow mass production of surrender values and paid-up values by administrative staff, probably via some computer application. The actuary must balance the need for simplicity with the requirement for fairness of discontinuance terms.

Frequency of change of discontinuance terms

For practical reasons, discontinuance terms should not change too frequently unless financial conditions would dictate this. This is to reduce the:

- risk of not meeting policyholder expectations
- costs of determining and implementing new terms.

9 Benefits offered on discontinuance – general insurance contracts

The benefits offered on discontinuance for a general insurance contract tend to be simpler, hence this section is short!

General insurance contracts usually have a period of cover of one year. Let's consider a policyholder who paid a single premium for their policy and who now wants to discontinue their policy. The insurer is likely to provide a lump-sum discontinuance payment (surrender payment) reflecting the premium for the outstanding cover less an administration fee.

So if a policyholder left half way through the policy year, they might receive a payment of half of their premium less an admin fee.

10 Benefits offered on discontinuance – benefit schemes

10.1 Introduction

In setting discontinuance terms for individuals in benefit schemes, it will be necessary to consider:

- the *form* of the benefits being offered
- *how* discontinuance terms might be set
- any *other considerations* relating to the discontinuance, in particular how the funding level of the scheme might affect the discontinuance terms offered.

We look at these factors below.

10.2 The form of the benefits offered

For a defined contribution scheme, the discontinuance benefit will reflect the member's account at the date of withdrawal. This account will continue to grow with investment returns less any charges up to retirement.

For a final salary defined benefit scheme the benefit provided is usually based on the number of years' service and the salary at the date of withdrawal increased at some low rate (usually based on price or capped price inflation) until retirement.

When a member moves from active to deferred status in the scheme the member is likely to be given the option not to transfer benefits away but to retain the full discontinuance benefits in the scheme.

So, for both defined contribution and defined benefit schemes the member may have the choice to either:

- remain in the scheme until retirement and receive the benefit, or
- at any time before retirement transfer the value of the benefits into another arrangement.

The rest of this section considers a member choosing to transfer the value of their benefits from a defined benefit scheme.

10.3 Setting the discontinuance benefits

For a defined benefit scheme, the benefits on discontinuance are likely to be known, but if they are to be transferred to another provider a value will need to be placed on them. The value will need to be equitable between members who leave the scheme and members who stay in the scheme.

The principle is that the transfer payment should be the expected cost of providing the benefits within the original scheme. So again, the overriding principle is that of fairness.

10.4 Other considerations

For defined benefit schemes, it is not always necessary to be fully funded.

Any payment to a member leaving the scheme may be reduced to reflect a lower level of funding.

For example, suppose a scheme is only 95% funded, *ie* has assets equal to only 95% of the value of the liabilities. If members withdraw from this under-funded scheme they are likely to be offered a *reduced* transfer value, say 95% of the value of their vested rights.

This reduced transfer value reflects the fact that the scheme does not currently have the assets set aside to provide the benefits in full. If members do not wish to take a reduced transfer value then they can instead stay in the scheme and retain 100% of their vested rights.

11 Financing considerations

11.1 Capital requirements

In life insurance, it is common for contracts to make a loss in their first year. This is commonly known as *new business strain*.

New business strain arises because the premium received in the first year may be less than the sum of the initial expenses, the initial commission paid and the initial increase in provisions (or reserves) and the initial solvency capital requirements. The sum of the provisions and solvency capital will be set at a prudently high level to provide security to policyholders' benefits.

In subsequent years, it is common for contracts to make profits as more premiums are received, the expenses reduce and the provisions and solvency capital are released.

The financing requirement is a particularly important consideration for small providers or providers with low levels of capital.

The capital requirements depend on the 'riskiness' of the benefits promised. Some 'attractive' contracts may require the provider to hold an unacceptable level of capital even if they can sell the contracts on profitable terms. This might particularly be the case where the regulatory capital requirements are assessed on a basis that is inconsistent with the economic capital requirements of the contract.

In other words where the regulatory capital requirement is much more prudent than the economic (in-house) assessment of capital needs.



Question

Give examples of contract design features that could be used to reduce the financing requirement (or new business strain).

Solution

Contract design features that could be used to reduce the financing requirement include:

- low guarantees
- charges that match the expenses by nature and by timing
- low initial expenses / commission
- low statutory provisioning requirements
- single premium.

In life insurance, unit-linked designs tend to have lower financing requirements than without-profit or with-profit designs because of the lower benefit guarantees offered and the ability to vary charges.

11.2 The method of financing the benefits to be provided

By the *method of financing* we mean when the money is set aside to provide the benefits.

Whenever there is a period of time between a financial structure being set up and the benefits actually being provided, there is a choice as to how and when monies should be set aside to pay for the benefits.

For an insurance contract the policyholder will pay either a single premium, *ie* funding all the benefit in advance or regular premiums, *ie* regular payments building up a fund. We might say therefore that, to a greater or lesser extent, the benefits have been *funded in advance*.

For a defined benefit scheme, there are more choices in terms of the method of financing the benefits.

For example, for a benefit scheme the range of options that could be used are:

- **pay as you go**
- **funding all the benefit in advance**
- **regular payments building up a fund**
- **paying an amount when the benefit event happens for example purchasing an annuity at the point of retirement**

These ideas are developed further in [Chapter 23](#).

Under the pay-as-you-go approach funds to finance the benefits are only set aside as each benefit payment is made. This is an *unfunded* approach.

For a defined contribution scheme, regular contributions will be made into the scheme and invested to provide an amount at retirement.

If benefits are funded in advance, a decision will be required as to the way the funds are to be invested. The range of possibilities, and the considerations to be taken into account, are covered in an earlier chapter.

The final choice depends critically on the attitude to risk of all the stakeholders. This topic was dealt with in [Chapter 4](#).

12 Administrative and accounting issues

12.1 Administrative issues

The product will need to be administered, this might be on the provider's own systems or might be outsourced to a third party. In any event, the system used needs to be able to carry out the functions that have been built into the product design at the cost that has been built into the product price. Systems changes needed to adapt to the requirements of a revised product design also need to be included as part of the development cost of the product.

Many product designs involve options or changes that only take effect some years after the launch of a product. An example might be offering a guaranteed surrender value on the fifth anniversary of a unit-linked savings bond. It is clearly not necessary to have these surrender processes working at the product launch, and if they are omitted the product can be launched more quickly. But the need to carry out the work at some point in the first five years will always be present, and it may be difficult for the business to schedule an appropriate time to carry out such work.

12.2 Accounting implications

The impact of the intended design on accounting requirements should be considered.

13 Premiums, contributions and charges

13.1 Premium / contribution pattern

The more premium or contribution flexibility that is offered, the more complicated and expensive the administration of the contract and the calculations involved will be. However, greater flexibility may enhance the marketability / competitiveness of the contract.

13.2 Charges vs expenses

The charges that are levied will need to meet the costs incurred by the provider in setting up and managing the financial structures in place and contribute towards the profit of the insurer.

Note that there is a difference between the terms *charges* and *costs / expenses*. Charges are an income to the provider, *ie* money taken from the customer (this may include a loading for profit). Costs / expenses are an outgoing payment from the provider.



Question

Describe the key risk relating to the charges vs expenses aspect of the contract design.

Solution

The key risk is that the charges mismatch the expenses, in amounts, timing and nature (*ie* fixed, real or varying in some other way) .

For an insurance company, the costs will include:

- **contract design**
- **advertising / sales**
- **commission**
- **the initial administration of setting up new policyholder records**
- **the ongoing administration of collecting premiums**
- **the administration of paying the claims / benefits as they fall due**
- **management of assets**
- **the overheads of the insurer, eg rental of office space, IT departments etc.**



Question

For each of the above costs, consider how the provider might charge for the cost:

- by function: with an initial, regular or termination charge
- with a type of loading: percentage of premium, percentage of funds under management, fixed amount per policy ...

... to best match the nature and timing of the cost.

Solution

<i>Cost</i>	<i>Charge</i>
Contract design	Initial charge, percentage of premiums or fixed amount per contract
Advertising / Sales	Initial charge, percentage of premiums
Initial commission	Initial charge, percentage of premiums
Renewal commission	Ongoing charge, percentage of premiums or of funds under management
The administration of setting up new client records	Initial charge, fixed amount per contract
The ongoing administration of collecting premiums <i>etc</i>	Regular charge, fixed amount per contract, (increasing in line with an index)
The administration of paying the benefits as they fall due	Termination charge, reduction in benefits payable at time they fall due, fixed amount per contract
Management of assets	Regular charge, percentage of funds under management
The overheads of the provider	Regular charge, loading on to one of the above charges

13.3 Extent of cross-subsidies

The provider may allow for there to be cross-subsidies within or across contract types.

An example of a cross-subsidy within a line of business would be to require larger policies to contribute more towards expenses and profits than smaller policies. So the larger contract is subsidising the smaller contract.



Question

State the main risk when allowing for cross-subsidies.

Solution

There is a risk that the business mix sold is not as expected, *eg* sell lots of small policies and not many large ones.

13.4 Consistency with other contracts

The provider will want to check for consistency in design and pricing with existing contracts that are being sold.



Question

Explain why the provider will want to check for this consistency.

Solution

The key reason is that a major change will result in significant systems development, which will take time and cost money.

There are also benefits in terms of saving time and cost with such things as training administration and sales staff, printing marketing literature and so on.

There is also a possibility that a design that appears much more attractive or favourable to new customers, may seem unfair to existing customers and may lead to some dissatisfaction and possible marketing risk.

14 'Conflicts' when designing a contract

In practice many of the factors discussed in this chapter may conflict.



Question

Give examples of pairs of contract design factors discussed in this chapter, that conflict and so are likely to need a compromise to be struck.

Solution

In practice, there will be conflicts between most pairs of these factors. For example:

- the desire for a profitable contract with big profit margins in the premium rates may conflict with the desire for a competitive contract
 - the desire to offer guarantees will conflict with the desire to reduce the financing requirement
 - the desire for 'bells and whistles' to improve marketability will conflict with administrative simplicity.
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The chapter summary starts on the next page so that you can keep
all the chapter summaries together for revision purposes.

Chapter 22 Summary

Contract design factors

In designing or reviewing any contract, the following factors need to be considered:

- customer needs and interests
- the characteristics of other stakeholders involved in contract design
- risk appetite of the parties involved
- the regulatory environment
- profitability
- the market for the product
- competitive pressures
- the level and form of the benefits
- options or guarantees
- discretionary benefits
- benefits offered on discontinuance
- contract terms and conditions
- capital requirements
- method of financing the benefits
- premium / contribution pattern
- charges vs expenses
- extent of cross-subsidies
- consistency with other contracts
- administration systems
- accounting implications.

These factors are neither independent nor mutually exclusive. Sometimes they will be conflicting and difficult to resolve.

The practice questions start on the next page so that you can keep the chapter summaries together for revision purposes.



Chapter 22 Practice Questions

- 22.1 Outline features of a contract design that increase the financing requirements.
- 22.2 Explain why a regular premium pure endowment assurance would result in higher financing requirements than a single premium version of the contract, all other things being equal.
- 22.3 A medium-sized general insurer sells a wide range of products, including a health insurance product. It has decided to re-launch this product in order to increase its market share and, in particular, to target certain sectors of the market.

The product will offer a set of core benefits, together with a choice of additional benefits that policyholders can select at the outset. The core benefits will cover in-patient and day-patient treatment, including hospital charges (*ie* accommodation, meals, nursing, drugs *etc*) and diagnostic tests (*eg* X-rays). Cover is renewable annually.

- (i) (a) List eight different categories of customers that the company may decide to target.
- (b) For each group listed in part (i)(a), suggest additional benefits that the policyholders might find attractive.
- (ii) Discuss the factors that the insurer should consider when designing this product.

- 22.4 A mutual life insurance company writes with-profit endowment products.

Discuss the factors to be considered in determining the lump-sum discontinuance terms under these products.

- 22.5 A life insurance company is proposing a new immediate annuity contract to attract financially sophisticated investors at retirement. It proposes that the benefits, payable throughout life, be linked to the performance of the domestic equity market but with the guarantee that the annuity cannot fall by more than a given percentage from any one year to the next.

Exam style

Discuss the factors that should be taken into account when determining a suitable design for this contract and deciding whether or not it should be launched. [11]

- 22.6 An oil provider has decided to raise long-term capital by issuing a 30-year corporate bond which will have both its coupon payments and its redemption proceeds linked to the spot price of oil.

Exam style

Discuss the considerations involved in designing this bond. [7]

- 22.7 The finance director of a company that sponsors a well-funded final salary pension scheme is keen to reduce the amount of the employer's contribution and to reduce the future volatility of the contribution rate.

Exam style

Outline the changes that could be made to the existing pension scheme and the other options available to achieve the finance director's objective. [10]

22.8

Exam style

A small insurance company is considering launching a renewable short-term savings plan, which will be targeted at individuals saving for Christmas. Individuals will make monthly contributions to the plan from January to November (inclusive) and will receive the amount of their contributions, rolled up at 2% *pa*, on a set date in December (selected by the policyholder at the outset). The level of the monthly contributions will be specified by the individual, but will be subject to a minimum and a maximum.

Policyholders will have the option to withdraw 25% of their total contributions (with interest) in October, and a further 50% in November. On death or lapse, policyholders will be entitled to a return of contributions with no interest.

As an extra feature, the insurance company will offer a free Christmas hamper to a small number of policyholders, chosen at random each year. The value of the hampers will be based on the number of years the 'winners' have been a part of the plan.

- (i) Outline the customer needs met by the product. [4]
 - (ii) Discuss the factors the insurance company should consider in designing the product and how well the features of the product meet these considerations. [16]
- [Total 20]



Chapter 22 Solutions

22.1 Features of a contract design that increase the financing requirement are:

- lack of historical data, and hence the need for greater margins in the provisioning calculation
- high guarantees, which increase the provisions
- policyholder options, which increase uncertainty involved, and hence the provisions
- high initial expenses
- high initial commission
- high overheads, *eg* development expenses
- without-profit designs with non-reviewable premiums, due to the guarantees involved
- regular premium designs.

22.2 When a contract is written, a financing requirement results from the shortfall between the premium received and the:

- initial expenses including commission
- provisions that need to be established in respect of the contract.

This shortfall will be smaller where a single (larger) premium is payable.

22.3 (i)(a) ***Different categories of customers***

Gender-related, *ie*:

- male
- female

Age-related, *eg*:

- old
- young

Health-related, *eg*:

- healthy
- recovering from existing condition, *eg* cancer, heart attack

Occupation-related, *eg*:

- trades people
- office workers
- nurses
- professionals
- sportspeople

Net-worth related, *eg*:

- individuals earning over a certain amount

(i)(b) **Possible additional benefits**

Gender-related:	maternity services (females)
Age-related:	replacement surgery, <i>eg</i> knee / hip, cataract operations (old) health checks (young)
Health-related:	radiotherapy, chemotherapy (cancer patients in remission) angiograms, by-pass surgery (past heart attacks)
Occupation-related:	chiropractic, personal accident, replacement surgery, <i>eg</i> knee (trades people) eye tests / glasses or contact lens vouchers, repetitive strain injury treatment (office workers) chiropractic, treatments for diseases caught from patients (nurses) stress counselling (professionals) physiotherapy, key-hole surgery (sportspeople)
Net-worth related:	choice of more expensive hospitals
Other:	dental treatment, optical treatment

(ii) **Contract design factors**

Interests and needs of the customers – the contract must meet the needs of a wide range of customers.

It is therefore important that the insurer knows:

- the risk appetite of potential consumers
- what benefits (core and additional) are desired
- their capacity to pay for the insurance.

Marketability – the possible additional benefits may enhance the marketability of the product but this depends on what competitors are providing.

Competitiveness – the insurer is unlikely to want the premiums charged for the product to depart too far from those charged by competitors for equivalent products. It may only be possible to do such a price comparison in respect of the core benefits.

The insurer should also consider the likely response of competitors to the introduction of the product.

Profitability – the insurer will want to ensure that the premiums charged will be sufficient to cover the expected claims and expenses in most foreseeable circumstances.

Profitability may conflict with marketability and competitiveness.

Risk appetite and risk aversion – by offering a range of cover, the insurer is catering for different risk appetites amongst consumers.

The level of risk that will be acceptable to the *insurer* depends on the insurer's ability or willingness either to absorb it internally or to reinsure it.

Offering optional benefits creates an anti-selection risk.

Extent of cross-subsidies – the insurer will need to decide on the extent of any cross-subsidies, for example between core benefits and additional benefits, new business and renewals, and hence its exposure to the risk of the mix of business being different to expected.

The desire to avoid cross-subsidies can conflict with a simple premium structure and administration.

Level and form of the benefits – the insurer will need to decide whether it meets all the costs of treatment, or whether it contributes a fixed percentage / amount to each claim. Alternatively, it could apply an excess to each claim. The benefits may be set to integrate with any State provision.

Contract terms and conditions – the insurer will want to ensure that the contract conditions are not so tight that they impact on marketability, but not so loose that unanticipated claims occur.

Advice on policy wording should be sought from lawyers, reinsurers and medical experts.

Consistency with other contracts – the insurer should try to ensure that the premiums and benefits are fairly consistent with the existing health insurance product in order to avoid discontentment from existing policyholders.

Administration systems – the new design may be restricted by the existing administration systems. If the existing system cannot cope with optional benefits, then the insurer will either have to modify the design, or buy / build a new administration system. The latter could be costly.

Financing requirements – the insurer will want the product to be designed so as to minimise its capital requirements, *eg* by paying regular commission payments over a period of time rather than a lump sum at the outset.

Premium pattern – the insurer will also need to decide on the frequency of premium payments under the contract, *eg* annually, monthly.

Statutory / regulatory requirements – the insurer should take into account any statutory or regulatory requirements on contract design or on the premiums that can be charged.

Accounting implications – the insurer should consider the effect that the new product will have on its accounting requirements.

These contract design factors are not necessarily independent, in that meeting one may mean that another cannot be met. The insurer will seek the optimal solution.

- 22.4 The starting point for determining the lump sum discontinuance terms should be assessing what the policy is worth, *ie* the retrospective reserve.

Paying this amount should generally be fair to discontinuing / continuing policyholders.

However at short durations this retrospective reserve is likely to be negative (as expenses exceed premiums paid).

At short durations, policyholders may have reasonable expectations of receiving a benefit equal to a return of premiums, possibly with interest, but with no adjustment for expenses.

Even if there are no guarantees, any surrender value illustrations provided, *eg* as part of new business disclosure, will influence policyholder expectations.

Therefore, the insurer may have to pay out more than what the policy is worth, particularly at short durations.

The losses on early discontinuance could be recouped by paying out less at later durations.

As maturity approaches, policyholders will have reasonable expectations that discontinuance terms smooth into the maturity value.

Over the full term of the contract, there should be a smooth progression in discontinuance terms.

The insurer should honour any guaranteed discontinuance terms that are part of the contract terms and conditions.

The method used to calculate the discontinuance terms should be straightforward and well documented.

The basis should not be subject to frequent change under normal circumstances.

Consider what competitors are paying on discontinuance.

Consider regulation, *eg* the regulator may prescribe a basis for calculating discontinuance terms, or a minimum amount.

- 22.5 *Customer needs*

Consider whether the contract will meet the needs of the target market. [½]

Level and form of benefits

Linking the return to a well-known equity index is innovative and may improve marketability. [1]

Onerousness of guarantees

Need to assess the likely cost of the guarantee; a stochastic model is likely to be most suitable. [1]

Profitability

Annuity rates should be set so that the company meets its required profit criterion. [½]

Marketability

On the one hand, the guarantee makes the contract more marketable than an equivalent contract without a guarantee. [½]

However, the complexity of the guarantee may make the contract difficult to understand and hence less marketable. [½]

Consider whether expected sales volumes will be sufficient for the company to make an adequate contribution to fixed expenses and profits. [½]

Competition

The contract design and annuity rates should be compared with those offered by competitors. [½]

Regulatory requirements

Any regulatory requirements, eg solvency requirements, should be taken into account. [½]

Financing requirements

Additional capital will be required to cover the guarantee. [½]

The company may seek to minimise how onerous the guarantee is, particularly if capital resources are scarce, for example by: [½]

- giving a lower initial annuity [½]
- introducing a maximum percentage increase in income in any one year. [½]

Investment choices to back the contract

The company will need to consider whether to use derivatives or a replicating basket of equities to match the index. [½]

Risk characteristics

The key risks of the product must be identified and quantified. [½]

For example:

- increasing longevity
- lower than expected investment returns
- higher than expected expenses.

[½ each, max 1]

There is a risk of anti-selection, *ie* policyholders with better than average mortality may be more likely to take out this contract. [½]

The risks are exacerbated since the contract is new and the company will have no past data or experience relating to this contract. [½]

Cross-subsidies

Consider whether cross-subsidies will be allowed, and the additional risk this introduces if the business mix is different from expected. [½]

Consistency with other contracts

Consider the annuity products currently sold by the company. The new contract should be consistent, both in design and pricing in order to reduce administrative requirements. [½]

Administrative systems

The contract is potentially expensive to administer. Consider how to minimise costs and load appropriately in the premium. [1]
[Maximum 11]

22.6 *Customer needs*

Consider whether this contract will meet the needs of investors. [½]

It may be suitable for some investors, *eg* those who want a long-term investment to hedge against oil prices. [½]

Level and form of benefit

Need to clarify exactly which oil price to use and the date on which it will be taken for determining the coupons and redemption payment. [½]

Onerousness of the guarantee

The guarantee (of providing coupons and a redemption payment linked to oil prices) should not be too onerous for an *oil company* to meet as its earnings should also be linked to oil prices. [1]

Marketability

Linking the contract to oil prices is an innovative feature. [½]

Investors may be attracted to this bond as it is likely to provide diversification from other, more traditional bond investments. [½]

In addition, the long-term nature of the bond, 30 years, may be attractive to potential investors with long-term liabilities to match, in particular if there are not many other very long-term bonds available in the market. [1]

Competition

Consider how competitors are raising finance and the cost of their borrowing. Has this approach to raising finance been tried by other companies? [½]

Regulatory requirements

Consider any regulatory requirements or constraints. [½]

Financing requirements

Compare the cost of borrowing by this method with more conventional methods, to determine which is cheapest. [½]

Stochastic models of interest rates and oil prices may help with the comparison, but the price of oil is subject to great volatility. [½]

Risk characteristics

There is a risk that the oil price increases faster than expected or is very volatile. [½]

There may be a currency risk if oil is priced in a different currency to the provider's. [½]

Administration systems

The contract will not be simple to administer as the company will need to keep track of the oil prices in order to determine bond repayments. [½]
[Maximum 7]

22.7 Note you need to outline changes to reduce cost **and** volatility.

Level and form of benefits

- Switch from final salary to a defined contribution scheme or set up a hybrid of defined contribution and final salary (reduces volatility). [½]
- Reduce the pension accrual rate (reduces cost). [½]
- Increase the normal retirement age (reduces cost). [½]
- Change from using final salary to career average salary (reduces volatility and cost). [½]
- Integrate the scheme benefits with any State provision (reduces cost). [½]

Options and guarantees

- Limit the provision of any 'costly' options (reduces cost and volatility). [½]
- Make some benefits discretionary rather than guaranteed, *eg* pension increases (reduces cost if discretionary benefits are not always paid and volatility due to greater control). [½]

Benefits taken early

- Review the events on which a benefit is payable, *eg* on ill health, early retirement (reduces cost). [½]

Contract conditions

- Review eligibility requirement, *eg* introduce a minimum starting age and/or waiting period (reduces cost) [½]

Method of financing the benefits / risk characteristics

- Consider 'buying out' some of the existing liabilities with an insurance company, *eg* using deferred and immediate annuities. This will reduce risk but the cost of doing so may be unacceptable (reduces volatility). [1]
- Ensure any risk benefits are purchased from the cheapest insurer (reduces cost). [½]
- Review the funding method adopted (reduces volatility). [½]
- Consider using the existing surplus to reduce the employer's contributions (reduces short-term costs) [½]

Asset choice when the benefits are funded

- Review investment policy to maximise return subject to an acceptable degree of risk (reduces cost). [½]
- Review diversification of assets (reduces volatility). [½]
- Review asset types held (reduces cost and volatility). [½]
- Consider using an asset-liability model to look at any asset-liability mismatch (reduces volatility). [1]

Contribution pattern

- Increase the employees' contribution rate (reduces employer costs). [½]
- [Total 10]

22.8 (i) **Customer needs met**

The need met is accumulation for a known purpose. [½]

In particular, the savings could be used for:

- buying Christmas presents
- buying food for the Christmas period. [½ for any suitable example]

This would be particularly suitable for people who are poor at saving themselves or for people who like to plan ahead. [½]

It could be identified via a logical needs analysis if the customer has identified a need to save for Christmas, after careful analysis and prioritisation ... [½]

... or an emotional need if the customer has been made to feel guilty about saving for Christmas ... [½]

... or if the customer believes they need more money for Christmas than is actually necessary. [½]

The product is meeting a future need (since it is saving for a future event). [½]

The product is flexible in terms of:

- amount of monthly contributions – so the customer can choose how much to save, *ie* how much they want to spend on Christmas presents [½]
- when the savings can be taken – so the customer has the option of starting their Christmas shopping as early as October. [½]

[Maximum 4]

(ii) ***Contract design factors***

Interests and needs of customers

The product will need to meet the interests and needs of customers (as per part (i)). [1]

Profitability

The insurer will want to make profits from selling this contract. The source of profit will be from investment returns in excess of 2%, less expenses and initial development costs, and the cost of the Christmas hampers. [1]

It must therefore invest contributions in assets that are expected to provide an expected return of sufficiently greater than 2%, net of investment expenses and tax. [½]

The existence of a minimum level of contributions will ensure that policies will make a minimum contribution to fixed expenses. [½]

The insurer will also make profits from lapses and deaths, as no interest is paid on these policies. [½]

It is therefore important that the insurer does not overestimate the probability of death and/or lapse, otherwise profits will be lower than expected. [½]

Marketability

The product design needs to be sufficiently attractive to potential customers so that the insurer sells an adequate volume of business. [1]

It must be sufficiently flexible to meet customers' needs, and should also be easy to understand. [½]

However, there is a risk that the nature of the contract only appeals to individuals with high disposable income who have no need to save! [½]

Features that should improve marketability are:

- choice of the level of contributions [½]
- the option to withdraw cash early (in October / November) [½]
- the option to withdraw from the scheme (and receive a return of contributions) [½]
- the chance of winning a Christmas hamper! [½]

Features that reduce marketability are:

- the minimum and maximum level of contributions, which might make it restrictive for lower / higher earners [½]
- the fixed interest rate of 2%, which may be lower than interest rates that can be obtained elsewhere [½]
- the return of contributions on death or lapse, which does not include interest; however the impact of this may be small, as the contract is short-term. [½]

The chance of winning a Christmas hamper needs to be great enough to be attractive to potential customers. [½]

Competition

If there are similar products on the market, *eg* offered by supermarkets, then this product should be competitive in terms of interest rate, or additional features offered (such as the Christmas hamper). [1]

The insurer should also consider the likely response of competitors to the introduction of the product. [½]

There will be a conflict between being profitable and competitive. [½]

Financing requirements

The financing requirements for this contract shouldn't be too onerous, since the contract is short-term, so the funds that build up are likely to be small ... [½]

... and the payout will relate to the contributions made by the policyholder. [½]

However, there may be new business strain, as the contract is regular premium and the initial contribution may not cover the initial statutory reserves and initial solvency requirements in respect of each policy as well as the initial expenses (including any commission) of writing the contract. [½]

Risk characteristics

The insurer will need to consider the risk characteristics of the contract design. It is therefore important that the terms and conditions of the contract are specified with care in order to minimise risk. [½]

Risk characteristics will be worse for this contract since it is new, and hence there is much more uncertainty around setting assumptions (parameter error). [½]

The level of risk that will be acceptable to the insurer depends on the insurer's ability and/or willingness either to absorb it internally or to reinsure it. [½]

It should also consider how well the contract design fits the likely risk appetite of the intended customers. [½]

Extent of cross-subsidies

If there are any cross-subsidies between different types of policy, the mix of business is important. [½]

In particular, there may be cross-subsidies between:

- large and small policies [½]
- lapsing and remaining policies [½]
- new business and renewals. [½]

Practical considerations

It is important that the administration systems of the company can cope with the features of the product. [½]

This product could be complex to administer due to features such as monthly contributions, the option to withdraw and the 'prize'. [½]

There may also be accounting implications of offering this product. [½]

The contract should be consistent with any other similar savings schemes offered by the insurance company, in particular, the interest rate offered. [½]

The insurance company should also take into consideration any regulation for this type of product, eg on minimum / maximum contributions, solvency requirements and on offering a 'prize'. [½]

These contract design factors are not necessarily independent, in that meeting one may mean that another cannot be met. The insurer will seek the optimal solution. [½]

Onerousness of options and guarantees

The insurance company should consider the onerousness of the options and guarantees offered.
In particular:

- the 2% *guaranteed* interest rate [½]
- the *option* to withdraw from the contract. [½]

Timing of contributions

The insurance company will need to decide exactly when policyholders should make their contributions. The product will be more flexible if the policyholders can choose the date at which contributions are made. [½]

[Maximum 16]

23

Pricing and financing strategies

Syllabus objectives

- 11.5.1 Discuss how to determine the cost of providing benefits on contingent events.
- 11.5.2 Discuss the factors to take into account when determining the appropriate level and incidence of contributions to provide benefits on contingent events.
- 11.5.3 Discuss the factors to take into account when determining the price or the contributions to charge for benefits on contingent events.
- 11.5.4 Discuss the influence of provisioning or regulatory capital requirements on pricing or setting financing strategies.

0 Introduction

Section 1 of this chapter looks at how we would determine the *cost* of providing benefits on future contingent events. The *numerical* techniques for calculating the cost of providing benefits on future contingent events were discussed in the earlier subjects. In contrast, the focus in Subject CP1 is a consideration of the *factors* that need to be taken into account in determining the cost of benefits rather than the calculations themselves.

Section 2 explores why the *price* charged for benefits on future contingent events may differ from the *cost* of these benefits.

Sections 3 and 4 focus primarily on defined benefit schemes, looking at various options for the timing and level of contributions.

1 Determining the cost of benefits

The 'cost' of benefits can be described as the amount that should theoretically be charged for them.

The main factors affecting the cost of benefits will be the:

- frequency of occurrence (which will affect the timing of the benefits)
- severity (which will affect the amount of the benefits).

The theoretical value of the benefits alone (also known as the *risk premium*) may be determined using a formula or using a discounted cashflow model.



Question

Write down a formula, using an assurance function, for the expected present value of the benefits under a 20-year term assurance contract that pays out £100,000 on death, issued to a life aged 43 exactly.

Solution

The expected present value of the benefits is given by:

$$EPV = £100,000 \bar{A}_{43:20}^1$$

1.1 Calculating a premium

Once a model has been developed to determine the theoretical value of benefits to be provided on future financial events, further work needs to be undertaken to translate this value into a premium or cost to the customer.

This is sometimes known as the *office premium*.

The premium or contribution could be calculated such that:

value of premium(s) = value of benefits + value of expenses + contribution to profit

using a formula or using a discounted cashflow model.



Question

Using the term assurance example in the previous question:

- Write down a formula that equates the expected present value of premiums (denoted 'EPVP') to the expected present value of benefits, expenses and contribution to profit, defining all the symbols that you use.
- Show how this equation could be solved to find the actual amount of each premium, assuming that they are level and payable monthly in advance.

Solution

The equation of value is given by:

$$(1-\pi)EPVP = £100,000\bar{A}_{43:20}^1 + IE + REa_{43:20}$$

where: π = contribution to profit (% of expected present value of premiums)

$EPVP$ = expected present value of premiums

IE = initial expenses (fixed monetary amount)

RE = renewal expenses (level monetary amount, paid annually in arrears).

Alternative expressions are possible, according to how the expenses and the contribution to profit are defined.

To solve for a monthly premium, we would work out $EPVP$ from the above equation and then, in turn, equate this as follows:

$$EPVP = P\ddot{a}_{43:20}^{(12)}$$

The monthly premium would be given by $P/12$.

1.2 Other adjustments

As we have seen, premiums or contributions should allow for:

- the theoretical value of the benefits to be provided
- the value of the expenses that will be incurred
- a contribution to profit.

Other factors also need to be taken into account; for example:

- **taxation**
- **commission – although this might be included as an expense**
- **the cost of any capital supporting the product**
For example, the cost of needing to hold solvency capital. This relates to the return required by providers of finance, and is covered in more detail in the next section.
- **margins for contingencies**
- **the cost of any options and guarantees**
- **the basis that will be used to set future provisions for the liabilities – as this may be different from the basis used to determine the cost**

For example, it could be more prudent – although many countries have moved to a best estimate basis for both provisions and premium setting, as noted in the next section.

- **the use of experience rating to adjust future premiums**

- **investment income**

If a formula method is used, the investment income is allowed for implicitly within the discount rate used to obtain the present value of future premiums, benefits and expenses.

- **reinsurance costs.**

1.3 The influence of provisioning or reserving requirements

Traditionally, financial product providers calculated the cost of financial products using a formula similar to that in Section 1.1 above. Risk margins were included in the various assumptions. The resultant costs of the financial product made no allowance for the cost of establishing provisions on a prudent supervisory basis, or of any explicit solvency capital that needs to be held.

Valuation of provisions (or liabilities) and solvency capital requirements are covered further in later chapters.

With a regulatory move to risk-based capital requirements for financial product providers, both the basic product costing basis and the reserving basis will be on a best estimate basis. The solvency capital therefore becomes entirely explicit rather than being partially held as prudential margins in a valuation basis.

In the past, it was more common for provisions to be calculated on a prudent basis, *ie* more cautious than best estimate. Under such an approach, the solvency capital held is a combination of the prudential margins within the valuation basis and the additional capital requirements imposed by the regulator.

Many regulators have now moved to an approach which uses a best estimate basis to calculate the basic liabilities or provisions, with an additional risk-based regulatory capital requirement. In such cases, the solvency capital held comprises only the latter.

This solvency capital cannot be used by the product provider for any other purpose. Thus, it is important to allow for the opportunity cost of the capital not being available for use by the organisation on other ventures.

The cost of establishing provisions and solvency capital should be included as negative cashflow during the term of the contract, and any prudential margins in the provision and the explicit solvency capital should be released as a positive cashflow when the contract terminates.

1.4 Testing the premium for robustness

Once the premium or contribution has been determined, the provider will want to know whether the contract will be profitable if actual experience turns out to be different from that expected, *ie* from that assumed in the cost calculation.

Profit testing models can then be used to estimate the results of providing the product under different scenarios.



Question

Give examples of scenarios that the provider might want to test for a life insurance product.

Solution

Examples of scenarios to test include:

- economic scenarios, *eg* investment returns being higher or lower than expected
- demographic scenarios, *eg* mortality rates being higher or lower than expected
- business scenarios, *eg* expenses being higher than expected, discontinuance rates being higher than expected, new business volumes being higher / lower than expected.

Special attention should also be paid to any guarantees and options.

The profit testing may be done by considering individual model points or by looking at a group of model points designed to be representative of the profile of the expected business from the product. If looking at a group of model points, variations in the mix / profile of business could be scenario tested.

The basic principles of the models used are discussed in [Chapter 17](#) on Modelling. The scenarios can be tested using either stochastic simulation or a set of deterministic scenarios, depending on the relative risk exposure and the cost / benefit analysis of the proposed modelling approach.

It is unlikely that a product can be priced to be profitable in all possible scenarios. The provider will need to determine a minimum level of profit that is made in all but a predetermined tail – for example, that a profit of $x\%$ of premiums is exceeded in 95% of simulations.

Finally, there will need to be some market testing to assess that the product is actually one that customers want and can afford. There are normally two ways of viewing a product price:

- **Factor a profit criterion into the pricing process, and thus calculate the resultant premium. Test whether the premium is acceptable in the market.**
- **Input the desired premium into the pricing model and calculate the resultant profit. Test whether this is acceptable to the company.**

In the next section, we look at why the price that is actually charged for a financial contract may differ from the (theoretical) premium that we have determined thus far.

2 Determining the price of benefits

The 'price' of benefits can be described as the amount that can be charged under a particular set of market conditions and may be more or less than the 'cost'.

2.1 Why the price may differ from the cost

Providers selling financial products may charge premiums or require contributions that differ from the actual cost, for example:

- **The provider's distribution system for the product may enable it to sell above the market price or to take advantage of economies of scale and reduce the premiums charged.**

Examples of distribution systems in the UK include selling through:

- *independent intermediaries*, who select products for their clients from all or most of those available on the market
- *tied agents*, who offer the products of one provider or a small number of providers
- *own sales force*, usually employed by a particular provider to sell its products direct to the public
- *direct marketing*, via press advertising, over the telephone, internet or mailshots.

The extent to which the distribution system used will enable the provider to sell above the market price will depend on the level of competition within that distribution approach.

- **The provider may have a captive market such as an affinity group that is not price-sensitive.**

An affinity group is a group of people linked by a shared interest or objective, such as a hobby, professional status or political interest. A group insurance arrangement may be set up to cover all members of such a group or society.

- **The provider may choose to sell a product that covers its direct fixed and variable costs but does not cover its expense overheads and minimum profit requirement. The purpose of the strategy is to stimulate sales of the product or other more profitable products.**

This is known as loss-leading.

Taking an extreme approach, the company might allow for no contribution to *any* fixed costs, direct or indirect. This is known as marginal costing, and is considered further in the next section.

As another extreme, the contribution to profit might even be negative.

As an example, private motor insurance new business may be written assuming a loss. However, there may be an expectation that a significant proportion of this new business will renew the following year on more profitable renewal premium rates.

- **A cheap product may attract customers to other, more profitable products of the company. The company may expect greater profits across its whole product range.**

In other words, the company may choose not to make a profit (or even to make a loss) on one of its products in order to cross-sell other more profitable products to those same customers, thus making higher profits overall.

- **If there are only a limited number of providers in the market, demand may exceed supply and so higher premiums can be charged. If there are many providers in the market and customers can choose between them, premiums will fall.**

In general insurance, this represents the underwriting cycle, which was introduced in the earlier chapter on the External environment.

2.2 Marginal costing

As discussed in [Chapter 21](#) on Expenses, the expenses of setting up and maintaining a policy can be divided into fixed and variable costs. Variable costs arise directly from policy-related activities such as policy processing. Fixed costs relate to management and overheads.

As long as a company's fixed costs are covered by margins from business currently on the books, each new policy only needs to cover the variable costs attributable to it, and it will make a profit for the company.

This means that only the variable expense margins need to be included in the product pricing and lower prices will therefore result. These lower prices might enable much larger volumes of business to be written.

This approach only works as long as the expenses included at least cover the variable costs. This is called marginal costing. If variable costs are not covered, each policy makes a loss, and writing large numbers is a disaster for the company.

While marginal costing can work, it must be remembered that it cannot be done for all product lines.

The fixed costs have to be covered somehow; therefore there has to be a subset of products offered which bear these expenses.

As the existing business that is supporting the fixed costs goes off the books, new business that supports the fixed costs will be required.

3 Determining the incidence of monies paid in

For the remainder of this chapter we look at the issue of *financing*. Financing is a term used for putting a price on benefits payable on future contingent events, primarily in the context of benefit schemes. This section looks at the timing (or incidence) of monies paid in, *ie* contributions, and the subsequent section looks at the level of such contributions.

3.1 Introduction

There are two approaches to financing benefits: *unfunded* or *funded*.

By *unfunded* we mean finding the money to pay for the benefit as the benefit falls due. The unfunded approach is called *pay-as-you-go*.

By *funded* we mean that to some extent the monies needed to meet the benefit costs are set aside before the benefit falls due.

Where significant sums are involved for individuals and companies, it is usual for monies to be set aside before the full benefit becomes due. This mitigates the risks of the direct payment approaches, and there are several options that could be followed.

We will consider the following funding choices available to the provider:

- lump sum in advance
- terminal funding
- regular contributions
- just-in-time funding
- smoothed pay-as-you-go.

3.2 Unfunded approach – Pay-as-you-go

Pay-as-you-go (PAYG) was introduced in the earlier chapter on the External environment.

It is not always necessary for funds to be established to provide benefits on future contingent events.

For example:

- **A company may choose to self-insure its motor damage risks. It will just pay for repairs as they arise.**
- **A government may choose to pay State benefits to the retired out of current taxation revenue from working individuals and companies.**
- **Where risks are insured, the period of cover may be short, and each contribution might just purchase cover until the next contribution is due.**

3.3 Funded approaches

Lump sum in advance

Funds that are expected to be sufficient to meet the cost of the benefit can be set up as soon as the benefit promise is made, ie a lump sum in advance, or single premium.

The lump sum is designed to be sufficient to provide all future benefit outgo. The entire funding payment is made even though the first benefit payment may not be expected for some considerable time.

This is the method of funding in which payment is made as early as possible.

The fund is *expected* to cover the liabilities of the scheme. The payment made may turn out to be too high or too low if actual experience differs from that assumed.



Question

Explain why payment of a lump sum in advance is rarely used for financing a benefit scheme.

Solution

From the provider's perspective, payment of a lump sum in advance ties up excessive funds in the benefit scheme. The money might be put to better use elsewhere. The scheme funds are excessive because they cover benefits that have not yet been earned.

A State that grants financial incentives on the cost of benefit provision may not permit such a high level of funding in order to prevent tax avoidance.

Terminal funding

Funds that are expected to be sufficient to meet the cost of a series of benefit payments can be set up as soon the first payment becomes due.

Under this method, a payment is made whenever a benefit *starts* to be paid. The payment is a capital sum, designed to be sufficient to provide all the future payments of the benefit.

Under terminal funding, a fund exists from the point at which benefits start to be paid. Thus the contributions are paid earlier than would be the case with PAYG.

Even when a terminal contribution has been paid, a fund might never exist within the scheme. For example, there would be no fund if the benefit payable is:

- a single payment, eg a lump sum payable on retirement
- secured with a third party, eg an annuity purchased from an insurer.

Regular contributions

Funds are gradually built up to a level expected to be sufficient to meet the cost of the benefit, over the period between the promise being made and the benefit first becoming payable.

For example, pension contributions may be paid each month over the working lifetime of the member in order to provide a pension from retirement age.

The regular contributions may vary. For example, contributions may be equal to:

- a level percentage of some factor, *eg* salary
- a fixed amount per period of time in monetary terms (*eg* \$500 *pa*)
- a fixed amount per period of time in real terms (*eg* \$500 *pa* linked to inflation).

There is a wide range of possibilities under this method for the speed at which the funds are built up. This is often referred to as the *pace of funding*.

Just-in-time funding

Funds that are expected to be sufficient to meet the cost of the benefit can be set up as soon as a risk arises in relation to the future financing of the benefits (*eg* bankruptcy or change in control).

Under this method, payment is made (as the name suggests) at the last possible moment. What distinguishes this method from terminal funding is that payment is triggered by an *external* event (not a benefit event), which jeopardises the security of the fund. In the case of a pension scheme, examples include employer insolvency or the sale of an employer.

If the anticipated risk event does not happen then terminal funding or a pay-as-you-go approach could be used.

This form of funding must be used in conjunction with some other form of funding. Otherwise of course, if a risk event does not occur, no funds would ever be set up.

Smoothed PAYG

Funds that are set up to smooth the costs under a pay-as-you-go approach to allow for the effects of timing differences between contributions and benefits, short-term business cycles and long-term population change.

PAYG systems are often operated by States. The idea of the smoothed PAYG system is to smooth income and outgo over time by maintaining a fund as a working balance. A working balance is necessary because:

- in some years income (for example from taxes) will exceed benefit outgo and the working balance will increase
- in other years benefit outgo will exceed income and the working balance can be drawn on to make up the shortfall.

3.4 Factors influencing the choice of financing strategy

Tax treatment

In some situations, for example in order to encourage retirement saving, governments may use the tax system to make some of these approaches more advantageous than others.

Risk

Different approaches to the incidence of funding will also affect the allocation of risks between the individual or company exposed to the contingent event, and the provider of a financial product to mitigate those risks.

For example, for a defined benefit pension scheme, funding benefits in advance provides more security to the individual who is expecting to receive those benefits. However, the further in advance the funding takes place, the greater the risk that the amount put aside will prove to be insufficient to meet the benefits.

Funding pension scheme benefits a long way in advance can put undue financial pressure on the sponsor company and may increase its own risk of insolvency.

The implications of funding incidence for the overall cost are considered in the next section.

4 Determining the amount of contributions for defined benefit pension schemes

For a benefit scheme such as a final salary pension scheme, the calculated contribution rate based on the cost of the benefits accruing is often adjusted to determine the actual contribution rate in any year.

The actual contribution rate will be equal to the calculated contribution rate (calculated to meet the costs of future benefits accruing) plus variation arising from the value of the scheme's assets not being equal to the value of the benefits that have already accrued.

Where the value of the assets is greater than the value of the accrued benefits, the scheme will have a surplus.

Where the value of the assets is less than the value of the accrued benefits, the scheme will have a shortfall.



Question

Outline possible reasons for there being a surplus in such a benefit scheme.

Solution

A surplus may have arisen because:

- the assumptions about future experience were unduly pessimistic, *ie* the contributions were unrealistically high
- the assumptions were reasonable but the experience turned out to be favourable (we are dealing here with uncertain outcomes)
- the sponsor paid more than the recommended contributions.

The actual contribution rate may be different from the calculated contribution rate for the following reasons:

- **The assets held are higher or lower in value than the accrued liabilities and there is thus a surplus or shortfall. This will normally be used to adjust the calculated cost for a number of future years.**

There are various ways to make these adjustments, *eg* spread as a percentage of salary or as an equal monetary amount each year over the chosen period.

- **The sponsor may want to change the pace of funding of the scheme by paying a higher or lower contribution in any year. This might be due to the sponsor's financial circumstances and be unrelated to the scheme's financial position.**

Reasons for changes to the pace of funding include:

- changes in the fortunes of the sponsor, *eg* if the sponsoring company has performed particularly badly, it may have to cut contributions until it recovers
 - the opportunity cost of the contributions and alternative investment opportunities
 - changes in views over the degree of caution / optimism required.
- **The limits within which contributions can be paid may in some circumstances be restricted by legislation.**

Contributions to a pension scheme may be subject to an upper limit because they may be subject to advantageous tax treatment. In such cases, the State will aim to restrict the tax concessions granted by restricting the contributions permitted.

Contributions to a pension scheme may be subject to a lower limit to provide a minimum level of security to scheme members' benefits.

As noted in the previous section, different approaches to the incidence of funding will affect the way in which risk is allocated between the individual and company.

The incidence of funding will influence the level of contributions required.

For example, in a territory with a well-developed fixed-interest investment market, a single premium at inception can be invested at a known yield to provide appropriately timed cashflows. If a stream of regular premiums is paid, the provider will have to include a margin for the risk of changes in future investment rates. This will increase the overall cost.

The above applies to the incidence of insurance contract premiums as well as pension scheme contributions.

Chapter 23 Summary

Cost vs price

The *cost* of benefits is the amount that should theoretically be charged for them.

The premium(s) (or contribution(s)) should be calculated by equating the value of premiums with the value of benefits and expenses plus a contribution to profit. This should then be adjusted to take into account other factors such as:

- tax
- commission
- cost of capital
- contingency margins
- options and guarantees
- provisioning bases
- experience rating
- investment income
- reinsurance costs.

The *price* of benefits is the amount that can be charged under a particular set of market conditions and may be more or less than the cost. Factors influencing the price include:

- the distribution channel(s) used
- the level of competition in the market
- the approach taken to expense and profit loading (eg marginal costing, loss-leading)
- the provider may have a captive market that is not price sensitive.

Once a price has been determined, it should be profit tested and market tested.

Incidence of monies paid in

The main methods of financing benefits are:

- pay-as-you-go (unfunded)
- funded
 - lump sum in advance
 - terminal funding
 - regular contributions
 - just-in-time funding
 - smoothed pay-as-you-go.

The choice of financing strategy might depend on:

- whether the government has used the tax system to make some approaches to financing more advantageous than others
- the way in which the approach to the incidence of funding affects the allocations of risks between the individual and company.

Defined benefit pension schemes – amount of contributions

Under a defined benefit pension scheme, the calculated contribution rate is typically set to meet the value of future benefits and expenses.

However, the actual contribution rate may be different to the calculated rate:

- so as to rectify any shortfall or surplus in the pension scheme
- to reflect the sponsor's desire to pay less or more into the scheme
- due to legislative constraints.

The approach to the financing strategy and how it affects the balance of risk between the parties



Chapter 23 Practice Questions

- 23.1 A life insurance company is deciding whether to use a formula approach, rather than a discounted cashflow model approach, to calculate the premium to charge for benefits.
- (i) Describe the formula method.
 - (ii) Discuss its advantages and disadvantages.
- 23.2 Discuss the extent to which different distribution systems may enable an insurance company to sell above the market price.
- 23.3 A general insurance company writes private motor insurance.
- List the reasons why it might undertake an investigation of premium rates for this business.
- 23.4 Outline the factors that will affect the price charged for the transfer of liabilities on a merger or acquisition.
- 23.5 A life insurance company sells a significant volume of term assurance business. However, new business volumes have fallen by 25% over the past three months.
- Exam style**
- The company has therefore performed an analysis of the term assurance market. This analysis indicates that a 20% reduction in premium rates is required in order to regain the lost business and to achieve the company's original target of a 10% increase in the volume of new business.
- (i) Suggest possible reasons for the recent fall in new business. [4]
 - (ii) Describe how the company would determine the impact on overall profitability of this reduction in premium rates. [5]
 - (iii) Discuss the factors that would be considered before a premium rate reduction was implemented. [9]
- [Total 18]
- 23.6 Outline the advantages of a pay-as-you-go (PAYG) benefit scheme funding approach.
- 23.7 Outline the advantages and disadvantages of funding a pension scheme in advance, from the viewpoint of the sponsoring employer.
- 23.8 Explain how the funding method chosen affects the actual cost of providing scheme benefits.
- 23.9 Explain why a sponsoring company might not necessarily make a single contribution to correct a benefit scheme shortfall.
- 23.10 (i) List six methods of financing the benefits of a defined benefit pension scheme. [3]
- Exam style**
- (ii) Discuss the factors to take into account when determining how to finance the benefits of a defined benefit pension scheme. [8]
- [Total 11]

- 23.11 For many years, Company XYZ's defined benefit pension scheme has been funded through regular payments building up a fund in advance.

Exam style

The incoming finance director has noticed that the company also has a significant amount of non-pension-related debt to service. The interest rate payable on the debt is higher than the future investment return assumed on the pension scheme's assets in the latest valuation report.

The director suggests that it makes financial sense to adopt an unfunded approach to financing the pension scheme and instead focus on repaying the company's debt.

Discuss the director's suggestion.

[7]



Chapter 23 Solutions

- 23.1 (i) The formula method determines the premium using:
- Value of premiums = value of benefits + value of expenses + contribution to profit.
- (ii) **Advantages and disadvantages**
- + The formula method is simple to apply and interpret.
 - However, it is only really suitable for modelling fairly simple contracts and for fairly simple situations.
- For example, it does not allow for:
- setting up any prudent supervisory provisions
 - the cost of capital supporting the product
 - the time value of any options and guarantees
 - experience rating.
- It would also only be able to cope with very simple taxation and expenses.
- The formula method is less well-suited to sensitivity testing and to the use of an explicit profit criterion.

- 23.2 Independent intermediaries can select products available from the whole market and so they are likely to recommend those products that offer best value for money, subject to the needs of the customer. Therefore, it is unlikely that the insurer will be able to take advantage of selling at above the market price.

A tied agent such as a bank will want the products sold by its employees to be reasonably competitive or they could damage its good name. However, as the tied agent will only be selling products relating to one or to a small number of insurers, there is not the same level of *direct* price comparison as described above for the independent intermediaries.

Members of an own sales force will not usually be in a competitive situation. It is likely that most or all of the customers who approach or who are approached by a member of an own sales force will, if they choose to take out a contract, decide to take out that contract without looking round the market for a better deal. Therefore, the insurer may be able to take advantage of selling at above the market price.

It is not clear where direct marketing should fit into this picture of competitiveness. It really depends on the target market. For example, press advertising in a financial magazine or heavyweight newspaper may reach financially sophisticated customers who are keen to compare rates. However, advertising in a more downmarket newspaper and to the financially unsophisticated may involve much less competitive pressure. Online sales may be very competitive.

23.3 An investigation of premium rates for this business may be undertaken in order to:

Profitability

- assess the profitability of the current premium rates, either overall or for particular subsets of the business written
- as above, but for the proposed new premium rates
- assess the extent of any cross-subsidies between rating factors or other policy groups
- examine why actual loss ratios differ from expected for certain segments

Internal factors

- assess the impact on premium rates if they were updated to reflect recent experience, *eg* claims amounts, claims frequency, expenses, renewal rates
- assess the impact of potential cover changes, *eg* new perils included, changes in excess
- assess the impact of an updated cost of capital
- assess the possibility of writing business as a loss leader
- assess the possibility of using marginal costing

External environment

- compare with premium rates offered by competitors
- consider the current position of the underwriting cycle
- assess the impact of changes in legislation, regulation or taxation
- assess the potential impact of new technology
- assess possible changes in distribution approach
- assess the impact of reinsurance changes or opportunities.

23.4 The price will be affected by factors such as the:

- *theoretical* value of the liabilities
- costs incurred in performing the transaction (*eg* legal expenses)
- size of the transaction relative to the overall deal
- relative bargaining power of the parties involved
- competitive position of the transaction, *ie* the supply of parties seeking a merger or takeover by a larger organisation and the number of acquirers with adequate finance in the market.

23.5 (i) ***Reasons for fall in new business***

The fall in new business may be due to:

Competitors' actions

- the introduction of new product features by competitors
- reduction in competitor premium rates
- commission rises by competitors

Other external factors

- downturn in the economic situation, making premiums less affordable
- changes to the tax environment
- changes to the regulatory environment
- introduction of or improvement in State-provided death benefits

Internal issues

- the company may have suffered reputational issues
- it may have poor service standards
- there may have been adverse press comment.

[½ each, maximum 4]

(ii) ***Determining the impact on profitability***

This relates to the earlier chapter on Modelling.

In order to calculate the impact of the change in rates a series of profit tests would be performed, using the revised premium rates. [1]

It is important that up-to-date assumptions are used for all elements of the basis. [½]

Experience investigations are needed for mortality, expenses and persistency. [1]

In particular it is possible that mortality rates may have improved since the rates were set. [½]

Future mortality improvements may also be taken into account. [½]

Per policy expense assumptions may need to be revised, if expected volumes result in a different allocation of fixed costs. [1]

A model of the expected new business would need to be constructed to assess overall profitability, including assumptions on volume and mix. [1]

Sensitivity tests should be performed. It will be particularly important to assess the effects of the expected growth in business not materialising. [1]

Profitability may be determined on various measures: net present value, internal rate of return and discounted payback period. [1]

[Maximum 5]

(iii) ***Factors to consider relating to the premium rate reduction***

The company needs to consider whether the premium rates are still profitable. [½]

If not, it may decide to reduce the premium rates by less than 20%. [½]

Alternatively, the product could be sold as a loss leader, ... [½]

... in order to aim to sell a higher volume of other products in order to increase overall profit. [1]

The company needs to consider profit per policy (which will have reduced) as well as overall profit (taking into account the higher expected volumes). [1]

It may only be possible to cut premium rates and remain profitable for particular rating factors, *eg* ages and terms. [1]

However, the company may wish to avoid changes that would introduce discontinuities into rates, with corresponding marketing difficulties. [1]

If certain rates are unprofitable and others profitable, there is the possibility of changes in business mix. [½]

This could lead to anti-selection or policyholders discontinuing their policies and taking out new ones. [1]

The insurer may consequently end up with a higher weighting of unprofitable rather than profitable business. [½]

The reactions of competitors need to be considered. [1]

The company has to consider the capital requirements of writing increased volumes, as this will increase new business strain. [1]

Reinsurance can reduce the impact of this, but will probably reduce profitability further as the reinsurer will wish to make a profit too. [1]

If the company already has reinsurance in place, the reinsurer may need to be involved in decisions involving premium rate changes. [½]

Alternatives to cutting rates to restore volumes should be considered. [½]

For example, the company could consider adding other features like conversion or extension options or additional benefits such as critical illness cover. [1]

The company may decide to offer additional sales support to insurance intermediaries or increase the amount of marketing and advertising that it is doing. [1]

The company may need to take actions that directly address the reason for the fall in new business, *eg* improving customer service, improving its reputation. [1]

It will be necessary to implement control processes to monitor new business volumes quickly, and ensure that action is taken if they do not increase. [1]

[Maximum 9]

23.6 The advantages of PAYG are that it:

- allows benefits to be introduced at a worthwhile level in the early years as there is no need to wait for a fund to accumulate
- involves lower transaction costs (as there is no funding)
- prevents funds from being tied up in the scheme (and so not being available for other uses)
- can increase solidarity within the community, if a State-operated scheme (the *contract between generations* whereby the working generations finance the pensions of the retired)
- makes it easier to organise payment according to need, with contributions according to ability to pay.

23.7 *Advantages of funding in advance*

- provides security for members and hence meets paternalistic aims of employer
- may be required by regulation
- tax incentives may be given on contributions and/or investment returns, making funding in advance attractive
- competitor schemes may be funded in advance and therefore this scheme may need to follow suit to make it attractive to new and existing staff
- if an appropriate funding method is chosen, *eg* regular contributions, then liquidity concerns can be eased ...
- ... and the employer will have some degree of flexibility in relation to the timing of contributions
- a single premium at inception might be able to be invested at a known yield to provide appropriately timed cashflows, thereby avoiding reinvestment risk and reducing costs.

Disadvantages of funding in advance

- opportunity cost of investing money in the pension scheme rather than in the business
- method must be chosen carefully, as some methods may require significant funds to be found at certain points in time (*eg* lump sum in advance)
- not all methods give a realistic assessment of cost.

23.8 The actual cost of benefit provision does not depend *directly* on the financing method chosen.

The actual cost instead depends upon the actual experience of the scheme. In other words the actual investment returns achieved, benefits paid *etc.*

The actual cost of benefit provision is, however, affected *indirectly* by the financing method since it:

- affects the timing of investment and the investments chosen
- may lead to the scheme being in surplus or deficit on regulatory tests, and the actions taken (*eg* to enhance or reduce benefits) will affect actual cost
- may affect the allocation of risks between the sponsor and members and thus the costs.

23.9 The sponsor may not want to make good the shortfall with a lump sum because this may:

- not be affordable
- result in excessive capital suddenly being tied up in the benefit scheme, that could be used elsewhere
- turn out to be unnecessary if actual experience improves.

23.10 (i) ***Methods of financing benefits***

The six methods are:

- pay-as-you-go
- lump sum in advance funding
- terminal funding
- regular contributions
- just-in-time-funding
- smoothed pay-as-you-go. [½ each, total 3]

(ii) ***Factors to assess in choosing a method***

The factors influencing the method chosen will include:

- the needs of the various parties [½]
- external factors. [½]

Needs of the various parties

Security of the benefits (members / trustees) – the further in advance the benefits are funded for, the more secure they will be. [1]

Flexibility of contributions (sponsor) – regular funding is more flexible than say lump sum funding. [1]

Stability of contributions (sponsor) – advance funding can allow a sponsor to pay for pension benefits gradually, and in a more stable manner than pay-as-you-go. [1]

However, even advance funding can be unstable, *eg* the stability of terminal funding will depend on the timing of the retirements under the scheme. [1]

Opportunity cost (sponsor) – there is an opportunity cost associated with any method of funding (which doesn't occur with pay-as-you-go), as the monies could be used by the sponsor on other projects. [1]

Liquidity / cashflow (sponsor) – advance funding provides good protection against cashflow problems provided that the assets held are marketable and produce cashflows when required, or if there is an adequate contribution flow. [1]

There may be liquidity problems with pay-as-you-go if the sources of income are not particularly liquid or if there is an unexpectedly high level of benefits to pay relative to the cash available. [1]

Realism – a funding plan with low contributions now and high contributions later may give the sponsor an unrealistic view of the cost of the benefits in the short term. [1]

Risk allocation – different approaches to the incidence of funding will affect the allocation of risks between the members and the sponsor. [1]

Expenses – funded vs unfunded and regular vs lump sum payments will incur different levels of administration and transaction cost. [1]

External factors

Legislation may restrict the method that can be used for the financing of benefits. [½]

There may be tax incentives / disincentives of, for example, funding over pay-as-you-go. [½]

Approaches used by competitor schemes may be taken into account. [½]

[Maximum 8]

23.11 The assumptions in the funding valuation may include margins, so as to err on the prudent side. Therefore the actual return on the scheme's investments would be higher than that suggested in the valuation report. [1]

However, the return is still likely to be less than the rates paid on the loan debt. [½]

This is because the borrowing rate must compensate the lender for risk and the loss of the immediate use of the money. [1]

This means there is an opportunity cost associated with funding the pension scheme in advance. [1]

However, there are still good reasons for continuing to fund the pension scheme in advance. In particular, funding in advance helps gives security to members' benefits, so as to ensure the company's benefit promises are met. [1]

A worst case scenario under an unfunded approach would be if Company XYZ ceased to exist and members' benefits were therefore not provided. [½]

Funding allows the cost to be recognised in a stable and predictable way over the members' working lifetime. [½]

This means that the company avoids sudden and unexpected cash calls that would cause liquidity problems, for example if a member left the scheme and requested a transfer value. [1]

Funding in advance helps to smooth the costs, in particular if the scheme is maturing, *ie* the average age of scheme members is increasing. [1]

Funding in advance is a standard approach to financing a scheme and is likely to be expected by the members. [½]

It may provide the employer with more flexibility in relation to the timing of contributions. [½]

Funding in advance may be required under the country's legislation. [½]

There may be tax advantages in funding the scheme ... [½]

... for example, if tax breaks are provided on contributions and investment returns for pension schemes. [½]

Competitor schemes may fund in advance, so Company XYZ may need to do so also in order to retain and attract good staff. [1]

[Maximum 7]

End of Part 6

What next?

1. Briefly **review** the key areas of Part 6 and/or re-read the **summaries** at the end of Chapters 20 to 23.
2. Ensure you have attempted some of the **Practice Questions** at the end of each chapter in Part 6. If you don't have time to do them all, you could save the remainder for use as part of your revision.
3. Attempt **Assignment X3**.

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Risk governance

Syllabus objectives

- 4.1 Describe the risk management process for a business that can aid in the design of products to provide benefits on contingent events.
- 4.2 Discuss the differences between risk and uncertainty and between systematic and diversifiable risk.
- 4.3 Describe how enterprise risk management can add value to the management of a business.
- 4.4 Discuss the roles and responsibilities of various stakeholders in the management of risk.

0 Introduction

Financial services providers have, for many years, used insurance and reinsurance to reduce their exposure to risk. However, the wider process of *risk management* has only really taken off as a discipline since the late 1990s. As a result, many providers now actively manage risk, and employ designated senior risk professionals who report to the board of directors.

Risk management can be described as the process of ensuring that the risks to which an organisation is exposed are the risks to which it thinks it is exposed and to which it is prepared to be exposed. The key aim of risk management is to protect an organisation against adverse experience that could result in it being unable to meet its liabilities.

This chapter introduces the over-arching risk management process and considers some of the key elements of risk governance, *ie* how this process is managed and controlled within an organisation.

The chapter also covers:

- the benefits of having an efficient risk management process
- the difference between risk and uncertainty
- the difference between systematic and diversifiable risk
- enterprise risk management: what it is and the value that it can add
- the relevance of risk governance to various key stakeholders.

The components of the risk management process are then covered in more detail in the subsequent chapters.

1 The risk management process

1.1 Introduction

The management of risk by any organisation, but particularly by a provider of financial products that provide benefits on contingent events, involves several steps.

These are outlined below and will be discussed in more detail in later chapters of this course.

It will be seen that these steps follow the approach of the actuarial control cycle.

The key steps are as follows:

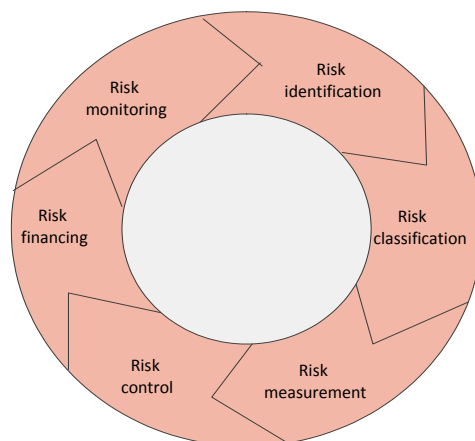
- risk identification
- risk classification
- risk measurement
- risk control
- risk financing
- risk monitoring.

As indicated in the Core Reading, these risk management process steps are consistent with the components of the actuarial control cycle:

- specifying the problem – identifying and analysing the risks
- developing the solution – selecting the most appropriate response to each risk and, where relevant, implementing the chosen mitigation action
- monitoring and feeding back into the process.

As for the actuarial control cycle, professionalism and a need to consider the external environment are also, of course, key elements of risk management.

The risk management process steps can be illustrated diagrammatically as the 'risk management control cycle' (the diagram does not form part of the Core Reading):



1.2 Risk identification

Risk identification is the recognition of the risks that can threaten the income and assets of an organisation. This is the hardest aspect of risk management.



Question

Explain why risk identification is the hardest part of risk management.

Solution

Risk identification is the hardest aspect of risk management because the risks to which an organisation is exposed are numerous and because risk identification needs to be *comprehensive*.

It is not surprising that the biggest risks to an organisation are those that are not identified, particularly when they relate to events that have not occurred before.

Having identified each risk, it is necessary to determine whether it is systematic or diversifiable.

This distinction is described later in this chapter.

For each risk it is necessary to have a preliminary identification of possible risk control processes that could be put in place which will reduce either the likelihood of the risk event occurring or the impact of the risk event should it occur.

It is also important to identify opportunities to exploit risks and gain a competitive advantage over other providers. Taking on risk is a potential source of profit and is the *raison d'être* for insurance and reinsurance companies.

In other words, taking on risk in order to make profit is the main objective of insurance (and reinsurance) companies. Accepting risk, including proactively seeking to take on risk, is covered in more detail in a later chapter.

Another part of the risk identification process is to determine to what extent the organisation is prepared to be exposed to each risk. This is called the *risk appetite* or *risk tolerance level*. Setting the organisation's risk appetite is a key part of risk governance, and is also considered further in a later chapter.

1.3 Risk classification

Having identified the risks, the company would then classify them – *ie* group them into categories.

Classifying risks into groups aids the calculation of the cost of risk and the value of diversification.

It also enables a risk 'owner' to be allocated from the management team. The risk owner would normally be responsible for the control processes for the risk.

1.4 Risk measurement

Risk measurement is the estimation of the probability of a risk event occurring and its likely severity.

This would normally be carried out before and after application of any risk controls, and the cost of the risk controls would be included in the assessment.

Risk measurement gives the basis for evaluating and selecting methods of risk control and whether the risk should be:

- **declined**
- **transferred**
- **mitigated**
- **retained with or without controls.**

For example, a company has performed a risk measurement exercise and finds that:

- the risk of computer failure has a high probability and low severity
- the risk of an explosion has a low probability and high severity.

In selecting methods of risk control, the company may decide that it is more cost effective to employ computer experts and retain the risk of computer failure rather than to transfer the risk to a third party. However, the financial consequences of an explosion are so high that the company may find that it has little option but to control it by transferring the risk to a third party, *ie* insuring it.

1.5 Risk control

Risk control is about determining and implementing methods of risk mitigation.

Risk control involves deciding whether to reject, fully accept or partially accept each identified risk. This stage also involves identifying different possible mitigation options for each risk that requires mitigation.

Risk control measures are systems that aim to mitigate the risks or the consequences of risk events by:

- **Reducing the probability of a risk occurring.**
An example would be control and checking procedures to prevent payments being made by a company on fraudulent claims.

Another example would be introducing good safety procedures within a company to reduce the risk of a fire starting.

- **Limiting the financial consequences of a risk.**
The financial consequences comprise the losses if the risk event occurs, together with the costs of mitigation techniques used, such as insurance premiums.

For example, a company could ensure that it has adequate insurance in place to meet the costs of a fire that does occur.

- **Limiting the severity of the effects of a risk that does occur.**

In particular, reducing significantly the probability of catastrophic loss. Insurance would be a common way of achieving this.

Another example would be having sprinkler systems and adequate fire extinguishers, so that a fire that does occur can quickly be put out, thus avoiding full loss.

- **Reducing the consequences of a risk that does occur.**

For example, by ensuring the survival of the organisation and its continued ability to trade. This might be by having a business continuity plan that can speedily be put into place.

This point relates to consequences of a risk event that do not have a direct financial cost, but that do lead to adverse implications for the company, often operational – for example, the loss of trading premises following a fire. The company could, for example, ensure that it has in place a plan for relocating to alternative premises that could be occupied swiftly following such an event.

A risk that gives rise to serious exposures to the organisation must be a priority candidate for the application of control techniques.

Not all risks occur at a single point event. For example, in a stock market ‘crash’, prices do not normally fall in a single day, but the full effect of the crash is observed over a number of weeks or months.

Frequently risk mitigation techniques involve management actions to be taken when certain trigger points are reached (for example to protect a portfolio value, or to reduce the amount of risk being accepted). It is vital that the actions really are taken when the trigger is reached and not delayed ‘because it might get better tomorrow’, however unpalatable the actions might be.

This reinforces the importance of senior management *buy-in* to the risk management process. The models and assumptions used in the process are only valid to the extent that the actions would actually be taken in practice. Discussion and modelling of possible courses of action and their consequences, including modelling the effects of no action or delayed action, is a useful tool in increasing management understanding of the business.

Where more than one option exists for mitigating a particular risk, it will be necessary to compare each option, identify which option is optimal and then implement the appropriate options.

Determination of risk appetite

The organisation’s risk appetite is another key feature in the decision on the approach to take to control individual risks. Risk appetite is likely to have both quantitative and qualitative components. The qualitative aspect of risk appetite includes risk preferences of the organisation. Risk appetite is discussed further in [Chapter 27](#).

It is important that risk appetite is set by the board and senior management, and then communicated clearly through the risk of the organisation.

The risk appetite will influence the extent to which the company will choose to reject (or avoid), accept fully or accept partially each risk to which it is exposed, and thus the extent to which risk controls are required.

1.6 Risk financing

Risk financing involves:

- **determining the likely cost of each risk (including the cost of any mitigations and the expected losses and cost of capital arising from retained risk)**
- **ensuring the organisation has sufficient financial resources available to continue its objectives after a loss event occurs.**

Ensuring that adequate financial resources are available in relation to retained risks is covered in more detail in a later chapter.

1.7 Risk monitoring

Having decided that all or part of a risk should be retained, with or without controls, the risks should be monitored.

Risk monitoring is the regular review and re-assessment of all the risks previously identified, coupled with an overall business review to identify new or previously omitted risks. It is important to establish a clear management responsibility for each risk in order that monitoring and control procedures can be effective.

Risk monitoring is the process of ensuring that risks *continue* to be managed. The objectives of risk monitoring might be to:

- determine if the exposure to risk and/or the risk appetite of the organisation has changed over time
- identify new risks or changes in the nature of existing risks
- report on risks that have actually occurred and how they were managed
- assess whether the existing risk management process is effective.

Carrying out risk monitoring does not *complete* the risk management process. The risk management process, like the actuarial control cycle, is iterative. From the objectives of risk monitoring listed above, we can see that the risk monitoring stage leads logically back into the risk management process through the re-identification of risks.

2 Benefits of a risk management process

Through an effective risk management process a provider of financial benefits will be able to:

- avoid surprises
- improve the stability and quality of their business
- improve their growth and returns by exploiting risk opportunities
- improve their growth and returns through better management and allocation of capital
- identify opportunities arising from natural synergies
- identify opportunities arising from risk arbitrage
- give stakeholders in their business confidence that the business is well managed.

'Risk arbitrage' in the above context relates to situations where the provider may have a different view on the 'price' of the risk relative to another party. The provider may therefore be to accept a risk for a higher premium than its own view of the cost of the risk, or conversely transfer a risk to another party for a lower premium than its own view of the cost. This idea of there being a 'market' in risk is explored further in a later chapter.



Question

Explain with the use of examples how natural synergies may arise in:

- (i) life insurance
- (ii) general insurance.

Solution

An insurer's portfolio may contain various risks that naturally offset (or *hedge*) each other, at least to some extent.

For example:

- (i) A life insurance company may sell some products (*eg* term assurance) that expose it to mortality risk and others (*eg* annuities) that expose it to longevity risk.
 - (ii) A general insurer may find that good weather increases claims on its domestic property policies as there are more subsidence claims, but reduces claims on its motor policies as there are fewer accidents.
-

Ideally, in the management of risk, providers need to look to find the optimal set of strategies that balance the needs for return, growth and consistency. The risk management process should:

- **incorporate all risks, both financial and non-financial**
- **evaluate all relevant strategies for managing risk, both financial and non-financial**
- **consider all relevant constraints, including political, social, regulatory and competitive**
- **exploit the hedges and portfolio effects among the risks**
- **exploit the financial and operational efficiencies within the strategies.**

3 Risk vs uncertainty

3.1 Introduction

‘Uncertainty’ means that an outcome is unpredictable.

‘Risk’ is a consequence of an action that is taken which involves some element of uncertainty. However, there may be certainty about some of the components of the risk.



Question

Give examples of components of risks relating to financial product benefit (or claim) payments that are certain rather than uncertain.

Solution

Possible examples are:

- that a claim will happen, although the timing of it is uncertain – *eg* whole life assurance
- the amount of benefit payable, although the timing is uncertain – *eg* without-profit term assurance
- the timing of a benefit payment, although the amount is uncertain – *eg* maturity benefit on a with-profit endowment assurance
- the range of possible outcomes – *eg* claim payments on a general insurance product if limited to a maximum amount.

This indicates that the concepts of risk and uncertainty are very closely related, but do not have precisely the same definition.

3.2 Certain and uncertain events

A risk can be associated with an event that is certain in time – will it rain on my wedding day?

Alternatively, the event can be certain and the issue is when it will occur – how long will I live to draw my pension?

Thirdly, both the occurrence and the timing can be uncertain – will my house suffer from storm damage?

A risk event having occurred, there can then be uncertainty about the consequences of the event – is the loss amount fixed or variable, and what is the shape of the loss distribution?

Finally, even certain strategies to avoid loss may not be risk-free on detailed investigation.

For example, purchasing insurance avoids loss in respect of the covered event, but still involves risks relating to counterparty default, liquidity (payment of the insurance premium) and whether there is sufficient market capacity when needed.

4 Systematic and diversifiable risk

4.1 Systematic risk

Systematic risk is risk that affects an entire financial market or system, and not just specific participants. It is not possible to avoid systematic risk through diversification.

In the context of investment markets, the risk of a decline in the market as a whole, with all stocks being affected, is a systematic risk. Assuming that the investor is required to participate in the market, the risk cannot be avoided.

Conversely, the risk of a decline in the value of a single security can be mitigated by an investor spreading the risk and investing in a large number of small holdings.

A portfolio of 30 to 40 securities in developed markets such as the UK or US (more in case of developing markets because of higher asset volatilities) will render the portfolio sufficiently diversified to limit exposure to that of systematic risk only.

So risks relating to individual securities, as opposed to risks relating to the whole market, can be diversified away.

The term **systematic risk** is sometimes used interchangeably with systemic risk. Systemic risk is a specific technical term used in finance. Systematic risk has an additional more general meaning that is 'of or pertaining to a system'.

4.2 Diversifiable risk

Diversifiable risk arises from an individual component of a financial market or system.

In the context of investment markets, diversifiable risk occurs when the value of an individual security falls. A rational investor should not take on any diversifiable risk, as only non-diversifiable risks are rewarded within the scope of most financial systems.

In other words each security is *individually* priced by the market given the market's perception of risk and reward. The market makes no allowance in the pricing for the investor choosing a concentrated portfolio. As a result, investors should diversify across asset classes and within asset classes.

The use of diversification as a risk control technique is covered in more detail in a later chapter.

Therefore, the required return on an asset, that is, the return that compensates for risk taken, must be linked to its riskiness in a portfolio context – *ie* its contribution to overall portfolio riskiness – as opposed to its 'stand-alone riskiness'.

According to the above theory, all rational investors would hold a portfolio of assets that was as well diversified as possible. If all investors had the same estimates of the relative risks and returns then they would all hold the same market portfolio. It would be impossible to outperform the market except by chance, so only index-tracking funds would exist.

However, in practice different investors have different estimates of the risks and returns. As a result, they will hold a less well-diversified portfolio if they believe that it offers a sufficiently higher expected return than the market to compensate them for the diversifiable risks they take. The risk appetite of the investor will affect the extent that they are prepared to move away from the market portfolio in search of higher returns.

4.3 Risks that are both systematic and diversifiable

Whether a risk is systematic or diversifiable depends on the context.

For example, an investment fund that is constrained to invest in domestic equities, because of the prospectus and other information issued to clients, will see the domestic equity market as a systematic risk.

A worldwide equity fund that can invest in domestic and overseas equities will see exposure to the domestic equity market as a diversifiable risk. Such a fund can hold investments from a wide range of international markets and thus limit the exposure to any particular national market.

5 Enterprise risk management

5.1 Business units

All but the simplest businesses comprise a number of business units. These units might:

- carry out the same activity but in different locations
- carry out different activities at the same location
- carry out different activities at different locations
- operate in different countries
- operate in different markets
- be separate companies in a group, which each have their own business units.

The largest multinational companies may comprise business units that carry out completely unrelated activities.

5.2 Managing risk at the business unit level

A decision must be made as to whether risk should be managed at:

- the business unit level
- the group (or enterprise) level.

The latter approach is called *enterprise risk management*.

One approach to risk management would be for the parent company to determine its overall risk appetite and to divide this up among the business units. Just as each business unit has its own management team to run its business, the business unit management team manages the risks of the business within the risk appetite they have been allocated.

As risk analysis involves allocation of capital to support the risks retained by each business unit, this approach is likely to mean that the group is not making best use of its available capital.

It is clear that this approach makes no allowance for the benefits of diversification or pooling of risks. A crude approach to allow for diversification would be simply to allow the risk appetites allocated to the business units to add up to perhaps 130% or 150% of the group's overall risk appetite.



Question

Explain why the total risk appetites of the business units should add up to more than 100% of the group's overall risk appetite.

Solution

Risk appetite refers to the amount of risk that the business can tolerate, *ie* the maximum exposure. The maximum exposure to risk for a particular business unit can be higher than its proportionate share of the maximum exposure to risk for the total group, due to diversification.

When the risks of the business units are aggregated together, diversification means that the overall group risk exposure will be lower than the sum of the risk exposures across each business unit.

This is because it is very unlikely that the risks will be perfectly correlated with each other. There is likely to be some independence of risks (imperfect correlation), meaning that it is extremely unlikely that the risk events across all business units will happen at the same time.

5.3 Managing risk at the enterprise level

A preferable approach is to establish the group risk management function as a major activity at the enterprise level. The group can then impose similar risk assessment procedures on the various business units, which will enable the results from the various models to be combined into a risk assessment model at the entity level.

By examining risk at group level allowance can be made for pooling of risk, diversification achievable and economies of scale. This should prove to be the most capital efficient way of managing risk.

Enterprise risk management involves considering the risks of the enterprise as a whole, rather than considering individual risks in isolation. This allows the concentration of risk arising from a variety of sources within an enterprise to be appreciated, and for the diversifying effects of risks to be allowed for.

This will also give the group management insight into the areas with resulting undiversified risk exposures where the risks need to be transferred or capital set against them. This will be an important feed into the business planning and capital allocation cycles.

Such an approach to risk management will enable the company to take advantage of opportunities to enhance value, *ie* if they understand their risks better, they can use them to their advantage by taking greater (educated) risks in order to increase returns. Enterprise risk management is not just about reducing risk – it is also about a company putting itself into a better position to be able to take advantage of strategic risk-based opportunities.

So the key features of enterprise risk management are:

- consistency across business units
- holistic – considers the risks of an enterprise as a whole, rather than in isolation, thus allowing appropriately for diversification *etc*
- seeking opportunities to enhance value.

Risk reporting at enterprise level is considered in a later chapter.

6 Stakeholders in risk governance



Question

List the stakeholders who should be involved in the risk governance of a company.

Solution

Stakeholders in risk governance include:

- directors / senior management
- risk managers and any Chief Risk Officer
- all other employees
- customers
- shareholders
- credit rating agencies
- regulators.

6.1 Internal stakeholders

Whilst the board and senior management will drive governance aspects such as setting the risk appetite, *all* employees have a responsibility in relation to risk.

In an efficiently run organisation, all members of staff are stakeholders in risk governance.

In a company with a well-embedded risk culture, all employees should be looking out for risks to which the business is exposed and should be suggesting ways in which risks can be mitigated or controlled. Reports from staff on risk should be noted and rewarded through the normal appraisal system.

All large companies and all providers of financial products should have a designated Chief Risk Officer. This role will normally be at the enterprise level. It will be responsible for allocating the risk budget to business units after allowing for diversification, and for monitoring the group exposure to risks and documenting the risks that have materialised and affected the group.

Business units will often have a risk manager, although this function may be combined with another role, depending on size. At business unit level the responsibility is to make full use of the allocated risk budget, as well as data collection, monitoring and reporting.

6.2 External stakeholders

Organisations can also encourage their customers to note and report risks that they come across in using the company's products or visiting the company's premises.

Other stakeholders may have a strong interest in risk governance within an organisation. This could include any shareholders of the organisation, any regulators of the organisation and credit rating agencies.

Shareholders can drive risk governance, *eg* by influencing the development of the risk appetite statement.

Credit rating agencies and regulators will be interested in the quality of risk governance, and may impose minimum standards.

Chapter 24 Summary

The risk management process

Risk management can be described as the process of ensuring that the risks to which an organisation is exposed are the risks to which it thinks it is exposed and to which it is prepared to be exposed.

The risk management process consists of risk:

- identification (of risks that threaten the income or assets of an organisation, and of possible controls)
- classification (into groups, including allocation of 'ownership')
- measurement (probability and severity)
- control (mitigation to reduce the probability / severity / financial and other consequences of a loss)
- financing (determining the likely cost of each risk, including the cost effectiveness of risk control options, and the availability of capital to cover retained risk)
- monitoring (regular review and re-assessment of risks together with an overall business review to identify new / previously omitted risks).

Risk appetite is an important input into this process.

Benefits of a risk management process

Through an effective risk management process a provider will be able to:

- avoid surprises
- improve the stability and quality of their business
- improve their growth and returns by exploiting risk opportunities
- improve their growth and returns through better management and allocation of capital
- identify opportunities arising from natural synergies
- identify opportunities arising from risk arbitrage
- give stakeholders in their business confidence that the business is well managed.

The risk management process should:

- incorporate all risks (both financial and non-financial)
- evaluate all relevant strategies for managing risk
- consider all relevant constraints
- exploit hedges and portfolio effects
- exploit financial and operational efficiencies.

Risk vs uncertainty

Risk contains an element of uncertainty, but may have some certain elements.

Systematic vs diversifiable risk

Systematic risk is risk that affects an entire financial market or system and cannot be diversified away.

Diversifiable risk arises from an individual component of a financial market or system and can be diversified away.

Whether a risk is systematic or diversifiable depends on the context.

Enterprise risk management

A company's business unit might:

- carry out the same activity but in different locations
- carry out different activities at the same location
- carry out different activities at different locations
- operate in different countries
- operate in different markets
- be separate companies in a group, which each have their own business units.

The parent company could determine its overall risk appetite and divide it between the units. However this is likely to make no allowance for the benefits of diversification. A preferable approach is to establish group risk management as a major activity at the enterprise level.

The key features of enterprise risk management are:

- consistency across business units
- holistic – considers the risks of an enterprise as a whole, rather than in isolation, thus allowing appropriately for diversification *etc*
- seeking opportunities to enhance value.

Stakeholders in risk governance

In an efficiently run organisation, *all* members of staff are stakeholders in risk governance.

All large companies and all providers of financial products should have a designated Chief Risk Officer, normally at enterprise level. Business units should also have a risk manager.

Customers, shareholders, credit rating agencies and regulators also have a stake in the risk governance of an organisation.



Chapter 24 Practice Questions

- 24.1 Outline the components that should be considered when determining the likely cost of each risk, under the risk financing stage of the risk management control cycle.
- 24.2 List the benefits of risk management for a provider of financial benefits.
- 24.3 Discuss whether longevity risk is a systematic or diversifiable risk for a life insurance company.
- 24.4 (i) Give examples of how a multinational composite insurer might comprise a number of business units. [3]
- Exam style**
- Risk management can be carried out at a business level or enterprise level.
- (ii) Discuss the advantages of each approach. [5]
- [Total 8]
- 24.5 Outline how different employees of an organisation are involved in risk governance.

The solutions start on the next page so that you can
separate the questions and solutions.



Chapter 24 Solutions

24.1 The components that should be considered are:

- the cost of putting in place internal risk control measures
- the cost of transferring risk to another party, *eg* insurance premium
- the expected cost of risk events occurring in respect of risks that are retained
- the cost of holding capital against adverse outcomes in relation to the risks that are retained.

24.2 Through risk management a provider will be able to:

- avoid surprises
- improve the stability and quality of their business
- improve their growth and returns by exploiting risk opportunities
- improve their growth and returns through better management and allocation of capital
- identify opportunities arising from natural synergies
- identify opportunities arising from risk arbitrage
- give stakeholders in their business confidence that the business is well managed.

24.3 If a life insurance company writes only (or predominantly) annuity business, then longevity risk is fundamentally a systematic risk. If mortality rates are falling for the population as a whole, this cannot be diversified away.

However, if longevity improvement rates vary for certain subsets of the population (*eg* certain socio-economic groups or geographical areas), the company may be able to diversify its exposure by targeting a wider range of such subsets in its sales and marketing process.

Selling a higher number of policies will also reduce the random variability in longevity experience (by the 'law of large numbers').

If the life insurance company also writes term assurance (or other protection) business, then longevity risk can be diversified away to some extent, since improving mortality has a beneficial impact on such business.

Longevity risk can also be diversified against other types of risk, *eg* market risk, operational risk.

24.4 (i) **Business units**

The multinational company:

- will have both a life insurance and general insurance operation, given it is a composite [½]
- may carry out the same insurance activities but in different areas of the country ... [½]
... for example selling business in America in both New York and Chicago [½]
- carry out different activities at the same location ... [½]
... for example selling personal lines and commercial lines general insurance business in New York [½]
- carry out different activities at different locations [½]
- operate in different countries [½]
- operate in different markets. [½]

[Maximum 3]

(ii) **Two approaches to risk management**

Advantages of managing risk at the business level

If risk is managed at the business level then the parent company decides on its overall risk appetite and then divides this between the business units. [½]

The management of each business unit then manages the risks of the business within the allocated risk appetite. [½]

Therefore each business unit feels a sense of responsibility / direct involvement in risk management. [1]

The management teams of the various business units are most closely involved in understanding the risks and how to deal with them. [1]

Advantages of managing risk at the enterprise level

If risk is managed at the enterprise level then a group risk management function is established. The risks of the various business units are identified and then the results combined into a risk assessment model at the entity level. [1]

Enterprise risk management involves considering the risks of an enterprise as a whole, rather than considering individual risks in isolation. [½]

This approach makes allowance for the benefits of diversification or pooling of risk. [1]

It provides insight, at a group level, into the areas with undiversified risk exposures or too much concentration of risk, where the risks need to be transferred or sufficient capital set aside to cover. [1]

Such an approach is important in ensuring efficient capital use across the group. [½]

Enterprise risk management is also more effective in enabling a company to take advantage of opportunities to add value. [1]

Understanding risk better across the whole enterprise can allow the company to take greater risks in order to increase returns. [1]

[Maximum 5]

24.5 All employees are stakeholders in risk governance.

All employees should be looking out for risks to which the business is exposed.

They should be suggesting ways in which risks can be mitigated or controlled.

Reports on risk from staff should be noted and rewarded through the normal appraisal system.

All large companies and all providers of financial products should have a designated Chief Risk Officer (CRO) at enterprise level.

The CRO is responsible for allocating the risk budget to business units after allowing for diversification, and for monitoring the group exposure to risks and documenting the risks that have materialised and affected the group.

Business units will often have a risk manager (possibly combined with another role).

At business unit level the responsibility is to make full use of the allocated risk budget, as well as data collection, monitoring and reporting.

The board of directors has responsibility for setting the overall risk appetite of the company.

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Risk identification and classification

Syllabus objectives

- 5.1 Describe the techniques that can be used to identify the risks associated with financial products or with the providers of benefits on contingent events.
- 5.2 Discuss how the risks of a project are taken into account in project management.
- 5.5 Show an awareness and understanding of the risk categories that apply to businesses in general, and particularly financial services businesses.

(Covered in part in this chapter.)

0 Introduction

Section 1 of this chapter describes techniques that can be used to identify risks in an organisation, including specifically within project management.

Section 2 then considers the classification of risks and the main high level categories of risk faced by financial product providers. Subsequent sections go on to look at each of these categories in more detail.

Exam questions can be practical applications of these risk categorisations, requiring identification of the risks faced by an institution described in the exam question. In this type of question, the list in Section 2.2 can provide a good framework for identifying a wide range of different risks.

1 Risk identification

1.1 Introduction

Risk identification is the first step of the risk management control cycle. We start with a recap of the purpose and key features of this step, as introduced in the previous chapter.

Risk identification is the recognition of the risks that can threaten an organisation's business plan.

For each risk identified it is necessary to determine any risk control processes that can be put in place which will reduce either the likelihood of the risk event occurring or the impact of the risk event should it occur.

It is also important to identify opportunities to exploit risks and gain a competitive advantage over other providers. Taking on risk is a potential source of profit if the risk is priced correctly.

Identifying all the risks in an organisation is a difficult task and requires good knowledge of:

- **the circumstances of the organisation concerned**
- **the features of the business environment in which it operates**
- **the general business and regulatory environment.**

This is equivalent to needing to consider the external environment when following the actuarial control cycle.

Not all risks are immediately obvious.

In particular, it may be difficult to identify newly emerging risks and other risks that have not yet been experienced by the company but which have the potential to occur.

1.2 Risk identification techniques



Question

Explain who should be involved in identifying the risks that could arise within an organisation.

Solution

It is important that everyone involved in an organisation is involved in risk identification, not just management and not just those employees who work in a dedicated risk management team.

This is because those who work directly within the business (*eg* customer service teams) and who use the processes on a regular basis are often most likely to be able to spot potential risk areas.

It is also useful to involve individuals who are external to the organisation. In particular, experts may be used to assist with those risks that are more difficult to identify. This could include new types of emerging risk and risks that have a low likelihood (and therefore the organisation will have no or limited experience of them) but potentially high impact.

External stakeholders can also be involved. For example, organisations can encourage their customers to report risks that they come across in using the company's products or visiting its premises.

To complete a full identification of risks requires gaining input from everyone involved in the business, at all levels. Senior management may not be aware of a weakness in an operational process that is a risk to the business, which the more junior operators of the process could readily identify.

There are some techniques available to ensure that all relevant risks have been identified:

- **use risk classification (see next section) to ensure that all types of risk have been considered**
- **use techniques from project management as described in the next sub-section**
- **use risk checklists, for example as used for regulatory purposes (see below)**
- **use the experience of staff who have joined from similar organisations, and of consultants with broad experience of the industry concerned.**

Risk checklists

Where there is a risk-based capital requirement regime, such as Solvency II in Europe, there may be lists of risks that regulators believe are relevant to the business.

For example, the standard formula for calculating capital requirements covers many risks relevant to financial product providers.

Such lists may not be exhaustive. For example, the Solvency II standard formula does not include equity volatility as a risk, which could be highly relevant to a business offering equity-backed products with point guarantees.

This example refers to a unit-linked product that is invested in equities but which offers a guaranteed fixed benefit at a specified point in time, *eg* a chosen maturity date. Equity volatility is a significant risk for the provider of such a product, as high volatility makes it more likely that the guarantee will 'bite' and hence generate an additional cost to the provider.

1.3 Risks in project management

This section relates specifically to risk management within a project.

Identification and analysis of risks

The steps necessary to achieve an effective identification and analysis of the risks facing a project can be summarised as follows:

- **Make a high-level preliminary risk analysis to confirm that the project does not have such a high-risk profile that it is not worth analysing further – in which case, the project should not proceed.**
- **Hold a brainstorming session of project experts and senior internal and external people who are used to thinking strategically about the long term.**

The aim will be to:

- **identify project risks, both likely and unlikely, and their upsides and downsides**
- **discuss these risks and their interdependency**
- **attempt to place a broad initial evaluation on each risk, considering both frequency of occurrence and probable consequences if it does occur**
- **generate initial mitigation options**
- **discuss these options briefly.**
- **Carry out a desktop analysis to supplement the results from the brainstorming session, by identifying further risks and mitigation options, eg by researching similar projects undertaken by the sponsor or others in the past (including overseas experiences).**
- **Obtain the considered opinions of experts who are familiar with the details of the project and the outline plans for financing it.**
- **Carefully set out all the identified risks in a risk register or a risk matrix, with cross-references to other risks where there is interdependency.**

High levels of correlation between individual risks will lead to a higher overall variance of the returns from the project, as the individual risks are less likely to cancel each other out.

A risk matrix is a very useful tool for the risk analyst because it acts as a reminder to consider particular types of risk, which may not have been sufficiently considered. It may be linked to the use of risk checklists, and also provides a convenient categorisation for risks.

The cells in the matrix can be ticked off to show whether the risk in question applies to the particular project, with a cross-reference to the appropriate entry in the risk register.

The rows in a risk matrix represent the *stage of the project* at which the risk arises. The columns represent the *causes (or types) of risk*.

For example, a risk matrix for a typical project may look as follows:

		<i>Causes (types) of risk</i>						
		<i>Political</i>	<i>Natural</i>	<i>Economic</i>	<i>Financial</i>	<i>Crime</i>	<i>Project</i>	<i>Business</i>
<i>Stages in the project</i>	<i>promotion of concept</i>					✓	✓	
	<i>design</i>					✓	✓	
	<i>contract negotiations</i>				✓		✓	
	<i>project approval</i>	✓					✓	✓
	<i>raising of capital</i>	✓		✓	✓	✓	✓	✓
	<i>construction</i>	✓	✓	✓	✓	✓	✓	✓
	<i>operation and maintenance</i>	✓	✓	✓		✓	✓	✓
	<i>receiving of revenues</i>	✓	✓	✓	✓	✓	✓	✓
	<i>decommissioning</i>	✓	✓		✓	✓	✓	✓

Both the columns and the rows would be further subdivided. For example, 'Natural' causes of risks may be subdivided into earthquakes, hurricanes *etc.*

Risk mitigation in project management

For each major risk, consideration would be given to identifying the main options for mitigating the risk. These options are the same as those that apply to businesses in general, and are considered in Section 1 of [Chapter 29](#).

2 Risk classification and categorisation

2.1 Risk classification

The phrase 'risk classification' can mean different things in different contexts.

As was described in the earlier chapter on Data, risk classification may refer to the grouping of risks into homogeneous cells in order to allow the data to be used for various purposes *eg* pricing insurance products by rating factors. This concept of risk classification is considered further in the chapter on Accepting risk.

In the wider risk management context, risk classification refers to allocating identified risks into higher level categories, in order to aid the other stages of the risk management control cycle.

2.2 Risk categories

This section provides a broad classification of the risks that impact the providers of products and schemes that provide benefits on future contingent events.

It can be used as a structure when considering any other type of organisation.

The risk categories covered in the next sections are:

- market risk
- credit risk
- liquidity risk
- business risk
- operational risk
- external risk.

As indicated, this is a useful starting point for identifying risks for any organisation, not just for financial product providers.

A clear understanding of the business undertaken by a provider and the organisational structure is a prerequisite to assessing the significance of each risk and how the outcome of that risk translates into a financial impact on the balance sheet and cashflow requirements. The main effort in the analysis can then be directed to those key risks.

The precise nature and relative importance of risks within each category will depend on the type of organisation and its specific circumstances.

Furthermore, the categories and their precise definitions are not standardised, and organisations may categorise the same type of risk differently. Examples of how some types of risk can be allocated to different categories are given in the later sections.

As described in the previous chapter, risks can also be classified between those that are systematic and those that are diversifiable – although the distinction can depend on context.

3 Market risk

3.1 Definition



Essentially market risks are the risks related to changes in investment market values or other features correlated with investment markets, such as interest and inflation rates.

The risk can be divided into:

- the consequences of changes on *asset values* (this is the most obvious implication)
- the consequence of investment market value changes on *liabilities*
- the consequences of a provider *not matching* asset and liability cashflows.

3.2 Asset value changes

Asset value changes can result from:

- Changes in the market values of equities and property. These risks can be systematic if they occur across the whole market under consideration, or may be specific to particular markets and can therefore be diversified by holding a range of assets and asset classes.
- Changes in interest and inflation rates. These primarily affect the value of fixed-interest and index-linked securities, although there is usually some effect on equities and property too.



Question

Describe the likely effect of an increase in short-term interest rates on the value of:

- fixed-interest bonds
- index-linked bonds
- equities
- property.

Solution

Fixed-interest bonds: An increase in short-term interest rates will almost certainly cause prices of short-term bonds to fall. The values of long-term bonds may go up or down depending on investors' views on future levels of inflation and monetary policy.

Index-linked bonds: If higher short-term interest rates are interpreted as a sign of lower expected future inflation, then demand for index-linked bonds, and so their values, might fall.

Equities: Higher interest rates might depress economic growth and so equity values might fall.

Property: Higher real interest rates should lead to a lower valuation of future rents and therefore lower capital values of property.

3.3 Liability value changes

Liability value changes might arise because promises to stakeholders, policyholders or benefit scheme members are directly related to investment market values or interest rates.

Alternatively, a change in interest or inflation rates might affect the level of provisions a provider needs to establish for future liabilities. For example, a reduction in interest rates may reduce the discount rate used to assess the liabilities and therefore increase the provisions that a benefit scheme is required to hold to meet its liabilities.

So, the two causes of liability value changes are changes to:

1. the liability *amount*, eg inflation-linked annuities or unit-linked benefits
2. the liability *value* as the interest rate used in the valuation changes.

3.4 Asset / liability matching

The fundamental principle of investment is that assets should be selected to match the liabilities in nature, term and currency. If it were possible to find such a perfect match, then market risk could be completely diversified away by choosing a matched portfolio.

In practice a perfect match may be impossible because:

- there may not be a wide enough range of assets available ...
... in particular it is unusual to find assets of long enough duration
- liabilities may be uncertain in amount and timing
- liabilities may include options and hence have uncertain cashflows after the option date
- liabilities may include discretionary benefits
- the cost of maintaining a fully-matched portfolio is likely to be prohibitive.

Hence even a well-matched portfolio is likely to retain some element of risk.

The existence of additional capital gives freedom to intentionally take an unmatched position in the hope of achieving an additional return. The capital will be used to cover the cost of the risk taken.

All of the ideas in this sub-section should be familiar from the investment strategy chapters of the course.

The consequences of mismatching include:

- greater exposure to market risk, as assets and liabilities will not move in line with each other
- higher liquidity risk
- reinvestment risk – the risk of having to invest asset proceeds on unknown future terms.

4 Credit risk

4.1 Definition and examples



Credit risk is the risk of failure of third parties to meet their obligations.

Particular examples are:

- **The issuer of a corporate bond defaulting on the interest or capital payments.**
- **The term ‘credit risk’ is sometimes also used to describe the risk associated with any kind of credit-linked event. This could include changes to credit quality (up or down) or variations in credit spreads in the market as well as the default events described above.**

A credit-linked event is of interest because it will be associated with a change in value of the associated bond.



Question

- (i) Define the term ‘credit spread’.
- (ii) Explain why credit spreads might change over time.
- (iii) Give some examples of ‘credit-linked events’.

Solution

- (i) Credit spread is the difference in yield between a particular corporate bond and an otherwise equivalent government bond.
- (ii) The most common reason for credit spreads to move will be perceived changes in credit quality of the issuers. However, changes might also occur if the market alters its view on the premium for illiquidity that is placed on corporate bonds in general (in turbulent times, the spread between any investment and government bonds will widen).

Alternatively the perceived security of a type of bond may change (*eg* the yield gap between debentures and unsecured loans may widen and affect the yield on all unsecured loans).

- (iii) Examples include:
 - bankruptcy (insolvency, winding-up, appointment of a receiver)
 - a rating downgrade or upgrade
 - failure to pay.
-

- **Counterparty risk, where one party to a transaction fails to meet their side of the bargain. An example of counterparty risk is settlement risk, which arises when a party pays away cash or delivers assets before the counterparty is known to have performed their part of the deal.**
- **General debtors – the purchaser of goods and services fails to pay for them.**



Question

Outline possible credit risk exposures of an insurance company.

Solution

Examples of possible credit risk exposures are:

- Issuers of government and corporate bonds in which the insurance company has invested may default on payments or their bonds may be downgraded.
 - The company's reinsurer(s) will represent exposure to counterparty risk.
 - The company is exposed to the risk of the failure of banks with which its deposits are held.
 - If the company uses outsourcing companies or external investment fund managers, it is exposed to the risk that they will not fulfil their obligations (this may alternatively be classified as an operational risk – see later in this chapter).
 - General debtors will include policyholders who may default on their premiums (this may alternatively be classified as a business risk – see later in this chapter) and/or brokers who may fail to pass on premiums.
-

4.2 Security

The extent to which credit risk arises in relation to an amount that has been lent to a third party depends on the security of the loan.

If a borrower can provide security, providing finance to that borrower will be more attractive to a lender. However, the existence of security is not an excuse for otherwise bad lending.

The decision as to what security is taken is dependent on:

- **the nature of the transaction underlying the borrowing**
- **the covenant of the borrower**
- **market circumstances and the comparative negotiating strength of lender and borrower**
- **what security is available.**

The covenant of the borrower means the overall creditworthiness of the borrower.

The most common asset to take as security is property. This can be built into the debt issue on the basis of a fixed charge (*ie* secured against a specified property or properties) or a floating charge (*ie* secured against a pool of changing properties).

However there are many different ways of ‘collateralising’ a loan. Banks, for example, may request that assets be assigned in their name before offering a bank loan (*eg* a life assurance policy may be assigned to the bank before a mortgage is given).

It must be within the ability of the lender to realise the security if necessary in a cost-effective manner.

4.3 Credit rating

A credit rating is given to a company’s debt by a credit-rating agency as an indication of creditworthiness, *ie* the likelihood of default / credit loss.

Many corporations now take the view that credit ratings play a key role at the centre of the company’s wider strategic and financial management.

Rating agencies (*eg* Moody’s and Standard & Poor’s) are specialised independent companies focussed on the provision of high quality, objective credit analysis. They assess, for example, the relative quality of tradable bonds. Each agency has its own classification of ratings, for example:

<i>Moody’s</i>	<i>Standard & Poor’s</i>	
Aaa	AAA	Investment grade
Aa	AA	
A	A	
Baa	BBB	
Ba	BB	Junk bonds
B	B	
Caa	CCC	
Ca	CC	
C	C	

A company may act to improve its credit rating and these actions may affect the market for that company’s and other companies’ shares.

5 Liquidity risk

5.1 Definition

The normal definition of liquidity risk relates to individuals or companies.



Liquidity risk is the risk that the individual or company, although solvent, does not have available sufficient financial resources to enable it to meet its obligations as they fall due.

This definition can be extended with: 'or that they can secure such resources only at excessive cost'.

5.2 Liquidity risk for different organisations

Non-financial institutions

Liquidity pressures are the most common reason why a trading company goes into liquidation. The phrase 'into liquidation' immediately gives the reason for the action.

A trading company may well have sufficient assets, probably largely stock and work in progress, to cover its liabilities, but if those assets cannot be realised the company may not be able to satisfy its creditors.

In such a case, the creditors may be able to prevent the company from trading.

Insurance companies and benefit schemes

Insurance companies and benefit schemes normally have little exposure to liquidity risk, because a large proportion of their assets are in cash deposits or bond and stock market assets. In general, these can readily be sold in the market to raise cash when required.

General insurers face liquidity risk if claim costs are higher than expected, for example in the event of a catastrophe.

A benefit scheme may face liquidity risk in the event of a bulk transfer out of the scheme.

Banks

Banks are generally exposed to significant liquidity risk. They lend depositors' funds and funds raised from money markets to other organisations, and generally do so for longer periods than they offer to the providers of the funds.

A retail bank that offers customers instant access to their deposits needs to maintain sufficient liquid resources to withstand a large number of customers asking for their money back.

For this reason banks frequently offer good investment returns on fixed term deposits, where the depositors are not able to access their funds until the maturity date.

So banks face liquidity risk if more customers than expected demand cash, *ie* withdraw their deposits.

Collective investment schemes and insurance funds

Similarly, collective investment schemes and insurance funds that invest in real property need to protect themselves if clients request access to their funds when the underlying properties cannot be sold. Such funds frequently have the power to defer withdrawals by up to six months if necessary, to allow time for property sales. Hedge funds that invest in illiquid assets also often have lock-in periods to mitigate liquidity risk.

The reference to 'insurance funds' here means that unit trusts and other funds used as the backing investments for unit-linked business face liquidity risk if more policyholders than expected surrender their policies.

Similarly, collective investment schemes face liquidity risk if more customers than expected wish to sell their units.

This is particularly the case if the scheme, trust or fund is invested directly in property, as this is not a liquid asset.

5.3 Managing liquidity risk

Financial companies will maintain a degree of liquidity to deal with anticipated liability withdrawals. In the event of these withdrawals being greater than expected, the company may have to convert some of its less liquid assets to cash or else try to borrow additional funds (which may be unavailable or expensive).

Financial companies can allow for liquidity risk to some extent, by allowing a margin for withdrawals being higher than they expect and by allowing for predictable seasonal variations (eg higher bank withdrawals pre-Christmas). Typically, the biggest liquidity risk issues for a financial company arise as a result of a *sudden surge* in liability withdrawals.



Question

Explain why there might be a sudden surge in customers withdrawing their deposits from a bank.

Solution

A sudden surge may occur for a number of reasons, including:

- concerns about the bank's security (*ie* its continued solvency)
- solvency concerns about one bank leading to heightened concerns about the solvency of other banks – this effect is known as 'contagion'.

Banks do not hold sufficient reserves to be able to repay all deposit holders immediately. Therefore, if concerned about the solvency or security of a bank, customers may be keen to withdraw their deposits in full as quickly as possible.

This would in itself further threaten the bank's solvency, and a 'run on the bank' may result.

5.4 Market liquidity risk

In the context of financial markets, liquidity risk can arise where a market does not have the capacity to handle (at least, without a potential adverse impact on the price) the volume of an asset to be bought or sold at the time when the deal is required.

In general, the larger a market is, the easier it is to trade and the more liquid it will be, because more participants in the market will be trading at any one time. Thus, when any member of the market wishes to complete a trade, it is likely that the market will be able to find a counterparty willing to accept the trade.

The market is sensitive to factors such as changes in interest rates and the economic outlook, which means that the price of the assets can vary significantly over time, so there is a risk that the asset holder may make a loss if they are required to make a sudden sale at a time the price is depressed.

The terms marketability and liquidity are often used interchangeably. Strictly speaking though, the two are slightly different:

- *Marketability* is how easy it is to buy or sell an asset.
- *Liquidity* is a measure of how quickly the asset can be converted into cash at a predictable price.

A highly liquid asset therefore has two characteristics:

1. It either will quickly become cash because of the terms of the asset itself (eg a short-term bank deposit or a government bond with one week until redemption) or else there is a high degree of certainty that the asset could be sold quickly if required.
2. The amount of cash it will or could become is (almost) certain.

Marketability considers only the characteristic of how certain it is that an asset can be sold quickly if required.



Question

Give one example of each of the following:

- an asset that is highly liquid but not marketable
- an asset that is marketable but not liquid.

Solution

A seven day fixed-term deposit at a bank is a highly liquid asset because it will become cash within a week. However, such deposits cannot be traded, so they are completely unmarketable.

A long-term government bond is a marketable asset because there are many market participants willing to trade at any time. However, it is not a liquid asset as the market value is quite volatile.

(We discussed the relative marketability of short-term and long-term bonds in an earlier chapter.)

6 Business risk

6.1 Definition

Business risks are risks that are specific to the business undertaken.

Business risk differs from operational risk in that the latter are non-financial events that have financial consequences.

We will discuss operational risk in the next section.

The business risks *of financial product providers* can be further divided into the following sub-categories:

- underwriting risk – arising in relation to the underwriting approach taken
- insurance risk – arising from the uncertainties relating to claim rates and amounts
- financing risk – arising in relation to the financing of projects or other activities
- exposure risk – arising in relation to the amount of business sold or retained, or to its concentration or lack of diversification.

Examples of business risk are:

- **a life or general insurer not having adequate underwriting standards, and thus taking on risks at an inadequate price**
This is an example of underwriting risk.
- **an insurer suffering more claims than anticipated**
This is an example of insurance risk.
- **a provider of finance, such as a bank, investing in a business or project that fails to be successful**
This is an example of financing risk.
- **a reinsurer having greater exposure than planned to a particular risk event – for example through writing whole account protection covers as well as primary reinsurance of the risk**
This is an example of exposure risk.
- **a music production company promoting a CD that fails to sell**
- **a competitor launching a new product in the week before your similar product launch**
- **an umbrella manufacturer whose sales suffer in a drought.**
It might be argued that a drought, as an external event, is an external risk. However, the profits of the company will be so closely correlated with the amount of rainfall that the risk is key to the company's business.

Each type of business is exposed to its own risks. Those relating to financial products and financial product providers are covered in the next chapter.

7 Operational risk and external risk

7.1 Operational risk



Operational risk refers to the risk of loss resulting from inadequate or failed internal processes, people and systems or from external events.

Risk that arises directly from external events are considered in the next section.

Operational risks can be controlled or mitigated by an organisation. For individuals, operational risks arise in carrying out their normal lifestyle. For an individual, crossing the road is an operational risk, which can be mitigated by looking and listening carefully before crossing.

Operational risk can arise from:

- inadequate or failed internal processes, people or systems



Question

Give some examples of inadequate or failed internal processes, people or systems that may be a source of operational risk to an insurance company.

Solution

Examples of inadequate or failed internal processes, people or systems:

- mismanagement, for example due to:
 - inappropriate actions of the board of directors / staff
 - failure (or lack) of management systems and controls
 - administrative complexity
 - data errors, for example inadequate, inaccurate or incomplete data
 - inadequate risk control measures
 - fraud.
-
- the dominance of a single individual over the running of a business, sometimes called dominance risk
 - reliance on third parties to carry out various functions for which the organisation is responsible, eg if administration or investment work is outsourced
 - the failure of plans to recover from an external event.

While it is possible to develop computer models to analyse and price operational risk, such models are only as good as the parameters input. Whether or not a model is used, identification of operational risks requires considerable input from owners, senior management and other individuals who have a detailed working knowledge of the operations of the business.

7.2 External risk

External risk is a form of non-financial risk but is separate to operational risk.

A 'non-financial risk' arises from an event, other than a financial transaction, that can negatively impact the operations of a company. Operational and external risks may be considered to be non-financial risks.

External risk arises from external events, such as storm, fire, flood, or terrorist attack.

However the failure to arrange mitigation against such risks is an operational risk.

In general these are systematic risks. Only for the largest entities is it economically efficient to diversify these by carrying out the same operation on different sites.

Regulatory, legislative and tax changes are some other examples of external risk.

Chapter 25 Summary

Risk identification

Everyone in an organisation should be involved in risk identification, at all levels.

Techniques that can be used as part of the process include:

- risk classification (to ensure full coverage)
- risk checklists, *eg* as used for setting regulatory capital requirements
- experience of staff joining from similar organisations, consultants, experts
- project management risk identification techniques:
 - high-level preliminary analysis
 - brainstorming
 - desktop analysis
 - risk register / risk matrix.

Risk categories

The major types of risk faced by an organisation are:

- market risk
- credit risk
- liquidity risk
- business risk
- operational risk
- external risk.

Market, credit, business and liquidity risks can be classified as *financial* risks and operational and external risks as *non-financial* risks.

Market risk

Market risks are the risks related to changes in investment market values or other features correlated with investment markets. Market risk can be divided into the consequences of:

- changes in asset values
- investment market value changes on liabilities
- mismatching assets and liabilities.

Credit risk

Credit risk is the risk of failure of third parties to meet their obligations. Examples include:

- default risk on bonds (and possibly also credit spread changes)
- counterparty risk (including settlement risk)
- general debtors.

Security may be used as a way of reducing credit risk when lending money to a third party. *Credit ratings* are an indication of creditworthiness, *ie* the likelihood of default.

Liquidity risk

In the context of an individual or a company, liquidity risk is the risk that the individual or company, although solvent, does not have available sufficient financial resources to enable it to meet its obligations as they fall due, or can secure such resources only at excessive cost.

In the context of financial markets, liquidity risk arises when the market does not have the capacity to handle that volume of transacted asset without a potential adverse price impact. Therefore liquidity (how quickly an asset can be converted into cash at a predictable price) differs from marketability (how easy it is to buy and sell an asset).

Business risk

Business risk is specific to the business undertaken. Examples include:

- poor underwriting standards (underwriting risk)
- poor claims experience (insurance risk)
- providing finance for a project that turns out to be unsuccessful (financing risk)
- exposure to a particular risk being greater than expected, or lower sales volumes than expected *eg* due to competitor actions (exposure risk).

Operational risk and external risk

Operational risk refers to the risk of loss resulting from inadequate or failed internal processes, people and systems or from external events.

Operational risk can be controlled by the organisation, and can arise from:

- inadequate internal processes, people or systems
- dominance of a single individual (*dominance risk*)
- reliance on third parties (*eg* outsourcers)
- the failure of plans to recover from an external event.

External risk arises from external events such as storm, fire, flood or terrorist attack. In general these are systematic (*ie* non-diversifiable) risks.



Chapter 25 Practice Questions

- 25.1 An aircraft manufacturing company is considering developing a new passenger aeroplane to be sold to airlines for use on long-haul flights between major international airports. The aeroplane will be designed to carry 35% more passengers than the largest aircraft currently in use, resulting in passenger numbers exceeding 500. The company also intends the aeroplane to be superior in comfort, amenities and safety than existing models. The development of aeroplane parts will be split between several different countries.

Identify key causes of risks that are specific to this project and which may appear in its risk matrix.

- 25.2 A city council is considering building a new tourist and leisure complex which it hopes will appeal to visitors to the city as well as to local residents.

Exam style

- (i) Describe the steps necessary to achieve an effective identification of the risks facing the project. [7]
 - (ii) Outline the major risks associated with this project. [4]
 - (iii) Suggest ways by which each of the risks identified in part (ii) might be mitigated. [8]
- [Total 19]

- 25.3 Define the following terms, including examples of each:

- (i) market risk
- (ii) credit risk
- (iii) liquidity risk
- (iv) business risk
- (v) operational risk
- (vi) external risk.

- 25.4 New government legislation is about to be introduced. It will require all car manufacturers to meet the cost of disposing of vehicles that they manufacture (from a certain future date) when they are subsequently scrapped by the owners.

Discuss the main risks that car manufacturers face in relation to this new legislation.

- 25.5 A project sponsor has decided to build a small power plant to supply steam and electricity to a paper mill. The sponsor has asked a bank to lend money to the company that will own the power plant, once it is built. The project sponsor will operate the plant. The bank recognises that this loan generates credit risk in respect of both repayment delay and default.

Outline the various ways in which the bank might be able to reduce this credit risk.

- 25.6 An IT company specialises in providing teaching and testing software to schools and colleges.

Exam style

- Describe the sources of risk likely to be faced by this company. [9]

25.7 Identify whether the following risks to an insurance company should be classified as market, credit, liquidity, business, operational or external:

- an economic downturn
- legislative changes
- discontinuance rates higher than expected
- currency movements
- capital demands higher than expected
- investment return lower than expected
- a merger of competitors
- terrorism
- adverse publicity
- a change in taxation
- fraud
- mortality rates higher than expected
- withdrawal rates from a property unit-linked fund higher than expected
- loss of key personnel
- power failure
- office fire
- war
- a new judicial ruling
- a stock market crash
- failure of a reinsurer to pay out on a claim
- expenses higher than expected
- theft
- earthquake
- new business volumes lower than expected.

25.8 Bank A and Bank B are two investment banks operating in a highly developed and liquid bond market in the same country. A and B enter into a swap agreement, under which A lends cash to B in return for borrowing fixed-interest securities.

Exam style

Describe the credit and market risks faced by Bank A under the loan agreement, and how they might be mitigated. [4]



Chapter 25 Solutions

25.1 *Political*

- There may be (public or governmental) opposition to the project, *eg* concerns over safety or pollution.
- Legislation may change, which affects the cost of construction of large aircraft.
- One of the participating countries may pull out of the project.
- War or terrorism in one of the participating countries could disrupt progress and/or demand for the aircraft.

Natural

- There may be a fire or explosion at one of the development sites.
- An earthquake, or other natural disaster, in one of the participating countries could disrupt development.
- Shortages in raw materials needed for construction or testing, *eg* fuel.

Economic

- A worldwide recession may adversely affect demand for planes from airlines.
- A rise in oil prices may lead to an increase in the cost of air travel, lower anticipated passenger demand, and lower demand from the airlines for planes.
- Exchange rate movements may adversely affect the cost of labour and parts.
- Interest rate rises may be higher than expected, increasing financing costs.

Financial

- A financial backer / sponsor may pull out at a crucial time during the project.
- Cashflows (initial capital, revenues and expenditures), and/or forecasts relating to air travel may have been mis-estimated (*ie* inadequate margins built in).
- A supplier may default.

Crime

- There may be incidences of theft, arson or fraud at any one of the development sites.
- An increase in perceived terrorist threats could cause a reduction in demand for flights, and hence for the aircraft.

Project

- The project may run over time or over budget due to, *eg* industrial action, poor planning, inadequate resources or incompetence.
- There may be flaws in the design, *eg* it is not possible to carry that many passengers in comfort and safely, or the parts are not compatible.
- There may be critical path issues, *eg* if lack of progress in one of the participating countries affects progress in one of the others.

Business

- Demand from airlines for the planes themselves may be lower than expected due to changing trends in air travel (*eg* a trend towards budget flights rather than superior comfort flights).
- A competitor may launch a similar development proposal, resulting in reduced market share.
- The international airports may lack the infrastructure to cater for such aeroplanes, *eg* length / width of runway, handling large volumes of passengers.

25.2 (i) **Identification of the risks**

Start with a high-level preliminary risk analysis.	[½]
This should confirm whether the project is too high risk to continue.	[½]
For example, could investigate whether the necessary finance can be raised, ...	[½]
... and if so, where it is likely to come from and who is managing the process of raising it.	[½]
Hold a brainstorming session of project experts and senior internal and external people, ...	[1]
... for example, experts in leisure and tourism, project management, government relations, financing <i>etc.</i>	[1]
The aim of brainstorming is to identify all project risks, both likely and unlikely...	[½]
... and their upsides and downsides.	[½]
The meeting will discuss these risks and their severity, frequency and interdependency.	[1]
It will also discuss initial mitigation options, <i>eg</i> outsourcing, insuring or removing the risk.	[1]
Use a desktop analysis to supplement the above, ...	[½]
... for example, further risks and mitigation options should be identified ...	[½]
... and similar projects should be researched.	[½]
Further discussion with experts should take place.	[½]

Set out all the identified risks in a risk register ... [½]

... with cross references to other risks where there is interdependency. [½]

A risk matrix could also be used. [½]

Risk checklists or risk classification categories could be used to help gain breadth of risk identification. [½]

[Maximum 7]

(ii) **Major risks**

For this particular project the major risks would be:

- underestimation of costs in the planning and construction phases, *eg* higher than expected costs of clearing / preparing the site, labour costs, material costs [1]
- events leading to delays in the planning and the construction phases, *eg* strikes, problems with planning permission, bad weather *etc* [1]
- overestimation of the usage of the complex after construction: [½]
 - by local residents [½]
 - by visitors [½]
- eg* due to an unattractive location, inadequate facilities *etc* [½]
- underestimation of the costs of running the leisure complex [½]
- political risk, *eg* opposition from local residents or from others in the city, due to costs, location, environmental impact *etc* [1]
- problems in raising the necessary finance initially / sponsor default [½]
- crime, *eg* fraudulent activities by workers. [½]

Other reasonable examples of major risks are also acceptable answers.

[Maximum 4]

(iii) **Risk mitigation**

Underestimation of the cost of clearing the site – research the likely costs under different scenarios, sub-contract to a third party. [1]

Underestimation of the labour costs – sub-contract to a third party, agree a fixed price contract in advance. [1]

Underestimation of the cost of materials – consult with building experts, sub-contract to a third party, enter into forward agreements. [1]

Delays in planning and construction – sub-contract to a third party, obtain insurance to protect against environmental disasters, include clauses in the builders' contracts that impose penalties if there are delays. [1]

Overestimation of usage by local residents – conduct surveys to identify the wants / needs of local residents, encourage residents to sign up for membership in advance, offer attractive packages, advertising. [1]

Overestimation of usage by visitors – research to determine the best location and the likely wants and needs of potential visitors, advertise in tourist locations / hotels, offer as part of tour package, compare with similar projects. [1]

Underestimation of running costs – research the costs incurred in other similar complexes, consider future increases in costs. [1]

Political risk – consult with local residents and others living in the city to gain support, research issues fully, develop a favourable media relationship. [1]

Problems raising finance – profit-sharing deals, use several sponsors to diversify risk, insure against credit risk, ensure financing is in place at the start, ensure there are procedures to follow if costs overrun. [1]

Crime – research the backgrounds of all key companies and personnel, purchase fidelity guarantee insurance. [1]

Other reasonable mitigation options are also acceptable answers.

[Maximum 8]

25.3 (i) **Market risk**

Market risk is the risk related to changes in investment market values or other features correlated with investment markets, such as interest and inflation rates.

Examples include:

- the consequences of changes in asset values, *eg* insolvency
- the consequence of a change in liability values that is due to investment market value changes, *eg* if liabilities are linked to asset values or interest rates
- the consequences of mismatching.

(ii) **Credit risk**

Credit risk is the risk of failure of third parties to meet their obligations.

Examples include:

- the issuer of a corporate bond defaulting on a payment
- a corporate bond's credit rating being downgraded
- counterparty or settlement risk
- debtor default.

(iii) **Liquidity risk**

In the context of an individual or a company, liquidity risk is the risk that the individual or company, although solvent, does not have available sufficient financial resources to meet obligations as they fall due.

Or alternatively that they can secure such resources only at excess cost.

Examples include:

- a trading company holding assets that are not readily realised and being unable to pay creditors
- significantly more insurance claims or surrenders than expected
- more withdrawals of cash deposits than expected from a bank.

In the context of financial markets, liquidity risk occurs when a market does not have the capacity to handle (at least, without a potential adverse impact on the price) the volume of an asset that is to be bought or sold at the time when the deal is required.

Examples of asset classes with significant liquidity risk include (direct) property and unquoted equities.

(iv) **Business risk**

Business risk is a financial risk that is specific to the business undertaken.

Examples for a financial product provider include:

- insurance risk – *eg* mortality higher than expected on an assurance product
- underwriting risk – *eg* poor underwriting procedures and hence incorrect pricing
- financing risk – *eg* failure of a sponsor
- exposure risk – *eg* overexposure to a particular class of business or geographical area, or selling a lower volume of new business than expected.

(v) **Operational risk**

Operational risk refers to the risk of loss resulting from inadequate or failed internal processes, people and systems or from external events.

Examples include:

- the dominance of a single individual over the running of a business
- reliance on third parties to carry out various functions for which the organisation is responsible
- the failure of plans to recover from an external event.

(vi) **External risk**

External risk arises from external events such as storm, fire, flood, or terrorist attack.

- 25.4 This is a new cost that needs to be absorbed in the cost of new cars being sold. If current prices do not allow for this cost then this is to the detriment of the manufacturer.

If car prices are increased to absorb this cost then there is a risk that the sale of new cars may fall by more than the manufacturer anticipates when pricing.

The manufacturer will not know how much this future cost will be, or its timing.

It is at risk of:

- cars being scrapped sooner than expected, so:
 - the manufacturer needs to find money at short notice
 - lower investment return is earned on funds than expected
- cars costing more to dispose of than expected.

- 25.5 Possible risk reduction actions include:

- require the owner to set up a liquidity (cash) account containing a minimum of 6 or 12 months interest
- require the owner / sponsor to transfer risk relating to the completion of the project *eg* using insurance
- require a loan guarantee from the sponsor
- require a loan guarantee from the builder during the construction period
- restrict the term of the loan to a sensible period of time following completion of the mill
- restrict any further borrowings by the sponsor and owner
- set a principal repayment schedule which is likely to be as fast as the cashflows will allow for the first say three to five years
- take a fixed security over all of the assets of the owner
- ensure that these assets are readily realisable in a cost-effective manner
- check the creditworthiness of the company to which the loan is being given, for example through their credit rating.

25.6 **Market risk**

Market risks are the risks relating to changes in investment market values or other features correlated with investment markets, such as interest and inflation rates. [1]

For this company, examples of market risk would be:

- inflation increasing its salary costs [½]
- high interest rates increasing its borrowing costs [½]
- exchange rate risk if it incurs any of its costs or sells its software overseas [½]
- falls in the company's own share price, as this would restrict its ability to raise capital in the future. [½]

Credit risk

Credit risk is the risk of failure of third parties to meet their obligations. [½]

This IT company will face the risk that its customers default on their payments for the software. [½]

However, to the extent that many schools and colleges are in the public sector, this risk should be relatively low. [½]

However, there is still the risk of failure to pay in a timely way. [½]

Business risk

Business risks are specific to the business undertaken. [½]

For this company, business risks could include:

- product failings, *eg* lack of reliability, problems marking and returning assessments [1]
- poor customer service / technical support [½]
- lack of innovation resulting in competitors taking the company's market share [½]
- inadequate publicity / advertising [½]
- poor understanding of the needs and concerns of customers in education and how these might differ from those of commercial entities. [½]

Liquidity risk

This is the risk that the company, although solvent, does not have the resources to enable it to meet its financial obligations as they fall due or can do so only at excessive cost. [1]

For example, although profitable, the company may face cashflow problems paying bills and salaries. [1]

Operational risk

Operational risk refers to the risk of loss resulting from inadequate or failed internal processes, people and systems or from external events. [1]

For example:

- reliance on third parties to carry out various functions for which the organisation is responsible [½]
- death or move to another employer of a key software developer [½]
- failure to patent software properly. [½]

External risk

Examples of external events that could be a source of risk include:

- fire / flood interrupting business [½]
- changes in government funding of the use of IT in schools [½]
- changes in government plans for testing of all pupils at various stages in their education.

[½]

[Maximum 9]

25.7 Risk categorisation could be as follows:

- an economic downturn – market
- legislative changes – external
- discontinuance rates higher than expected – liquidity / business
- currency movements – market
- capital demands higher than expected – business
- investment return lower than expected – market
- a merger of competitors – external / business
- terrorism – external
- adverse publicity – operational
- a change in taxation – external
- fraud – operational
- mortality rates higher than expected – liquidity / business
- withdrawal rates from a property unit-linked fund higher than expected – liquidity
- loss of key personnel – operational
- power failure – operational / external (depending on the cause)
- office fire – operational / external (depending on the cause)
- war – external
- a new judicial ruling – business / external
- a stock market crash – market
- failure of a reinsurer to pay out on a claim – credit
- expenses higher than expected – business (or market if due to higher than expected inflation say)
- theft – business / operational
- earthquake – external
- new business volumes lower than expected – business.

25.8 *This swap is really just a loan from Bank A to Bank B, secured on some fixed-interest bonds.*

At outset:

- *Bank A gives a cash lump sum to Bank B.*
- *Bank B gives some fixed-interest bonds to Bank A.*

During the term of the swap, Bank A receives fixed-interest coupons on the bonds from the bond issuer.

At the end of the swap:

- *Bank B repays the cash lump sum with interest (at an agreed rate) to Bank A*
- *Bank A returns the fixed-interest bonds to Bank B.*

Bank A is exposed to the risk of default from two parties. Consider:

- *who these parties are and when they might default*
- *what security / collateral Bank A would have rights to on default*
- *whether there is a market risk attached to the value of this security.*

For mitigation options, consider the different ways in which Bank A can reduce the risk of default from the two parties and the market risk relating to the security.

Credit risk

Bank A has two credit exposures:

- Bank B may default on the termination date and thereby not return the cash in exchange for the bonds [1]
- the issuer of the bonds might default during the period of the agreement, and Bank A would then have no assets to return. [1]

Market risk

The security underlying the cash loan transaction is the fixed-interest bonds. Bank A faces the risk that the market value of the bonds acquired as security will drop below the amount of cash lent plus any accrued interest. [1]

This risk increases with the duration of the bonds, and will be greater for long-term bonds than for short-term bonds. [½]

Risk mitigation

- Bank A could lend less cash than the market value of the bonds held as security, giving a margin in the event of adverse bond price movements [1]
- Bank A could insist on only including the following in the arrangement:
 - short-term bonds [½]
 - bonds with a credit rating of AA-rated or higher [½]

- The swap agreement could specify that, if the value of the bonds falls below a certain value: [½]
 - Bank B must repay part of the loan immediately [½]
 - Bank B must provide a replacement security. [½]
- [Maximum 4]

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Financial product and benefit scheme risks

Syllabus objectives

- 5.3 Describe the risks and uncertainties affecting:
- the level and incidence of benefits payable on contingent events
 - the overall security of benefits payable on contingent events.
- 5.5 Show an awareness and understanding of the risk categories that apply to businesses in general, and particularly financial services businesses.
- (Covered in part in this chapter.)

0 Introduction

This chapter considers specifically those risks that relate to the provision of financial products and schemes.

Much of the content relates to risks arising in *benefit schemes*.

The primary type of benefit scheme that actuaries are involved with is a pension scheme. However, the material in this chapter extends to any situation where a benefit has been promised, *eg* medical benefit schemes.

The material is also relevant to products sold by insurance companies.

The chapter describes separately the risks that arise in relation to benefits (under schemes or insurance products) and those that arise in relation to contributions or premiums.

The final section gives examples of business risk that arise for insurance companies, continuing the introduction to this category of risk from the previous chapter.

Before starting, it is worth recapping on the main different types of pension scheme, which were introduced much earlier in the course.



Question

Describe, with examples, how the following types of scheme operate:

- a defined benefit scheme
- a defined contribution scheme
- a defined ambition scheme.

Solution

Defined benefit scheme

Under a *defined benefit scheme*, the scheme rules define the benefits independently of the contributions payable, and benefits are not directly related to the investments of the scheme.

Examples of a defined benefit scheme are:

- final salary schemes, *eg* benefits are based on earnings in the three years prior to retirement
- career average schemes *eg* benefits are based on earnings over career, possibly revalued
- fixed benefit schemes *eg* a fixed amount for each year of service.

The scheme may be *funded* or *unfunded*.

Funded means that money is set aside in advance of the benefits being paid. *Unfunded*, or *pay-as-you-go*, means that no funds are accumulated. Regulation is likely to require that if this is a private pension, then it is funded.

Defined contribution scheme

A *defined contribution scheme* provides benefits where the amount of an individual member's benefits depends on the contributions paid into the scheme in respect of that member, increased by the investment return earned on those contributions.

For example, an employer may contribute 8% of salary into a member's pension account. When the member reaches retirement the contributions made together with investment returns achieved are used to purchase an annuity or alternative retirement benefit. The options open to the member at retirement will depend on regulation.

Defined ambition scheme

A *defined ambition scheme* is designed such that risks are shared between the different parties involved, for example scheme members, employers, insurers and investment businesses.

Examples of a defined ambition scheme are:

- a cash accrual scheme where benefits are defined as a lump sum rather than as a pension
 - a defined contribution scheme offering a defined benefit underpin *eg* the benefit will not be less than 1/100th of final salary for each year of service.
-

1 Risks and uncertainties

Where there is a delay between a benefit being promised and that benefit being provided, there will always be some uncertainty.



This uncertainty may relate to the level or the incidence of:

- the benefits, or
- the contributions / premiums required to pay for those benefits.

Uncertainties relating to the benefits occur primarily under defined contribution schemes and life insurance products that are unit-linked or with-profit. Uncertainties relating to the contributions occur primarily under defined benefit schemes and without-profit life insurance products.

1.1 Risks to the beneficiary

There is a risk that the beneficiary's circumstances will have changed and that:

- the benefits will be less valuable than required, or
- they will not be received at the required time.



Question

Give possible reasons why the benefits might be less valuable than expected in relation to a:

- defined contribution scheme
- defined benefit scheme.

Solution

Defined contribution scheme

Benefits may be less valuable than expected due to:

- lower than expected investment returns or higher than expected expense charges
- poorer than expected annuity rates at retirement (if an annuity is purchased)
- higher than expected inflation, eroding the real value of the benefits (if a fixed income annuity is purchased)
- sponsor default on contributions or failure to pay contributions in a timely manner
- inappropriate advice and/or poor communication with beneficiaries
- fraud or mismanagement
- tax or regulatory changes.

Defined benefit scheme

Benefits may be less valuable than expected due to:

- a change in benefits, eg by the State
 - higher than expected inflation, eroding the real value of the benefits (if they are not inflation-linked)
 - a shortfall in the fund, which results in the sponsor reducing benefits
 - sponsor default on benefits or failure to pay benefits at the times required
 - takeover of the sponsor by an organisation that won't meet the promised benefits
 - sponsor insolvency
 - inappropriate advice and/or poor communication with beneficiaries
 - fraud or mismanagement
 - tax or regulatory changes.
-

In circumstances where there is no uncertainty about the level or incidence of the benefits or contributions, there may still be a risk that inflation has adversely affected the value of the amount.

1.2 Risks to the provider

There is a risk to the provider (eg insurance company or scheme sponsor) that benefit payments will be greater than expected or that payments will be required at an inopportune time.

1.3 Risks to the State

There may be a risk for the State that it is expected to put right any losses that the public incurs.

This is particularly relevant if the State provides means-tested benefits, for example a minimum income level in retirement.

Means-testing is a process for establishing whether an individual is eligible to receive benefits and/or how much benefit they should receive. It is often based on an individual's income or assets or both.

If an individual believes that the minimum income level is sufficient for all their needs, they would be better advised to spend surplus funds on improving their immediate lifestyle. If the surplus funds were invested to provide a future income, this income might simply reduce the sum that the State would provide by exactly the same amount. The individual would forgo immediate consumption for no increase in income later.

2 Benefit risks

In this section we cover the risks and uncertainties relating to benefits. We will consider risks relating to contributions in the next section.

2.1 Benefits that are known in advance

This sub-section principally relates to benefits from defined benefit schemes, without-profit life insurance policies and fixed benefit general insurance policies.

Risk of inadequate funds

Where the benefits are pre-defined, the greatest risk for a potential beneficiary is that there are insufficient funds available to provide the promised benefit.

This may be as a result of:

- insufficient funds having been set aside, *ie* underfunding
- the insolvency of a sponsor or provider of the benefits
- the holding of investments which are not matched to the liabilities
- a combination of these events.



Question

Give examples of how underfunding in a benefit scheme may have occurred.

Solution

A funded benefit scheme, *ie* one in which money is set aside prior to paying the benefits, could be underfunded because:

- the assumptions about future experience were unduly optimistic, *ie* the contributions were unrealistically low
 - the assumptions were reasonable but the experience turned out to be unfavourable, *eg* poor investment returns or regulatory changes requiring benefit improvements
 - the sponsor did not pay what was required in terms of contributions, *eg* due to poor commercial performance or even insolvency.
-

Risk of illiquid assets

A separate risk is that the funds, although sufficient, are not available when they are required to finance the benefit. This illiquidity may arise when assets have been set aside to fund the benefits, but it is more likely to occur if no separate assets exist.

The usual way of mitigating against liquidity risk is to hold cash. However, it is not normally necessary for a funded scheme to hold significant levels of cash as the income flow from contributions and investments will usually provide sufficient liquidity for most schemes to meet benefit outgo.

The same applies to insurance companies in relation to premium and investment income relative to claim outgo. There is though the risk that new business volumes may fall and the insurer then lacks sufficient liquidity to meet outgo.

For an unfunded benefit scheme, *ie* one in which the employer meets the cost as the benefit payments are made (also known as pay-as-you-go), the risk is that the resources are not available when needed to meet the benefit once it comes into payment, *eg* due to poor commercial performance.

Risk of benefit changes

There may be a further risk that a benefit promise is changed or is changeable within the terms of the contract.

In the case of non-State provision of benefits, legislation will usually prevent a worsening of benefits that relate to past periods, unless the beneficiary agrees to the change.

However, some types of contract, for example critical illness contracts, may have definitions of an insured event that are not guaranteed throughout the terms of the contract.

Many critical illness contracts allow flexibility to the insurer to extend the range of conditions covered, or limit them (for example if medical advances mean that a certain condition is no longer deemed life threatening).



Question

Give an example of why each of the State, employer (as scheme sponsor) and individual may want to change benefits.

Solution

State

State benefits usually change in order to reduce costs, *eg* to deal with the increased costs arising in an ageing society. They may change to meet legislative requirements too, *eg* the equalisation of State retirement ages for men and women following a European Court ruling.

Employer

An employer-sponsored scheme may be integrated with the State scheme, *ie* target an overall level of provision including the State benefits. Any change in State benefits will have an impact on net employer benefits.

Individual

Personal arrangements need to change due to changes in an individual's circumstances, eg marriage or the arrival of children.

Risk of failing to meet the beneficiaries' needs

Where funds are sufficient and liquid, and the level and incidence of benefits is exactly as promised, the beneficiaries are still exposed to the risk that these promised benefits do not meet their needs.

This may be as a result of:

- a failure to recognise this when the benefit promise was made
- inflation eroding the value of the benefits
- beneficiaries' circumstances changing.

2.2 Benefits that are not known in advance

This sub-section principally relates to benefits (and claim payments) from defined contribution schemes, with-profit and unit-linked life insurance policies. Some of the ideas are also relevant to (most) general insurance policies.

Investment and expense risk

Where benefits are not fully defined, but are instead linked in some way to the funds available and investment conditions, there is further uncertainty, and hence risk, for the beneficiary that the level of the benefits will be lower than expected if:

- the investment return is lower than had been anticipated, or
- any expense charges deducted are higher than expected.

Annuity risk

The level of the benefits will also be reduced if the terms of purchase for any investment vehicles are worse than had been anticipated.

For example, for a member of a defined contribution scheme, if an annuity were to be purchased to provide a retirement pension, the level of the pension would be dependent on the terms on which an annuity could be purchased at the retirement date.



Question

State the two main factors that would lead to a worsening of the terms on which an annuity can be purchased.

Solution

The two main factors are:

- falling bond yields (because annuity providers tend to back annuities with bonds)
 - increasing longevity.
-

The annuity risk can be mitigated to a certain degree by switching the assets of a retirement pension fund into those that underlie the annuity as retirement approaches.

Fixed-interest bonds are typically held to back fixed-interest annuities and index-linked bonds are typically held to back index-linked annuities.

If yields on these assets fall, the cost of purchasing annuities will rise. However, this should be offset by a rise in the value of the retirement pension fund.

Risks exist to the extent that the investments held prior to retirement differ from those underlying the basis for calculating the annuity rate.

The risk may remain with the provider of the defined contribution arrangement if there are guaranteed annuity rates that provide higher benefits than could be bought in the market.

In the past, insurance providers in the UK offered contracts with guaranteed annuity options. These allowed policyholders the option to purchase a guaranteed minimum level of income with a lump sum, and these contracts were sold in large numbers. Falling interest rates combined with improving mortality led to the guaranteed minimum annuity rates 'biting' unexpectedly, often with a high cost to providers.

Risk of inadequate benefits

There is a risk that either inflation or a failure to recognise benefit needs when planning provision leads to benefits that do not meet the beneficiaries' true needs, and they consequently suffer a lower than expected standard of living.

Inflation risk

As mentioned above, there is inflation risk for the beneficiary. Inflation may mean price or earnings inflation.

For a pension scheme, the inflation risk applies both before and after retirement. Before retirement, the risk is that the value of past contributions will reduce in real terms relative to earnings if the investment return is below earnings inflation. After retirement, the risk is that the purchasing power of the pension will be reduced if it does not increase as quickly as price inflation.

There is also inflation risk for the provider. For example:

For non-life insurance policies there is the risk that the payment on an insured event occurring is much higher than was anticipated when the policy was written. This could happen when inflationary increases in the value of the insured property are higher than general inflation, or when the courts award higher than anticipated levels of compensation for insured events.

2.3 General benefit risks

Whether benefits are defined or not, there are some general factors that create uncertainty around the benefits to be received.

These are:

- **default by sponsor / provider at a time when the funds held are insufficient**
- **default by sponsor / provider when funds held include loans to the sponsor / provider**
- **failure by sponsor / provider to pay contributions / premiums in a timely manner**
- **takeover of the sponsor / provider by an organisation unwilling to continue to meet benefit promises**
- **decision by the sponsor / provider that future benefits will be reduced**
- **inadequate communication by the sponsor / provider with beneficiaries, for example relating to the strength of the sponsor / provider, guarantees etc, giving rise to complaints and possible compensation to some beneficiaries and shortfall for others**
- **general economic mismanagement by a sponsor / provider of assets and liabilities may also lead to a risk of a benefit shortfall.**

3 Contribution / premium risks

3.1 Contributions / premiums that are known in advance

For example, for a defined contribution scheme.

Risk of unaffordable contributions / premiums

If the contributions / premiums are pre-defined, there is a risk that the payer will be unable to afford them. There is a particular risk if the payer and the beneficiary are not the same person, for example in the case of a company sponsored benefit scheme providing pension payments for employees.

The risk is that the specified contributions / premiums are not made because:

- the party is unable to afford the contributions because it is in poor financial circumstances (or, in the extreme, bankrupt), or
- the party's immediate cashflow position is poor and assets cannot be liquidated readily to meet the contribution / premium requirements.

The second point may not be so much a risk of *non-payment* as *late payment*.

Contributions / premiums that are defined in real terms will create a risk that the inflationary factor to which they are linked increases at a rate greater than that anticipated.

If contributions are fixed in monetary terms, there is the risk that the resultant benefits are unable to provide for an expected standard of living.

Note that the *inflationary factor* could be prices or earnings. Specifying contributions in real terms helps to ensure that the levels invested are consistent over time in terms of their purchasing power. There is the risk that such contributions defined in real terms become unaffordable for the payer.

3.2 Contributions / premiums that are not known in advance

For example, for a defined benefit scheme.

Uncertain level of future contributions / premiums

If benefits, rather than contributions / premiums, are defined, it will not be possible to be certain about the level of contributions required until all benefits have been provided and no future liabilities exist. These issues are relevant to a sponsored benefit scheme where the sponsor (usually the employer) is not the beneficiary.

It is useful here to distinguish between cost and contribution. Cost is only known once the benefits have been paid in full. When funds are set aside in advance of benefits being provided, the contributions are payments towards the *estimated* cost of the benefits.

The overall level of the contributions required will depend on:

- **the amount of the promised benefit**
- **the probability of individuals being eligible to accrue the benefits**
- **the probability of individuals being eligible to receive the benefits**

An example of the two bullet points above would be the likelihood of a member being entitled to an ill-health early retirement pension as part of their benefit package, and then the likelihood that they actually need to take ill-health early retirement and satisfy the scheme's definition of serious ill health.

- **the effect of inflation on the level, or the real level, of the benefits**
- **the investment return achieved on the contributions (net of tax and expenses, if appropriate).**

To the extent that liquid funds are not set aside in advance of benefits being provided, the above factors will also lead to uncertainty about the incidence of contributions.

Risk of insufficient assets

Other uncertainties relating to the incidence of contributions result from the extent to which the value of any funds set aside does not equal the value of funds that are expected to be required to cover future benefit payments.

For example, if it is thought that the funds set aside will not be sufficient to meet the benefits for which they were intended, additional funds will be required. In theory, these additional contributions could be provided at any point in time before the benefits need to be provided. However, in practice there may be either legislative or self-imposed constraints on the timing of these contributions or the sponsor may become insolvent before the additional funds are provided.



Question

Suggest ways in which a deficit in a defined benefit scheme may be corrected.

Solution

A deficit may be corrected via:

- an immediate lump sum contribution
 - an addition to the contribution paid each year for several years to eliminate the deficit
 - a reduction in the benefits payable (although this is not normally allowable retrospectively in many regulatory regimes).
-

Holding a margin of assets over those required to meet the expected benefits reduces the risk of having insufficient assets in the future, which in return reduces the risk of additional contributions being required.

One legislative approach is to require that the values of assets and liabilities are regularly assessed and compared, with corrective action being required if the assets are not sufficient.

Furthermore, in some countries a minimum capital requirement must be held in addition to the value of the liabilities.

Liquidity risk

Any requirement to make good any shortfall by payment of extra contributions clearly creates a risk that the sponsor / provider has insufficient liquid funds to do so. If re-assessments are frequent, changes in contributions are likely to be of a manageable size.

Excessive contributions required

A further risk that may result from excessive contributions is that the sponsor / provider itself may become insolvent. This may affect a beneficiary's total income more than the loss of insecure benefit promises. There may be a balance to be struck if the employer is the sponsor of the benefits.

For example, it would not be in an employee's interest for a very high contribution rate to be required from the employer to fund the pension scheme, if as a result of this onerous contribution requirement, the employer became insolvent and hence the employee lost their job.

Takeover risk

There is also the risk that if the sponsor / provider is taken over by a third party, the new owner may not be willing to continue to sponsor / provide the benefits.

Cost of guarantees

If contributions / premiums are pre-defined but there is a minimum guarantee applying to the level of benefits, the sponsor / provider will incur extra costs, which will arise if those guarantees ever apply. To reduce the extent of these risks for a sponsor / provider, who meets the balance of the cost, the cost of any guarantees should be taken into account in setting the defined contributions and the investment strategy.

For example, the above might be the case in a defined ambition scheme. There is the additional risk of not knowing in advance which element, defined benefit or defined contribution, will apply. The sponsor may therefore build in an extra element of contribution to cover the likelihood that the guarantee will apply at some point in the future.



Question

Explain how the additional risk would be assessed for a pension scheme that provided a defined benefit promise with a defined contribution underpin.

Solution

Firstly we need to know how the underpin is calculated (*eg* based on just members' contributions or an element of the employer's as well) and how the defined contribution will be invested.

Stochastic modelling may then be used to assess the risk, *ie* how likely the defined contribution underpin is to bite.

If it is unlikely to bite, the situation is very similar to that for a defined benefit scheme. If it is very likely to bite, the situation is effectively the same as for a money purchase scheme.

3.3 General contribution risks

Whether contributions / premiums are defined or not, there are a number of other factors that may lead to uncertainty in the contributions / premiums required.

These are:

- **loss of funds due to fraud or misappropriation**
- **incorrect benefit payments**
- **inappropriate advice**
- **administrative costs, especially resulting from compliance with changes in legislation**
- **decisions by parties to whom power has been delegated**
- **finances or removal of tax status resulting from non-compliance with legislative requirements**
- **changes to tax rates or status.**

Often benefit schemes will delegate certain powers to specialists, *eg* investment managers, benefit administrators, *etc.* Any bad advice given or mistakes made by them may result in the sponsor having to make higher contributions than otherwise anticipated.

Inappropriate advice

Inappropriate advice may result from:

- **incompetence or insufficient experience of the advisor**
- **lack of integrity of the advisor, perhaps due to sales related payments**
- **the use of an unsuitable model or parameters**
- **errors in the data relating to the beneficiaries**
- **State-encouraged but inappropriate actions**
- **over-complicated products.**

A major example of the risks of inappropriate advice arose in the UK in relation to the mis-selling of personal pension policies to individuals who had better provision through an employer-sponsored arrangement. This is thought to have been caused by a combination of some of the above factors.

Guarantees

Any guarantees provided by the sponsor / provider reduce uncertainties for the beneficiaries. However, they lead to an uncertainty for the sponsor / provider because of the risk of the guarantees biting and causing an increase in costs.

The benefits of guarantees and the costs of meeting them is an important feedback loop into the actuarial control cycle.

4 Overall security

4.1 Security

The overall security of benefits is related to all of the factors that affect the uncertainty of benefits, contributions and investment returns.

The factors set out so far in this chapter can affect the overall security of a benefit scheme or financial product provider. Investment returns are also a source of uncertainty in relation to the security of the benefits. A recap of the components of investment risk is included below.

The security is affected to the extent that a need for extra contributions, for whatever reason, is not met immediately.

If any of the risks do materialise, then the security of members' benefits within a benefit scheme can be preserved provided that additional contributions are available. This assumes that the contributions required are correctly assessed. There are risks involved in the calculation of those contributions.

4.2 Investment risk

As described in earlier chapters, where the investment risk exposure lies depends on the nature of the scheme or product. For example for defined benefit schemes and without-profit life insurance products, it is borne principally by the provider; for defined contribution schemes and unit-linked products, it is borne principally by the beneficiary.



Question

List the investment risks associated with a financial product.

Solution

Investment risks for a financial product include:

- uncertainty over the level and incidence of investment income
 - uncertainty over the level and incidence of capital gains
 - reinvestment risk arising from mismatching assets and liabilities
 - default risk
 - investment returns being lower than expected
 - benefits not being appreciated due to poor investment returns
 - liquidity risk
 - lack of diversification
 - changes in the taxation of investment income and gains
 - investment expenses.
-

4.3 Model, parameter and data risk

There may also be risks to overall security that result from errors in determining the contribution / premium requirements. Such errors may be a result of:

- **the use of an unsuitable model**
- **the use of unsuitable parameters**
- **errors in any data used to determine parameters for the models**
- **errors in the data relating to the beneficiaries.**

These are examples of operational risk.

The errors described can lead to the problem of inappropriate advice, *eg* incorrect recommendations about the levels of contributions to be paid into a benefit scheme. This in turn can threaten the security of the scheme.

Similarly, if insurance companies erroneously charge premiums that are too low, this will impact profits in the first instance and ultimately could jeopardise the solvency of the company.

4.4 Strength of the sponsor / provider promise

The strength of the promise by the sponsor / provider and the impact of the asset allocation on the ability to meet promises made in adverse circumstances should be communicated to the beneficiaries.

The ability and the willingness of the sponsor to pay sufficient contributions to meet benefits as they fall due are known as 'sponsor covenant'. It is a source of credit risk, but is very difficult to measure.

5 Business risks for financial product providers

5.1 Introduction

Business risk was introduced as a risk category in the previous chapter. This section considers in more detail the business risks that are typically faced by financial product providers, particularly insurance companies – but also with relevance to benefit scheme providers.

These risks relate to:

- claims: mortality / longevity, morbidity, general insurance claim rates and amounts
- expenses
- withdrawals / renewals
- new business volume and mix
- options and guarantees
- use of reinsurance (insurance company) or insurance (benefit scheme).

There is some overlap with these risks and those considered earlier in this chapter. In particular, the 'insurance risks' covered in the first three sub-sections below relate to uncertainty in the timing (and possibly amount) of benefit payable, and the 'exposure risks' relate to both benefits and contributions.

5.2 Mortality and longevity risks

These are examples of insurance risk and also relate to underwriting risk.

These are the risks that assumptions made about the future mortality of lives taking out new products, or with existing contracts, are not borne out in practice.

Longevity risk tends to be defined as being the risk of individuals living for *longer* than expected, *ie* mortality rates *lower* than expected. Mortality risk may then be defined similarly as the risk of *higher* than expected mortality rates.

Under-estimating mortality rates will have an adverse impact on the profits obtained from term assurance business, and over-estimating mortality rates will have an adverse impact on the profits obtained from annuity business.

This might be due to a change in the long-term mortality rate, a change in the rate of mortality improvement, a one-off shock such as a pandemic, or even random variation.

Mortality (pre-retirement) and longevity (post-retirement) are also key risks for pension scheme providers.

A pandemic may have a more significant impact if the company has written a lot of business concentrated in one geographical area. This is an example of 'exposure risk'.

5.3 Morbidity risk

This is the risk that the actual morbidity experience of existing and new customers differs from assumptions made.

As with mortality experience, differences between the actual and assumed morbidity experience could be due to changes such as the duration of illness, the rate of incidence of illness or a one-off pandemic shock.

The need to consider both the rate of incidence and duration is particularly the case for income protection business, where the benefit is payable for an ongoing period whilst the individual remains ill or disabled.

The duration of the claim is generally modelled through claim termination (rather than an explicit duration assumption).

For pension scheme providers, there may be a risk of mis-estimating ill-health retirement rates, depending on the relative generosity of the benefits provided.

5.4 General insurance claim risks

There is a risk that claim volumes or claim amounts may be significantly different to those expected.

For general insurance, the equivalent to the insurance risk that arises in relation to mortality, longevity and morbidity rates is the uncertainty in relation to the claim rates or claim *frequency* of the business written.

For most general insurance products, there is also uncertainty relating to the *amount* of claim.

There is therefore a risk that the assumptions made about claim rates and amounts, for both existing and future new business, prove to be incorrect.

For example, this might be due to climate change, exceptional natural events, changes in customer behaviour, unexpected increases in court award inflation *etc.*

These risks can be categorised as insurance (claim variation), underwriting (inappropriate rating approach) and exposure (concentration) risks.

5.5 Expense risk



Question

Outline the main causes of expense risk.

Solution

Expense risks include:

- higher than expected base expenses (*eg* due to budget over-runs, lack of expense control or poor estimation)
 - unexpected one-off or exceptional costs (*eg* due to dealing with unexpected regulatory change)
 - higher than expected levels of expense inflation
 - mismatching between the timing and level of expense outgo and charge income
 - inadequate spreading of fixed expenses.
-

A product provider's expenses can be expressed in terms of unit costs: the cost per new plan written, the cost per in-force policy and the cost of each claim paid. Unit costs comprise expenses as the numerator and a volume measure as the denominator. Lapses and business volumes written affect the denominator and so expense, persistency and new business volume risks are interlinked.

In particular, a low volume of new and/or retained business means having to spread fixed expenses over a smaller number of contracts. Therefore expense risk is partially related to exposure risk.

Expenses comprise variable costs, directly related to business activity volumes, and fixed costs that are independent of business volume. Variable costs can generally be managed easily by expansion or contraction of operational areas. Fixed costs are less tractable and are where expense risk usually arises.

Expenses could also differ from the level expected, for example, due to an unplanned budget overrun.

Expense risk is also relevant to benefit schemes.

5.6 Persistency or renewal risk

This can be considered to be an example of exposure risk, as it impacts the amount of in-force business.

Whether lapses are a source of surplus or deficit depends on the funds notionally held against a particular policy compared to any surrender value paid. If the lapse rate is different from that assumed, surplus or deficit will result.

For example, an insurance company is at risk from policyholders withdrawing at a time when the amount of premiums less expenses accrued in respect of that policy is negative and/or is less than any surrender value payable. This is most likely to happen at early durations, before the company has recouped its initial expenses. A higher than expected number of such withdrawals will cause a deficit.

There may similarly be withdrawal risk for a benefit scheme relating to the number of members leaving the scheme, depending on the benefits offered.

Increased lapses will always adversely affect expense unit costs.

As mentioned above, this will impact the spread and therefore recovery of fixed costs.

There may also be a risk of *selective* withdrawals, ie 'better than average experience' policies withdrawing, leaving a set of policies with 'worse than average experience'.

A high level of withdrawals can also cause liquidity issues for a financial product provider or benefit scheme.

5.7 Volume and mix of business risks

These are more examples of types of exposure risk.

Writing new business requires capital to support the additional risks taken on and thus the available capital places an upper limit on new business volumes.

If higher than expected volumes of business are sold, the company might face solvency issues arising from new business strain. Furthermore, the administrative department might struggle to deal with very high new business volumes, leading to potential operational and reputational issues. Hence companies may have to limit new business volumes in order to mitigate these risks.

Volumes of new policies directly affect expense unit costs, and so link to expense risk.

If an insurance company sells lower than expected volumes of business, then it is at risk that its fixed expenses will not be met.

For benefit schemes, there are equivalent risks relating to the number of new members joining.

All products carry risks, so a different volume and mix of business to that anticipated affects all other risk areas.



Question

Explain how mix of business risk arises for an insurance company.

Solution

It is often the case that certain types of business subsidise other types. For example, the fixed expenses associated with policies providing small benefits might be too high to allow the policies to be competitive, therefore premiums for policies providing large benefits might subsidise the fixed expenses for smaller benefit policies. This means that an insurance company will be at risk of selling a higher volume of smaller benefit policies relative to larger benefit policies. There may also be subsidies by distribution channel.

Not all insurance products or policies may have been priced to generate the same level of profit. There is therefore a risk that the actual mix of new business sold is weighted more towards those products or rating factors with lower profit margins than was originally expected.

5.8 Option and guarantee risks

If a financial product or scheme provider has offered options or guarantees, then it will be exposed to further risks:

- There is a risk that the options become valuable to beneficiaries (and so are exercised) or that the guarantees bite, so that the cost to the provider will be higher than expected. This is normally driven by other sources of risk, *eg* market risk, depending on the precise nature of the option or guarantee offered.
- There is a risk that more beneficiaries take up an in-the-money option than had been assumed, thus similarly increasing the cost.
- By offering options and guarantees, the provider is likely to be required to hold more capital (to cover the extra risk). There is therefore a risk of higher than expected capital strain and potential solvency or surplus issues, if there is a high additional business volume.

5.9 Reinsurance risk

An insurance company may choose to reinsure some of its risks and similarly a benefit scheme may choose to use insurance (*eg* for pensions in payment).

Using a counterparty in this way generates credit (default) risk, but there may also be business risk relating to uncertainties arising from:

- inadequate appreciation of the scale of the risks assumed and hence of the (re)insurance needs
- limited availability or prohibitive cost of the desired (re)insurance
- failure to comprehend the coverage / limits of a (re)insurance arrangement.

Chapter 26 Summary

Risks and uncertainties

Risks and uncertainties relate to both benefits and contributions / premiums.

The key risks to the *beneficiary* are that:

- the benefits will be less valuable than required or expected, or
- they will not be received at the required time.

The key risks to the *provider* are that:

- benefit payments will be greater than expected, or
- payments will be required at an inopportune time.

There are also risks to the *State*, in particular the risk of having to put right any losses incurred.

Benefit risks

For benefits that are *known in advance*, a key principle is to ensure that sufficient assets are available to meet the liabilities as they fall due. The risks that need to be managed include:

- inadequate funds having been set aside, *ie* underfunding
- insolvency of sponsor / provider
- asset / liability mismatching
- illiquid assets, *ie* funds not available when required
- change in the benefit promise, *eg* by the State or provider
- beneficiaries' needs not being met, *eg* due to misunderstanding, inflation erosion of value, changed circumstances.

For benefits that are *not known in advance*, the risk of inadequate benefits arises from:

- investment returns being lower than expected
- expense charges being higher than expected
- where relevant, annuity purchase terms being poorer than expected (*eg* defined contribution scheme, if an annuity is taken)
- beneficiaries' needs not being met, either due to design or inflation erosion of value.

For both cases, there are further risks resulting in benefit uncertainty. These are:

- default by sponsor / provider
- failure by sponsor / provider to pay contributions / premiums in a timely manner
- takeover of the sponsor / provider
- decision by the sponsor / provider that benefits will be reduced
- inadequate communication by sponsor / provider with beneficiaries
- general economic mismanagement of assets and liabilities by a sponsor / provider.

Contribution / premium risks

For contributions / premiums that are *known in advance*, the risks are:

- the contributions / premiums are unaffordable and hence not made
- insufficient liquidity to make the payments in a timely manner
- the contributions / premiums are linked to an inflationary factor, thereby introducing the risk that they increase more rapidly than anticipated
- the contributions / premiums are not linked to inflation and therefore the resultant benefits are eroded by inflation.

For contributions / premiums that are *not known in advance*, it must be remembered that cost and contributions / premiums are likely to be different. Costs will not be known until no future liabilities exist. Future contributions / premiums will depend on:

- the amount of the promised benefit
- the probability of individuals being eligible to accrue the benefits
- the probability of individuals being eligible to receive the benefits
- the effect of inflation on the level, or the real level, of the benefits
- the investment return achieved on the contributions / premiums (net of tax and expenses, if appropriate).

If there is a shortfall in a *defined benefit scheme*, the sponsor may be required by legislation to make extra contributions / premiums. Associated risks include:

- lack of liquid funds
- excessive contributions, which the sponsor may not be able to afford.

There are also risks relating to:

- takeover of the sponsor / provider by a third party that is not willing to continue to provide the benefits
- extra costs incurred through the provision of guarantees.

For both cases, there are further risks resulting in contribution / premium uncertainty. These are:

- loss of funds due to fraud or misappropriation
- incorrect benefit payments
- inappropriate advice
- administrative costs, *eg* to comply with changes in legislation
- decisions by parties to whom power has been delegated
- fines or removal of tax status resulting from non-compliance with legislation
- changes to tax rates or status.

Overall security

Other uncertainties arise in relation to:

- investment risk
- model, parameter and data risks
- the strength and security of the sponsor / provider.

Business risks for financial product providers

The following generate business risk for financial product providers:

- claims: mortality / longevity, morbidity, general insurance claim rates and amounts
- expenses
- withdrawals / renewals
- new business volume and mix
- options and guarantees
- use of reinsurance (insurance company) or insurance (benefit scheme).

The practice questions start on the next page so that you can keep the chapter summaries together for revision purposes.



Chapter 26 Practice Questions

- 26.1 Construct a table that summarises the benefit risks for defined benefit and defined contribution schemes.
- 26.2 Construct a table that summarises the contribution risks for defined benefit and defined contribution schemes.
- 26.3 (i) Explain the operation of a defined contribution benefit scheme. [1]
- Exam style** An individual has purchased an individual defined contribution pension arrangement.
- (ii) Give reasons why the individual may receive a lower pension than anticipated from the arrangement. [8]
- (iii) Outline the steps that could be put in place to reduce the likelihood of the individual's pension being significantly lower than anticipated. [4]
- [Total 13]
- 26.4 An individual is purchasing a private medical insurance policy.
- Exam style** (i) Describe the factors that may lead to that individual being advised to purchase an inappropriate policy. [6]
- (ii) Suggest ways in which the individual can mitigate against inappropriate advice. [4]
- [Total 10]
- 26.5 List the main claim-related business risks for a life insurance company.
- 26.6 Employers' liability insurance provides compensation to an employee or their estate for bodily injury, disease or death suffered, owing to negligence of the employer.
- Exam style** Describe the characteristics of claims under this type of business. [6]
- 26.7 A small general insurance company writes only personal lines motor insurance business.
- Exam style** (i) Describe the areas of risk and uncertainty that relate to the claims experience of this insurer. [12]
- (ii) Describe the other business risks to which this insurer might be exposed. [8]
- [Total 20]
- 26.8 A life insurance company plans to launch a regular premium unit-linked pension product.
- Exam style** The only charge levied under the product will be a fund-based annual management charge, equal to 1% of the value of the units.
- The benefit payable at maturity or on earlier death or surrender is the value of the units.
- Describe the main risks the company faces in relation to this new pension product. [12]

- 26.9 A house-owner is considering taking out an endowment assurance to repay the capital sum under a mortgage of £60,000 due in 25 years' time. During the term of the loan, interest payments are made to the lender, but no capital is repaid.

The individual first considers:

- (a) A regular premium, 25-year, without-profit pure endowment where the only benefit payable is £60,000 on survival to the maturity date.

Then the individual considers two other products:

- (b) A regular premium, 25-year, with-profit endowment assurance where the basic sum assured is £40,000 payable on death or survival to the maturity date. Regular and terminal bonuses are payable. In recent years the regular bonus has been a simple bonus of 3% of the basic sum assured. On death before the maturity date, the minimum benefit payable is guaranteed to be £60,000.
- (c) A regular premium, 25-year, unit-linked endowment assurance where the sum assured payable on death before the maturity date is £60,000, or the value of units if greater. On the maturity date the value of units is payable.
- (i) Describe the risks avoided and accepted by the investor in opting for product (a).
- (ii) Suggest insurance products that could be purchased in order to overcome some of the risks accepted.
- (iii) Describe the additional risks avoided and accepted by the investor in opting for each of products (b) and (c) compared with (a).



Chapter 26 Solutions

26.1 Summary table of benefit risks:

<i>Benefit risks</i>	
<i>Defined benefit schemes</i> • Inadequate funds due to: – underfunding – sponsor insolvency – asset / liability mismatch • Illiquid assets • Benefit changes, <i>eg</i> by State • Members' needs not met due to: – misunderstanding – inflation erosion of value – changed circumstances	<i>Defined contribution schemes</i> • Lower than expected investment returns • Higher than expected expense charges • Poorer than expected annuity purchase terms (if an annuity is purchased) • Members needs not met due to: – design – inflation erosion of value
<i>Both defined benefit and defined contribution schemes</i> • Sponsor default • Failure by sponsor to pay contributions on time • Takeover of the sponsor • Decision by the sponsor to reduce benefits • Inadequate communication with beneficiaries • General economic mismanagement by sponsor	

26.2 Summary table of contribution risks:

Contribution risks	
<i>Defined benefit schemes</i> • Future contributions unknown and depend on: – the amount of benefit – eligibility to accrue benefits – eligibility to receive benefits – inflation – investment return net of tax and expenses • Extra contributions may be required to meet a shortfall, resulting in liquidity risk or excessive contributions • Takeover by third party not willing to continue contributions	<i>Defined contribution schemes</i> • Unaffordable contributions • Insufficient liquidity to make the payments in a timely manner • Contributions may be linked to an inflationary factor, introducing an inflationary risk • If not linked to inflation, the resultant benefits may be eroded by inflation
<i>Both defined benefit and defined contribution schemes</i> Extra contributions may be required due to: • loss of funds due to fraud or misappropriation • incorrect benefit payments • inappropriate advice • administrative costs, <i>eg</i> to comply with changes in legislation • decisions by parties to whom power has been delegated • fines or removal of tax status resulting from non-compliance with legislation • changes to tax rates or status.	

26.3 (i) **Defined contribution scheme**

A defined contribution scheme provides a benefit payment that is dependent on the contributions paid into the scheme in respect of that member, together with the investment return earned on those contributions. [1]

(ii) **Reasons for a lower pension**

Less is paid in contributions than expected, *eg* due to: [½]

- salary increases being less than expected (since often the contributions into the scheme are expressed as a percentage of salary) [½]
- the individual taking career breaks [½]
- the individual retiring earlier than expected [½]
- net invested contributions being less than expected due to higher charges. [½]

Lower investment return is achieved than expected, *eg* due to: [½]

- under-performance of assets leading to lower than expected investment income [½]
- under-performance of assets leading to lower than expected capital growth [½]
- contributions being paid later than expected, so there is less time to earn investment returns [½]
- a fall in market values at the time that the pension annuity is purchased [½]
- investment expenses (or fund-related charges) being greater than expected. [½]

The pension annuity purchased may cost more than expected, *eg* due to: [½]

- a fall in the investment return the annuity provider expects to receive post-retirement, *ie* fall in bond yields (since bonds are typically used to back annuities) [1]
- improving mortality, so more benefit payments are expected to be made [½]
- a change in the type of annuity purchased, for example: [½]
 - inclusion of spouse pension [½]
 - inclusion of pension increases [½]
- expense and profit allowances in the cost of the annuity may be greater than expected. [1]

The member may choose to take some of the fund as cash, so less money is available to purchase the annuity. [½]

There may be changes to regulation that affects benefits. [½]

For example if the tax incentives available on contributions, investment income, capital growth or the benefit are reduced then the net pension will be lower. [1]

[Maximum 8]

(iii) Steps to help reduce the likelihood of the pension being lower than expected*Regular reviews*

Regular reviews of the accumulating fund should be carried out. [1]

These will identify any changes in, for example:

- the individual's circumstances [½]
- the performance of investments [½]
- charges [½]
- legislation. [½]

Actions can be taken in response to these issues to ensure the member's fund remains on target to provide the benefit. [1]

For example contributions may need to be increased, or investment choice changed. [1]

Matching of assets

As the member approaches retirement, if the fund is moved into the appropriate type of bonds to match that used in pricing the annuity then the individual will be protected against movements in market values close to retirement. [1]

[Maximum 4]

26.4 (i) Sources of inappropriate advice

Inappropriate advice may be a result of:

Incompetence or insufficient experience of the advisor [½]

A medical plan is a complex product and there are many different products in the market designed to meet different needs. The advisor may take insufficient care in determining the exact needs of the individual, leading to the recommendation of a plan that provides benefits of inappropriate types and/or at an inappropriate level. [1]

Lack of integrity of the advisor [½]

The advisor may be swayed to recommend a product that provides a higher commission payment to the advisor. [½]

The use of an unsuitable model or parameters [½]

Projections may be provided to illustrate the likely benefits that can be provided for a given level of premiums. Errors in the underlying model or the parameters used may mean the policy does not meet the individual's needs. [1]

The provider may reserve the right to review premiums at certain dates in the future. If the original model or parameters were inappropriate then future premiums may rise and be unacceptable to the policyholder. [1]

Errors in the data [½]

An inappropriate policy may be recommended in the light of incorrect information being supplied or recorded in respect of the individual and any other dependants intended to be covered under the policy. [1]

State-encouraged but inappropriate actions [½]

A policy may be recommended or chosen that has been encouraged by the State but is in fact inappropriate, *eg* covering something already provided by the State. [½]

Over-complicated products [½]

Medical plans are complex products, and consequently the individual may end up with the wrong policy as a result of not understanding how a particular product operates. [½]

[Maximum 6]

(ii) Mitigating against inappropriate advice

- Check that the advisor is appropriately qualified.
- Only use a financial advisor who has been recommended by a trusted source.
- Carry out research of their own into private medical schemes before consulting the advisor (so as to be better equipped to understand and question the advice given).
- Look for an advisor who operates on a fee basis, rather than using commission.
- Make sure that the product sold incorporates a cooling-off period (so that the policy can be cancelled during an initial period if it is found that inappropriate advice has been given).
- Seek a wide range of quotes for comparison.
- Be honest about their needs, state of health and financial position (so that the advisor has the correct data with which to offer advice).
- Make sure that they are financially aware.
- Question government advice.
- Read the small print.
- Check their understanding of the product before committing to purchase.
- If the individual discovers that inappropriate advice has been given, then they could write to the regulator or ombudsman in pursuit of compensation.

[½ for each sensible mitigation option, maximum 4]

26.5 For a life insurance company, the main claim-related business risks relate to:

- mortality
- longevity
- morbidity:
 - critical illness incidence rates
 - income protection claim inception / termination rates
 - long-term care claim inception / termination rates
- medical advances (diagnosis, cures *etc*)
- loose policy wordings
- accumulations of risk and catastrophes
- anti-selection
- moral hazard
- selective withdrawals (increasing mortality / longevity / morbidity risk)
- use of reinsurance
- mortality / morbidity options.

26.6 ***Claims characteristics of employers' liability insurance***

Variability

Policies will be heterogeneous, since employers will vary significantly in the types of risk to which they are exposed. [1]

For example, there would be big differences between the types of risk faced by an actuarial consultancy and a chemical factory. [½]

In addition, claims may be quite variable from year to year. [½]

Unusual claims

There is a risk of a single large claim, *eg* a highly paid young employee suffers an accident, for which the employer is liable, that prevents future work. [1]

There is a risk of a catastrophic event, *eg* an explosion at a chemical factory. [1]

There is a risk of accumulations, *ie* lots of claims from a common cause, *eg* lots of claims due to repetitive strain injury. [1]

There is a risk of claims arising from causes that were unknown at the time the policy was sold (latent claims), *eg* the significant number of asbestosis claims that have emerged in recent years. [1]

Reporting and settlement delays

There may be delays in claims being reported, for example an employee may not suffer the symptoms of an industrial disease until several years after exposure. [1]

There may be delays in settling claims, since claims need to be validated and complex cases may undergo court proceedings. [1]

Nature of claims

Some types of claim may have fixed payments that have been agreed in advance, whereas other claims are likely to be real in nature, linked to lost earnings. [1]

Currency

Claims are likely to be in the domestic currency, except where the employer has overseas operations that are also covered. [1]

[Maximum 6]

26.7 (i) ***Risk and uncertainty in the claims experience***

Risk and uncertainty will arise both from the outcome of business already written and in the determination of premiums to charge in future periods. [1]

Claim amount and frequency

There is uncertainty about the amount of each claim, ... [½]

... and claim frequency. [½]

Motor insurance claims are subject to wide variability in amount. [½]

As the insurer is small, it may have limited experience on which to base its assumptions about future claims, ... [1]

... particularly for those claims which are relatively low frequency but high potential cost (*ie* liability claims). [1]

Delays from occurrence to notification and from reporting to settlement result in uncertainty regarding the ultimate cost of claims. [1]

Poor underwriting standards generate the risk that claim experience is not as intended. [1]

Changes in risk over time

There is uncertainty as to whether changes in claim amounts and frequency year on year are due to changes in the underlying risk or merely random variation. [1]

If the company is aiming to attract different risks to those it has historically held, the claims experience may differ from the past. It is difficult to determine how the claims will change. [1]

If cover has been changed, there probably won't be sufficient data to make a reliable estimate of the impact of the change. [½]

There is uncertainty in relation to customers' attitude to claiming. Society is becoming increasingly litigious and experience suggests that policyholders are starting to claim for events that they would not have done so for previously. [1]

Claims for accidental damage and theft may increase due to crime rate changes. The timing of any increasing crime rate is uncertain. [1]

Changes in economic conditions may impact claim experience, *eg* due to its relationship with crime, and future such changes are uncertain. [1]

New vehicle types may be underwritten incorrectly. [½]

Anti-selection

There may be opportunities for anti-selection if the premium rates do not appropriately reflect the risk across the full range of business written. The degree of anti-selection within the portfolio may change over time and be difficult to estimate. [1]

Accumulations of risk and catastrophes

A flood or hurricane could lead to many claims, *eg* due to trees falling on cars or cars being washed into rivers. [1]

As this is a small company it could be geographically exposed by writing a lot of business near its head office. This could lead to an aggregation of claims from a weather event in the area. [1]

Inflation

There is uncertainty about future inflation, which will affect claim amounts – especially for bodily injury claims. [1]

'Court award' inflation is uncertain, being based on judicial decisions. [1]

(Precedents will be set involving new types of claim eligible for compensation, and occasionally a new level of awards is set for existing types of claims. This will immediately increase the average amount at which all future claims are settled. Sometimes these decisions will be retrospective, meaning that the uplift applies to all outstanding claims incurred as well as future claims.)

Legislation

Tax changes might impact claim costs. [½]

There may be legislative changes that result in changes in the cost of cars or the cost of repairs. [½]

Legislation changes might result in changes in cover, *eg* the removal of an upper limit on compensation or the introduction of a requirement to pay hospital charges *etc.* [1]

There may be the introduction of a restriction on the factors that can be used in underwriting. [½]

Claims handling costs

Variability will also exist in terms of the incidence and cost of handling claims. [1]

Currency risks

Paying claims in other territories exposes the company to the risks of fluctuating currencies and currency mismatching (if provisions are not backed by assets denominated in those currencies). [1]

Reinsurance

The use of reinsurance is subject to uncertainty as:

- the company may inadequately appreciate the scale of the risks and purchase inadequate reinsurance [1]
- it may have doubts about the value for money and availability of reinsurance [1]
- it may not have understood fully the coverage / limits of the reinsurance arrangement [½]
- the ability to make a recovery will depend on the solvency position of the reinsurer. [½]

Policy wording

There is a risk that policy wording is too loose, so that the company has to pay claims that it did not intend to provide cover for. [1]

Similarly the wording on reinsurance contracts must be precise so that the company can recover what it expects to. [½]

[Maximum 12]

(ii) Other business risks*Expenses*

Sales, marketing and administration expenses may be higher than expected *eg* due to poor expense control. [1]

Expense inflation may be higher than expected. [½]

There may be unexpected one-off or exceptional costs, *eg* dealing with unexpected regulatory change. [1]

Renewals

Renewal rates may be lower than expected, generating less profit for the company. [1]

Also, per policy expenses will be higher than expected as fixed expenses have to be spread over a lower volume of business. [1]

New business volume

New business volume may be lower than expected, which reduces total profits ... [1]

... and increases the risk that fixed expenses are not recouped. [½]

This might arise because:

- competitors may offer better product features ... [½]
- ... and lower prices [½]
- the insurer may have fallen behind in the use of technology and so gained less business. [½]

There are business volume risks relating to the underwriting cycle. The insurer only writes motor business, so there is no opportunity to cross-subsidise with classes at different stages of the cycle. [1]

Therefore, at the bottom of the cycle, the insurer will either lose business or will have to charge lower premiums (which has implications for profit and the solvency position). [1]

The insurer may sell much higher volumes of business than expected, causing administration strain, ... [½]

... and potentially also capital strain, depending on the extent of capital requirements. [½]

New business mix

Not all policies may have been priced to generate the same level of profit. There is therefore a risk that the actual mix of new business sold is weighted more towards those products or rating factors with lower profit margins than was originally expected. [1]
[Maximum 8]

26.8 ***Unit-linked pension product***

Business risk

The sales, marketing and administration costs may be higher than expected, thus reducing the profit achieved per policy. [1]

The product development costs may be higher than expected, making it more difficult to achieve an acceptable return on the capital invested. [1]

The withdrawal rate may be higher than expected. [½]

With a large part of the total charges emerging late in the term of a policy, this would significantly reduce the profitability of the business. [1]

For early withdrawals, there is a risk that the company has not recouped its initial expenses. [1]

This is particularly an issue if the company pays up-front sales commission. [½]

Insufficient new business may be generated to recover the costs incurred when developing the product. [1]

This may be due to various reasons, *eg* unrealistic plans or unfamiliarity of the existing sales outlets with the new product. [½]

The average premium size achieved may be lower than expected. [½]

Since charges received depend on premium size and a reasonable proportion of expenses are fixed, this would reduce the profitability of the business. [1]

The new product might be much more popular than expected, selling high volumes. [$\frac{1}{2}$]

The consequent demand on capital may be higher than expected, placing a strain on the company's ability to finance the business – or reducing the volume of business that can be written. [1]

Administration teams might also be put under pressure in those circumstances, causing operational or reputational issues. [1]

As the death benefit is the value of units, mortality is not a significant risk (and it is also unlikely that reinsurance would be used). [$\frac{1}{2}$]

Market risk

The investment performance of the unit funds might be worse than expected. [$\frac{1}{2}$]

If poor relative to competitors, this reduces the marketability of the product and may reduce new business volumes and increase surrenders. [1]

In addition, the fund-based charges will be lower than expected. [$\frac{1}{2}$]

Credit risk

There may be issues relating to the performance of counterparties if some of the operations of the new product are outsourced, *eg* investment management. [1]

Liquidity risk

There may be liquidity issues if a large number of policyholders wish to surrender at the same time, ... [1]

... particularly if the unit funds invest in direct property. [$\frac{1}{2}$]

Operational risk

There may be errors made in the pricing (*ie* setting the charges) of the new product. [$\frac{1}{2}$]

If there are significant differences from the company's current products, greater problems than expected may be experienced developing new administration systems or training staff in the new product. [1]

External risk

Competitors may offer lower charges on a similar product in order to attract a higher market share, forcing the company to respond or to accept lower levels of new business. [1]

Future regulatory, legislative or tax changes may undermine the attractiveness of or profit from the product. [1]

[Maximum 12]

26.9 (i) ***Risks avoided and accepted with product (a)***

The main risk avoided is any inability to repay the loan amount at maturity, since the survival benefit is exactly equal to the mortgage amount.

The main risk accepted is the lack of any benefit payable on death or serious illness before the end of the loan period.

Depending on the terms of the contract, little or no benefit may be available on early surrender and the surrender value is likely to be less than £60,000 throughout the term.

There is therefore a risk involved if the mortgage is to be repaid early.

There is a risk that the client cannot afford to pay the premiums due to illness.

There is a risk that the insurance provider becomes insolvent and does not pay the benefit.

(ii) ***Other insurance products***

Some of the risks accepted could be overcome by additionally purchasing:

- a 25-year (without-profit) level term assurance for a sum assured of £60,000
- critical illness insurance, as for the term assurance
- income protection insurance (or a waiver of premium benefit which pays the insurance premiums during the period of sickness)
- if available, pecuniary loss insurance to protect against the default of the insurer.

(iii) ***Alternative endowment assurances***

Product (b)

This covers the death risk since the benefit on death is £60,000, or £40,000 plus bonuses if greater.

An additional risk is accepted because the maturity benefit is now unknown rather than known.

The maturity benefit is now £40,000 plus bonuses, which may be less than £60,000.

This risk might be considered small, however, as a simple bonus of 2% in each of the 25 years will give a maturity value of £60,000, even without the payment of a terminal bonus. The recent rate of regular bonus has been higher than this, at 3%.

The product is likely to have a surrender value but, as with product (a), it may be on unattractive terms.

Product (c)

This covers the death risk since the benefit payable on death is at least equal to the mortgage amount of £60,000.

An additional risk is accepted because the maturity benefit is now unknown rather than known.

The value of units could be more or less than £60,000, depending on the investment performance.

The level of this risk will depend on the level of premium being paid, and whether there any policy reviews to keep the policy 'on track'.

The risk of charges reducing the size of the fund particularly when investment returns are also low

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Accepting risk

Syllabus objectives

- 4.5 Discuss risk appetite and the attainment of risk efficiency.
- 5.4 Describe how risk classification can aid in the design of financial products that provide benefits on contingent events.
- 7.2 Distinguish between the risks taken as an opportunity for profit and the risks to be mitigated.
- 7.3 Describe the principle of pooling risks.

0 Introduction

The decision to accept risk, or even to actively take on more of it, and how this relates to risk appetite was introduced in the earlier chapter on Risk governance.

Section 1 of this chapter discusses risk appetite in more detail. It also describes the need to hold sufficient capital for risks that are accepted or retained, and considers the existence of a market for risk. A 'market for risk' exists if the price at which one party is happy to accept a risk is less than the perceived cost of the risk to a second party. Where there is a good market for risk transfer, the system is said to be 'risk efficient'.

The classic example of an organisation proactively accepting risk is an insurance company. The rest of the chapter explores this example in more detail. Section 2 considers the relationship between risk and insurance product design and Section 3 covers the criteria for a risk to be insurable (and hence for a price to be set), including the principle of pooling risks.

1 Risk appetite and risk efficiency

1.1 Risk appetite of different stakeholders

As introduced in the earlier chapter, risk appetite can be broadly defined as being a statement of the maximum amount and types of risk that an individual or organisation is prepared to take on, in order to meet their objectives.

Different stakeholders will have different appetites for risk and even within a particular class of stakeholder there will be different appetites for risk.

For example, one individual may have a speculative attitude to market risk, while another might be highly cautious. The speculative individual will prefer investing in emerging markets or highly geared funds, while the cautious individual would avoid any equity investment at all.

Corporate entities also have different appetites for risk. Frequently the risk appetite is described in public documents, such as the company's annual report.

For a corporation, the risk appetite needs to be set by the board and then communicated clearly throughout the organisation.

Although the published statements of risk appetite may be unquantified, most organisations, and particularly those in the financial sector, should quantify their risk appetite so that it is a measurable item that can be included in monthly or quarterly management information packs.

For a provider of schemes providing benefits on future contingent events, a quantifiable risk appetite might be that the organisation will not accept risks that would cause its available capital to fall below $x\%$ of the regulatory minimum capital requirement (where x might be 150 or 200, for example).

Other examples for a company might be:

- that the probability of a credit rating downgrade over the next twelve months should be less than 1%
- that profit volatility over the next twelve months should be no more than $y\%$.

Risk appetite may be linked to other features of the individual or company, such as their existing exposure to a particular risk, but it may also be a feature of the culture of the company or the type of individual.



Question

Give other examples of features of a company that may influence its risk appetite.

Solution

Other features of a company that may influence its risk appetite include:

- size
 - period of time for which it has operated
 - level of capital available
 - existence of a parent company / other guarantors
 - level of regulatory control to which it is exposed
 - institutional structure (*eg* mutual or proprietary)
 - previous experience of the board members
 - attitude to risk of owners and other providers of capital.
-

In advising clients, it is important that the actuary has a good understanding of the client's risk appetite in all the relevant areas.

1.2 Capital requirements of risk

A person or company that retains any risks needs to have sufficient capital to cope with the consequences of the risk event occurring. For individuals, this is almost never the case.

For example, individuals who do not insure the contents of their houses against flood normally do not insure either because they cannot afford the premium or because they have a risk preference not to insure low likelihood events. The choice to go without insurance is not because they are in a situation where they have sufficient capital to pay to repair and refurbish their house after a flood.

Companies also have risk appetite and this can result in inadequate available and working capital being held for the risks retained.

This situation would arise if the risk appetite is set at an inappropriate level, accepting or retaining more risk than there is available capital to cover, or if the amount of required capital held to cover such risk is not set at an adequate level.

To avoid financial product providers adopting an inappropriate risk appetite, regulatory authorities may impose minimum levels of retained solvency capital derived from a risk assessment of the business.

In Europe and other territories that have adopted regulatory regimes based on Solvency II, insurance companies are required to hold sufficient capital as calculated by an internal model or standard formula based on the company's exposure to the main risks affecting insurance business.

We look at such capital requirements in more detail later in the course.

1.3 Markets for risk

The fact that different entities have different appetites for risk enables a market for risk. Risk can then be transferred between entities with a small appetite to those with a larger appetite. Almost all financial transactions can be simplified to a transfer of risk from one entity to another in exchange for a payment of money.

An important illustration of this 'market for risk' is the transfer of risk from an individual to an insurance company through the purchase of a life or general insurance contract.

For example, an individual is likely to have an appetite for theft of contents from their home that is lower than the value of the contents that might be stolen. The individual consequently pays a premium to an insurance company to transfer the risk to the insurance company.

The insurance company has a greater appetite for the theft risk because:

- **it is larger**
- **by pooling the risks, the company can still have stable returns and make a profit from the premiums it charges.**

Where there is a good market for risk transfer, the system is said to be risk efficient.

Individuals and companies with excess of risk can transfer the excess to others who have less risk than they are prepared to accept. If the market is of adequate size, normal economic factors will result in an efficient market.

2 Risk and product design

The previous section introduced the idea of insurance contracts as being part of the 'market for risk'. This section explores that idea further, describing the considerations for the insurance company when designing products to accept such risks.

2.1 Financial products as a risk transfer mechanism

A financial product is a means by which one party transfers risk to another party, normally making a cash payment to the party taking on the risk.

The prime examples are pure insurance products: term life assurance cover, motor vehicle insurance and property damage insurance.

The payment made not only needs to cover the cost of the risk being transferred, but also needs to enable the party taking on the risks to make a profit.

In the examples above, the insurance company normally needs to expect to make a profit in order to take on those risks.



Question

Give two examples of reasons why the insurance company might not aim to make a profit when taking on an insured risk.

Solution

The company might be writing the business as a loss leader, *eg* in order to sell a higher volume of other products.

The company might be insuring that risk because it diversifies against other risks already accepted, and does not need it to be profitable on a standalone basis.

It is more difficult to see why investment in a collective investment scheme results in risk transfer. It can be argued that the investor does not want to take the risk of poor performance because of a lack of knowledge of certain investment markets. The investor buys a service, investment expertise, because they cannot do the job as well themselves, and any poorly done job increases the risk of failure.

It is also possible that the person transferring the risk may be able to do the job just as well themselves, but there are other activities they would rather spend their time doing, either because they are more profitable, or just because they are more enjoyable. Quality of life has a value.

2.2 Cost of risk

Refer to [Chapter 28](#) for methods of quantifying risk.

Each risk covered by a product has a cost. Methods of quantifying risk are outlined in the next chapter and are covered in more detail in the various Specialist Principles subjects.

However, it is important to note that the cost of risk depends not only on the features of the financial product being designed, but also on the features and other business of the product provider.

For example, an insurance company with a large book of immediate annuity business may be able to offer competitive terms for without-profit whole life assurances, such as products designed to cover funeral costs or inheritance tax liabilities. While there is no perfect match for the annuities, writing the new assurance products will reduce longevity risk across the company and it may be able to include negligible or zero cost of mortality on the new contract.

Good product design techniques will list all the risks involved in the product and will consider how each is controlled, transferred, or accepted and costed.

2.3 Risk classification

In order to determine an appropriate cost for a particular policy, it is necessary to perform risk classification. In this context, risk classification means analysing a portfolio of prospective insured risks by their risk characteristics, such that each subgroup represents a homogeneous body of risk.

For example, prospective policyholders for life assurance can be classified by age group and by whether a smoker or non-smoker. Thus the price to be charged for the risk to be covered can be assessed more accurately.

In deciding on the extent of the classification, there will be a trade-off between the desire for homogeneity within each group of risks (and hence for more accurate pricing of the contract) and the need to have sufficient data in each risk group to give credibility. If the risk classification process has split the risks into too many subgroups, there will be insufficient data in each subgroup to be meaningful.



Question

- (i) Suggest factors by which a general insurer could classify risks under a personal motor insurance policy.
 - (ii) Explain why there is typically a greater degree of risk classification for general insurance risks compared to life insurance risks.
-

Solution

(i) A general insurance company could classify risks under a personal motor policy by:

- gender of the insured driver
- age of the insured driver
- postcode of the area in which the vehicle is kept
- type of vehicle
- age of vehicle
- number and type of previous accidents / claims
- use of the vehicle – social, domestic or pleasure
- existence of driving convictions
- anticipated mileage
- and many more...

The factors used in setting premiums are known as *rating factors*.

(ii) The reasons for typically greater risk classification in general insurance than in life insurance are that:

- General insurance is highly competitive and largely sold on price. Market pressures have led to greater classification in order for general insurance companies to protect themselves against adverse selection from the policyholder.
- General insurers typically have a greater volume of data to work with than life insurers, making greater risk classification more possible and meaningful.
- Policyholders are likely to be more willing to provide the data required by general insurers, *eg* in relation to number of miles driven, type of car *etc* when purchasing motor insurance, as opposed to data required by life insurers relating to their state of health.

2.4 Appreciation of benefits by recipient

In most cases, financial products and schemes are designed to meet the needs and desires of the beneficiaries, by someone other than the beneficiaries themselves. This might be an employer or the trustees of a sponsored benefit scheme, or the marketing department of an insurance company.

There is a risk that the designer's perception of the needs and desires is not consistent with the views of the potential beneficiaries. If the beneficiaries do not appreciate the benefits, it is unlikely that they will purchase the product, or take up the relevant scheme options.

This risk can be mitigated by small scale product trials, market research, focus groups and similar activities.

2.5 Product complexity

It is a common feature of product design that various groups consulted in the design process believe that the product will be that much more marketable or will look better than a competitor's product if this or that additional option was included.

It is important to realise that all such options introduce new risks, and that each additional risk needs to be paid for.

Reverting to the underlying risk analysis behind the product will enable the designers to determine an appropriate design for a mass-market product and to decide on the extent to which additional risks can be covered.

In markets aimed at high net worth individuals, including additional options and complexity may be viewed as being part of providing a superior product and worth the additional costs.

3 Risk taken as an opportunity

In financial services, risk is a tradable commodity. Insurance is one of the processes whereby risk is assessed and priced. If the price at which one party is happy to accept a risk is less than the perceived cost of the risk to a second party, the opportunity exists for a risk transfer to the mutual satisfaction of both parties. This is a fundamental rationale for both insurance and reinsurance.

It is wrong to believe that risk is always bad. Often, risk can represent an opportunity. For example, people that live in coastal or riverside areas may face the risk of flooding to their property. However, companies that produce sand bags or flood defences will see this risk as an opportunity. In fact, the *non-occurrence* of flooding or the removal of flood risk could be a business risk for such companies, as it could even put them out of business.

3.1 Insurable risk

Not all risks are insurable. There are some criteria that a risk *must* satisfy in order for an insurer to be prepared to take on the risk.

For a risk to be insurable:

- the policyholder must have an interest in the risk being insured, to distinguish between insurance and a wager
- a risk must be of a financial and reasonably quantifiable nature
- the amount payable in the event of a claim must bear some relationship to the financial loss incurred.



Question

Explain why each of the bullet points above is important for a risk to be insurable.

Solution

- The policyholder must have an interest in the risk being insured in order to have an interest in the claim event not happening. They therefore will not (in theory) encourage it to happen. For example, a homeowner has an insurable interest in protecting their own home against theft and fire but not in protecting someone else's home. Therefore, a homeowner can generally only take out insurance on their own property or properties and not on a property or properties belonging to other people.
 - The risk must be of a financial and reasonably quantifiable nature so that a monetary claim amount from an insurer can compensate for the loss, and so that the insurer is able to assess the risk and set an appropriate premium.
 - The claim amount must bear some relationship with the size of the financial loss since:
 - if the claim amount is too large, this will encourage fraud and moral hazard
 - if it is too small, purchase of the insurance may not be deemed to be worthwhile.
-

In most countries, individuals are deemed to have an unlimited insurable interest in their own lives and that of any spouse.

For the purposes of life insurance, other parties in which an individual might be deemed to have an insurable interest include:

- business partners of the individual
- someone on whom the individual is financially dependent.

3.2 The principle of pooling risks



Insurers and reinsurers take on risks in return for a premium because in doing so they can combine or pool many risks together, which means that there is greater certainty in the future payments they are likely to have to make on the occurrence of an insured event.

The 'law of large numbers' should be familiar from earlier mathematical studies. The law of large numbers states that, as a sample of observations (drawn from independent and identically distributed random variables) increases, the average of these observations will tend towards the true expected value.

For example, if we roll a fair die several times, the average score will vary widely at first, but as the number of rolls increases, the average score will tend towards the true expected value of 3.5.

In relation to insurance, the more risks that are insured, the more likely it is that the average outcome is close to the expected outcome.

As well as the three *definite* requirements for a risk to be insurable, as stated in the previous subsection, there are a further six *desirable* criteria.

Ideally risk events need to meet the following criteria if they are to be insurable, as the law of large numbers means that these will help the insurer reduce the volatility of the risk profile they hold:

- Individual risk events should be independent of each other.
- The probability of the event should be relatively small. In other words, an event that is nearly certain to occur is not conducive to insurance.
(On the face of it, death is certain, so a whole life assurance does not fit within the above criterion. However, the considerable uncertainty over timing still gives rise to an insurable event.)
- Large numbers of potentially similar risks should be pooled in order to reduce the variance and hence achieve more certainty.
- There should be an ultimate limit on the liability undertaken by the insurer.
- Moral hazards should be eliminated as far as possible because these are difficult to quantify.
- There should be sufficient existing statistical data / information to enable the insurer to estimate the extent of the risk and its likelihood of occurrence.

However, the desire to write business means that an insurer may be found to provide cover when these ideal criteria are not met.

For example, ideally risks should be independent of each other. In practice we won't often get strict independence, but a low correlation is desirable.



Question

Explain why the risks under private motor vehicle insurance policies sold by an insurer may not be independent of each other.

Solution

There is the risk that the actions of one policyholder could affect those of another. For example, if an insurer covered many vehicles in one particular district, then several of its policyholders could be involved in the same accident, *eg* a motorway pile-up.

It is in the assessment and quantification of risk that the actuary can create opportunities. This analysis may be taken to a further stage with the recommendation of risk mitigation processes. A process by which risks are identified and by which procedures are proposed to manage and control them is further evidence of opportunity arising from the existence of risk.

Risk mitigation and control techniques are described in later chapters.

Chapter 27 Summary

Risk appetite and risk efficiency

Different stakeholders will have different risk appetites. It is important for an actuary to understand the client's risk appetite.

Risk appetite will also vary within a class of stakeholders, *eg* dependent on features of a particular individual or a particular company.

Risk appetite may be related to:

- existing exposure to the risk
- the culture of the individual / company.

Sufficient capital is needed if a risk is to be retained. Individuals rarely have sufficient capital to absorb the consequences of a risk event occurring.

The fact that different stakeholders have different appetites for risk enables risks to be transferred between different entities in exchange for a monetary payment.

Where there is a good market for risk transfer, the system is said to be risk efficient.

Risk and product design

Insurance products are prime examples of a means by which one party transfers risk to another party, for a cash payment which needs to cover the cost of the risk plus profit.

Collective investment schemes allow individuals to transfer the risk of making poor investment decisions due to lack of expertise or lack of time to perform research.

All risks involved in a product should be identified during the product design process, and mitigation techniques considered. It may be possible to hedge risks across different product types (*eg* immediate annuities and whole life assurances).

In order to determine an appropriate cost for a particular policy, risks should be classified into subgroups, each of which represents a homogeneous body of risk with a particular set of rating factors.

There is a risk that a product design will not meet beneficiaries' needs and desires. This can be addressed through market research and trials.

Additional options may make a product more attractive, but also introduce new risks and therefore additional cost.

Insurable risk

A risk is insurable if:

- the policyholder has an interest in the risk
- the risk is of a financial and reasonably quantifiable nature
- the claim amount payable bears some relationship to the financial loss.

The following criteria are also desirable for a risk to be insurable:

- individual risks should be independent
- the probability of the event occurring should be relatively small
- large numbers of similar risks should be pooled to reduce variance
- there should be a limit on ultimate liability undertaken
- moral hazard should be eliminated as far as possible
- there should be sufficient existing data / information in order to quantify risk.

Pooling risk

Insurers and reinsurers take on risks in return for a premium because in doing so they can combine or pool many risks together.

This means that the law of large numbers takes effect, which implies that actual results are increasingly likely to be close to expected results, which results in greater certainty (lower volatility) for the insurer.

Through the assessment and control of risk, actuaries create opportunities for insurance companies to make profit by accepting risk.



Chapter 27 Practice Questions

- 27.1 A large multinational pharmaceutical company has recently expanded its range of products and also the level of investment in future research and development.

Outline the factors that will affect the company's appetite for risk.

- 27.2 Risk is transferred between the following pairs of stakeholders:

- (i) sponsors of pension schemes to insurance companies
- (ii) trustees of a pension scheme to their advisors
- (iii) insurance companies to auditors of insurance companies
- (iv) members of an investment scheme to investment managers
- (v) insurance companies to banks
- (vi) insurance companies to reinsurance companies.

Describe the key risk(s) transferred and the payment involved in each case.

- 27.3 (i) State the six *desirable* criteria for a risk to be insurable.
- (ii) Explain why each of these criteria is desirable to an insurance company.

- 27.4 In a few years' time, Spaceport USA aims to offer flights into space for paying passengers. This will be the first time that such flights have ever been made available, anywhere in the world.

Exam style

The company that will be operating these flights has asked an insurer to provide it with a liability insurance contract that will pay out on the death or injury of passengers as a result of any incident during take-off, flight or landing. The company will be the policyholder and the contract will indemnify against the legal liability to make payments to the passengers (or their estates) following such an incident.

Discuss whether this risk meets the various criteria that must or should be satisfied in order for it to be insurable.

[12]

The solutions start on the next page so that you can
separate the questions and solutions.



Chapter 27 Solutions

27.1 The appetite for risk will be affected by:

- the size of the company – as it is a large company it is likely to be able to take on more risk
- the nature of the company's business – the work is highly speculative, for example the costs of developing new drugs, obtaining and maintaining patents
- the company being a multinational – this means there is currency risk but also scope to diversify risk by currency / geographical region
- the level of capital available – need to consider how the recent expansion and development has been financed
- the culture of the company – which will be dependent on:
 - past experience
 - views of the board
 - views of shareholders
- the extent to which the risks relating to the new products differ from the existing risks
- any regulatory requirements / level of regulatory control to which it is exposed.

An indication of the risk appetite may be found from looking at public documents, such as the company's annual report.

27.2 (i) ***Sponsors of pension schemes to insurance companies***

The key risks faced by the sponsors of pension schemes are that benefits cost more to provide than expected, or that benefits are due at an inopportune time creating liquidity problems.

A pension scheme can transfer these risks to an insurance company by paying a premium to purchase deferred and immediate annuities with which the pensions to members are subsequently provided. The main underlying risk being transferred here is longevity risk, but other risks (market risk, expense risk) are also transferred.

The pension scheme can also purchase insurance to cover any death-in-service benefits offered by the scheme. The main underlying risk being transferred here is mortality risk.

(ii) ***Trustees of a pension scheme to their advisors***

Trustees must meet various legislative requirements with the aim of providing members' benefits. They are required to manage the pension scheme, invest the funds prudently and consider the best financial interests of all members. They may be sued by members if they fail in any of their duties. This could be classified as a type of operational risk.

By seeking and following advice (eg investment, actuarial and legal) this risk can be passed on to the advisors as these can be sued in turn if their advice is inadequate.

This transfer of risk will be in return for a fee to the advisors.

(iii) Insurance companies to auditors of insurance companies

There is a risk to the insurance company that financial statements are incorrectly prepared – an example of operational risk.

In return for an auditor's fee, auditors carefully review the financial statements of the insurance company.

(Since audits are legal requirements for limited companies, there is also a risk that by *not* getting accounts audited the insurance company is breaking the law.)

(iv) Members of an investment scheme to investment managers

The risks to an individual member of an investment scheme are their lack of expertise and having too small an individual fund to create a well-diversified portfolio.

In return for management charges, investment managers provide expertise on investment decisions and create much larger funds by pooling.

(v) Insurance companies to banks

There is a risk to insurance companies that claims fall due earlier than expected and that the insurance company does not have sufficiently liquid funds. This is an example of liquidity risk.

In return for charges, banks can provide liquidity facilities (*eg* bank overdrafts, bridging loans).

Banks also provide over-the-counter derivatives, which can be used by insurance companies to hedge market risks, *eg* protection against stock market falls. Derivatives such as options require payment of an initial premium.

(vi) Insurance companies to reinsurance companies

There is a risk to insurance companies that claims experience is more volatile than expected and that a single big claim, or an accumulation of claims or a catastrophe renders the insurance company insolvent. This is insurance (business) risk.

Insurance companies can seek insurance with reinsurance companies. This involves paying a premium to the reinsurance company.

27.3 (i) Desirable criteria for a risk to be insurable

The following criteria are desirable for a risk to be insurable:

- individual risks should be independent
- the probability of the event occurring should be relatively small
- large numbers of similar risks should be pooled to reduce variance
- there should be a limit on ultimate liability undertaken
- moral hazard should be eliminated as far as possible
- there should be sufficient existing data / information in order to quantify risk.

(ii) Explanation of criteria

- Independence – this is so that there is a spread of risk (*ie* catastrophes arising from concentrations of risk are avoided) and so that the law of large numbers can apply.
- Small probability – if the likelihood of the insured event is too high, the cost of cover, and hence the premium, could be unaffordable.
- Pooling – this is so that the law of large numbers can apply so that actual experience is likely to be in line with expected experience, and hence uncertainty surrounding claims is reduced.
- Ultimate limit – this is because an insurer will have only a finite amount of capital with which to absorb risk. An unlimited liability could cause the insurer to go insolvent.
- Moral hazard reduction – this is because it is difficult to estimate and can be costly to an insurer.
- Data available – this is so that the insurer can estimate the price.

27.4 Required criteria for insurability

The policyholder does have an interest in the risk. [½]

If there is an incident and the company is found to have legal liability to pay compensation to a passenger (or their estate), it will incur financial loss. [½]

It is in the company's interests for the claim event not to happen. [½]

As well as the process of having to agree legal compensation, an incident in which one or more passengers are killed or injured will generate reputational damage and have a detrimental impact on future sales. [1]

The risk is of a financial nature, in the form of a compensation payment. [½]

However, it may be difficult to quantify the risk as there is no precedent in terms of the amounts that would be awarded. [1]

The amounts awarded are likely to be agreed through court process, which makes them more difficult to estimate. [½]

The claim amount will indemnify the financial loss, so there is a clear relationship. [1]

Therefore, overall, these requirements are largely met. [½]

Desired criteria for insurability

There is not full independence of events: a spacecraft crash would trigger claims for multiple passengers. [1]

It would be hoped that the probability of claim is small. [½]

However, this depends on the quality of safety processes in terms of the development and build of the spacecraft, pilot training and flight protocol. [1]

The insurance company would need to assess these safety processes before considering the risk to be insurable. [½]

The flights are likely to be very expensive and there will be limited numbers who can afford them. [1]

It is unlikely that the company will operate significant numbers of flights, so it may be difficult to gain large numbers of risks for pooling. [1]

There will therefore be significant uncertainty and volatility in relation to claims. [½]

The liability to pay compensation may not be limited. [½]

As the passengers are likely to be high net worth individuals, compensation payments could be for huge amounts of money. [1]

The insurer may therefore wish to impose a maximum claim amount in the terms of the contract in order to limit its liability. [½]

Moral hazard should not be an issue, as the impact of an incident would be so devastating that those involved would not amend their behaviour simply because this insurance was in place. [1]

There is very little (or no) experience data available on which the insurance can be priced. [½]

This is because this is the first time that such an operation has been set up. [½]

It is also because in general space flights do not occur very frequently. [½]

Data from non-passenger space flight and from testing may be available, but this may not be directly relevant. [1]

Overall, many of these desirable features are not met. [½]

However, the insurer may still be prepared to provide cover due to a desire to write this business for other reasons, *eg* publicity. [1]

[Maximum 12]

End of Part 7

What next?

1. Briefly **review** the key areas of Part 7 and/or re-read the **summaries** at the end of Chapters [24](#) to [27](#).
2. Ensure you have attempted some of the **Practice Questions** at the end of each chapter in Part 7. If you don't have time to do them all, you could save the remainder for use as part of your revision.

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Risk measurement and reporting

Syllabus objectives

- 6.1 Describe the various methods used to quantify risk
- 6.2 Discuss the uses of scenario analysis, stress testing and stochastic modelling in the evaluation of risk.
- 6.3 Describe different methods of risk aggregation and explain their relative advantages and disadvantages.
- 6.4 Explain the importance of risk reporting to managers and other stakeholders.
- 6.5 Discuss the methods of measuring and reporting risk that can be used by the main providers of benefits on contingent events.
- 12.3.2 Describe the reports and systems which may be set up to monitor and manage risk at the enterprise level.
- 12.3.3 Discuss the issues facing the main providers of benefits on contingent events relating to reporting of risk.

0 Introduction

In this chapter we consider two more steps of the risk management control cycle: risk measurement and risk monitoring. These are closely linked to each other and to risk reporting, as the cycle of measuring, monitoring and reporting risk is in practice a continuous process.

In Section 1 we introduce the concept of risk quantification and then in Section 2 we consider a number of risk evaluation approaches, some of which will be familiar from the earlier chapter on Modelling.

Section 3 covers the importance of allowing for the relationship between risks when measuring them in aggregate, and describes some approaches by which this can be done. Section 4 describes some common risk measures.

Sections 5 and 6 focus on risk reporting, including the use of risk portfolios and risk registers, reporting at enterprise level and issues arising when reporting on risk to external stakeholders.

1 Risk quantification

1.1 Introduction

For all risk events there are two key features to be assessed:

- the probability of the event occurring
- the expected loss if the event occurs.

These features are sometimes referred to respectively as the frequency and severity of the risk event.

Each of these is normally a random variable, although there are some situations where the loss if the event occurs is a fixed amount rather than a random variable. This situation would normally arise in a single event insurance risk, for example an individual purchasing a term assurance policy that pays a fixed sum assured if the individual dies within the specified term.

A 'single event' insurance risk is one where there can only be a maximum of one claim during the policy term. This contrasts with most general insurance policies, which would continue to pay out on multiple claims that are incurred within the period of cover.

1.2 Subjective assessment

A common approach to risk assessment used by financial institutions is to extend the risk identification 'brainstorming' approach covered in [Chapter 25](#) so that the probability and cost or impact of the risk event are each estimated.

These estimates would be on a five-point scale (or three-point scale). For a five-point scale the assessments would be based on: 5 = high, 4 = medium-high, 3 = medium, 2 = medium-low, 1 = low.

The product of the probability assessment and the impact assessment gives a scale of 1 to 25 (or 1 to 9 for the three-point scale) as an assessment of the risk. This risk-scoring approach provides a method for ranking risk events.

The organisation could then prioritise dealing with risks with a score of higher than a certain amount (eg 15 and over for the five-point scale). Such risks could, for example, be of only medium likelihood but high potential impact, or alternatively of only medium impact but high probability of occurring.

The assessment would be carried out with and without possible risk controls, to generate a figure for the effectiveness of proposed controls. This will enable the efficiency of risk controls to be assessed against their cost.

In other words, a risk control should reduce the score by an amount which justifies the cost of implementing that control.

The assessment may be recorded in a risk register – as described later in the chapter.

1.3 Using a model

A risk event may be assessed by developing a model in which the probability of loss and the amount of loss are both treated as a random variables.

To use a mathematical model, the first need is to assign a distribution both to the probability of the risk event occurring, and also to the loss if the event occurs.

For some risks occurrence isn't an on/off event, but to quantify the risk simply it is necessary to define the event.

For example, investing in equities carries market risk. The firm could set an event as a 25% fall in equity price over a year and then research historic data to determine a probability distribution of this event. The choice of parameter for the fall in the equity market would need to be consistent with the firm's risk appetite.

Another approach would be to set the frequency of the loss event in advance, and to use this to determine the size of the parameter. For example, a 0.5% probability of an equity fall might involve a market movement of 40%.

All the considerations described in [Chapter 17](#) on Modelling need to be taken into account in designing an appropriate model – in particular, the decision as to whether a stochastic or deterministic model is appropriate.



Question

Suggest features of a risk that would make it more appropriate to model using a stochastic rather than a deterministic approach.

Solution

Possible features that would indicate that a stochastic approach is more appropriate include that the risk:

- has a high score (high severity and/or frequency) and therefore is a high priority to assess carefully
 - has a high variability of possible outcomes
 - has a lot of experience data on which to base the probability distributions
 - relates to financial guarantees or options
 - involves the mismatching of assets and liabilities.
-

Obtaining the data to parameterise the model will be a crucial issue, and the availability of data may influence the decision as to what, or whether, a model is used.

This is particularly important when rare events are considered. Even in areas where there is a large volume of data, such as mortality, where developed countries have been conducting censuses for well over 100 years, there is a need to consider a pandemic event. Here one has to go back almost 100 years to the 1919 influenza epidemic, and then realise that the effects need to be adjusted for improvements in medical science (antibiotics, antivirals), lifestyle (population movement) and general population health.

1.4 Operational risk

Operational risk is one of the most difficult to quantify. There are so many operational risk events that can affect a firm that to quantify each would be impractical, and because the events are rare and often independent each would have little impact on the aggregate risk exposure of the firm.

Not all operational risks are 'rare': events relating to administration and processing errors or systems downtime may occur relatively frequently, but would typically have relatively low severity. The more difficult operational risks to quantify are those that have low likelihood, such as dealing with the impact of external events *eg* terrorism or flooding. However, as noted above, even the more frequent operational events can be difficult to assess in totality, as there are normally so many possible processes, people and systems where failures could occur.

There are two approaches that are typically used to assess or allow for operational risk with an organisation:

- a broadbrush approach that does not perform any detailed analysis
- scenario analysis.

One approach which has been adopted in the banking sector is simply to add a percentage uplift to the total aggregated risks other than operational risks. This approach is also followed in the European Solvency II standard formula model for insurers.

This relates to the assessment of the amount of capital that is required to be held against adverse outcomes in relation to the risks, and is covered further in a later chapter.

Another approach is to use the technique of scenario analysis described in the next section. This could involve dividing the possible operational risks into perhaps 10 – 15 categories and, for each category, assessing the cost of a plausible adverse scenario.

For example, the categories might include:

- fraud
- loss of key personnel
- mis-selling of financial products
- calculation error in the computer system
- loss of business premises
- loss of company e-mail access for 72 hours.

2 Evaluation of risks

Evaluation of risks should take place throughout the risk management process, not just at one specific stage.

2.1 Scenario analysis

Scenario analysis is a deterministic method of evaluating risk. It is useful where it is difficult to fit full probability distributions to risk events (and hence where a stochastic model would be inappropriate). This could be because the risks are not suitable for mathematical modelling, or because the distribution would need so many subjective parameters that the value of using it is eroded.

Scenario analysis is frequently used when evaluating operational risks but can also be used to assess the impact of financial risks such as a global recession.

It involves a number of steps:

- **Risk exposures need to be grouped into broad categories – all risks involving financial fraud, all risks involving systems errors, for example. This step is likely to involve input from a wide range of senior individuals in the organisation.**
- **For each group of risks, a plausible adverse scenario is developed. The scenario needs to be plausible, otherwise it will not be possible to determine the consequences of the risk event. The scenario is deemed to be representative of all risks in the group.**
- **For each scenario, the organisation must translate the scenario into assumptions for the various risk factors in the model. Again, this is likely to involve senior staff input. The consequences of the risk event occurring are then calculated. The financial consequences include redress paid to those affected, the cost of correcting systems and records, regulatory fees and fines, opportunity costs while any changes are made, etc.**

In practice the mid-point of a range of possible values is usually taken.

- **The total costs calculated are taken as the financial cost of all risks represented by the chosen scenario.**

One drawback to scenario analysis is that it quantifies the severity of the scenario but not the probability of it occurring. Organisations often use their capital models to determine the probability of a particular scenario occurring.

If capital requirements have been modelled stochastically, then the probability distributions can be used to identify a confidence level for (or probability of) a particular outcome.

2.2 Stress testing

Stress testing is also a deterministic method of modelling risks, where the risk events are extreme. It is commonly used to model extreme market movements, but also has applications in modelling credit and liquidity risks.

The risks that are incurred by extreme events can be identified and investigated by the process of financial stress testing.

For example, in relation to market risk, this involves subjecting an asset portfolio to extreme market moves by radically changing the underlying assumptions and characteristics, in order to gain insight into the portfolio's sensitivities to predefined risk factors. In particular, both asset correlations and volatilities are often observed to increase during extreme market events.



Question

Give two examples of assets where a positive correlation may exist.

Solution

Examples of assets with a positive correlation:

- assets in the same sector, *eg* two shares in the same industrial sector
 - assets from different sectors that react in the same way, *eg* shares and property are both correlated to inflation.
-

There are two types of stress test:

- **to identify 'weak areas' in the portfolio and investigate the effects of localised stress situations by looking at the effect of different combinations of correlations and volatilities**
- **to gauge the impact of major market turmoil affecting all model parameters, while ensuring consistency between correlations while they are 'stressed'.**

For example, a 'weak area' may be corporate bonds if there is too high an exposure to a particular type of industry.

2.3 Combining stress and scenario testing

The principle of stress testing can be coupled with scenario testing to determine a stress scenario.

Scenario analysis identifies the factors which are impacted under the chosen scenario, and these become the factors to which stress tests can be applied. The overall stress scenario test combines the individual factor stress tests, and this is ideally done simultaneously in order to allow for inter-relationships.

When constructing a stress scenario, decisions need to be made as to how other aspects of the business will react if a stress event occurs.

For example, for a provider of unit-linked investment bonds, a sustained reduction in market values will affect:

- **income received from fund management charges**
- **persistence of existing investment bonds**
- **new business volumes**
- **the provider's regulatory capital requirements**
- **the value of the shareholders' interests**
- **the probability of any guarantees biting.**

All these factors need to be built into the model.



Question

Explain how the above factors might be affected under the given scenario of a sustained reduction in market values of the assets in which the bonds are invested.

Solution

The following might occur:

- income from charges would fall if the fund management charges are expressed as a percentage of the fund value
- persistence might worsen (*ie* higher levels of surrender) due to nervousness about the future performance of the underlying assets, or due to policyholders needing to cash in *eg* due to a shortfall of income from other investments
- new business volumes might fall, due to uncertainty about when it is best to invest in a falling market
- regulatory capital requirements might have to increase, *eg* if the calculation is risk-based and there is greater uncertainty or volatility in the market and/or if there is greater risk of not meeting expenses due to the lower expected future charges
- the value of free capital (which is ultimately shareholder-owned) would fall if invested in the same type of assets, and the value of profits expected to arise on these investment bonds would also fall due to the lower future charges, higher withdrawals and lower new business volumes
- the probability of a guaranteed minimum benefit coming into the money will increase.

Other economic factors, such as interest rates, inflation and investment returns on other asset types might also be impacted to the extent that they are correlated to this market.

The scenarios should be tailored to reveal weaknesses in terms of risk exposure and sensitivity, and should thus focus on the risk factors to which the business is most exposed.

2.4 Reverse stress testing

A requirement of regulatory bodies is often that regulated firms carry out a reverse stress test. This is the construction of a severe stress scenario that just allows the firm to be able to continue to operate its business plan.

In other words, reverse stress testing is about identifying a scenario which would *just* be enough to stop the company fulfilling its strategic business plan.

Business plan failure needs to be determined by the firm and needs to consider both the short-term and the long-term plan. This might, for example, occur if the firm has insufficient capital to meet statutory requirements, or to cover its minimum risk appetite.

It might also occur from a non-financial external event that causes the firm to cease having access to its major market.

For well-capitalised firms a reverse stress test may be an extreme event, but it nevertheless needs to be a plausible scenario.

2.5 Stochastic modelling

An obvious extension of stress testing is a full stochastic model with all the variables that give rise to risk being incorporated as probability distributions, and a full set of dynamic interactions between the variables specified. The model can then determine the capital necessary to (just) avoid ruin at any desired probability level.

Not only is such a model extremely complex to specify and build, the run times that result from having more than one, or possibly two, variables simulated by stochastic methods become impractical with even the most modern computing power.

It is therefore necessary to limit the ideal scope of the model by one or more of the following approaches:

- **Restrict the duration of the model to two years if the risk criterion is expressed as a one-year ruin probability. Some parts of the model, such as calculation of basic policy reserves for life assurance contracts, will still require projections to run-off.**
- **Limit the number of risk variables that are modelled stochastically. Deterministic approaches can be used for other risk variables. Variables that only have an adverse effect when they move in one direction can be modelled using deterministic scenario analysis. For example, in a benefit scheme it is increasing longevity that will put the scheme under stress, rather than deteriorating mortality.**
- **Carry out a number of runs with a different single stochastic variable, followed by a single deterministic run using all the worst-case scenarios together. This will determine the effect of interactions between the various variables.**

It is important to remember that the results are only as good as the model used.

The steps involved in running a stochastic model and the pros and cons of such a model were covered in the earlier chapter on Modelling.

3 Aggregating risks

3.1 Capital requirements and relationships between risks

In managing risk, attention needs to be paid to all risks, though the methods outlined in the previous sections indicate the key risks that merit most management involvement.

In many regulatory regimes for financial product providers, the capital requirement is set in respect of an event occurring within 12 months with a probability 0.5%.

For example, this is the measure used to determine the solvency capital requirement under Solvency II – which is described further in a later chapter.

This is frequently called the capital requirement for a ‘1 in 200-year event’. This phrase can be misleading to non-experts, as it implies that if an event has just occurred, it will be another 200 years before they need to worry about the next one. In practice, rare events, such as stock market crashes and extreme weather events, appear to be happening more frequently than the assumed probability indicates.

It is also the case that a 1 in 200-year overall combined event is not the same as combining individual 1 in 200-year events.



Question

Explain why the effect of multiple risks may be *less* than the sum of individual risks.

Solution

The overall combined impact may be less than the sum of that for the individual risks due to the impact of diversification or less than perfect (or even negative) correlation.

Less than perfect correlation (*ie* some independence) between the individual risks means that they are very unlikely to occur all at the same time.

The technique of stochastic modelling can be used to determine capital requirements for a firm for all risks to which it is exposed. Stochastic modelling can provide a complete distribution of outcomes to calculate capital required at a pre-determined probability level.

The stochastic model should be designed to allow automatically for programmed correlations between risk events under each simulation.

However, the time taken to run a single scenario for the whole firm can be long, and therefore it may be impractical to run the very large numbers of scenarios required to produce credible results allowing for all risks stochastically.

Numerical aggregation of risks is a practical simplification often used to aggregate the capital requirement to cover a risk at a pre-determined probability level.

Fully dependent risk events

If events are fully dependent, then the capital requirement to cover the aggregation of all risks is simply the sum of the capital required for each risk at a pre-determined probability level.

The formula for the resultant capital requirement for that probability level from n dependent risks each with a capital requirement R_j is given by:

$$\text{Capital requirement} = \sum_{j=1}^n R_j .$$

Fully independent risk events

If the risks are fully independent (and hence uncorrelated) then the capital requirement for a combination of risks that occurs with a given probability is less than the sum of the individual capital requirements.

For example, if the joint distribution of risks demonstrates certain statistical properties, the formula for the resultant capital requirement for n fully independent risks could be:

$$\text{Capital requirement} = \sqrt{\sum_{j=1}^n R_j^2} .$$

Partially dependent risk events

In most circumstances, there are dependencies between risks such that they are neither fully independent nor fully dependent.

Dependency between risks is also called correlation.

If risks are partially dependent (*ie* not perfectly correlated), the capital requirement for a combination of risks that occurs with a given probability is again less than the sum of the individual capital requirements.

The extent to which the overall capital requirement is less than the sum of the individual capital requirements is called the diversification benefit. If the risks are all fully dependent on each other, there is no diversification benefit. The lower the correlation between risks, the higher the diversification benefit. Diversification is maximised (and overall capital requirements minimised) if the correlations are *negative*.

Partially dependent risks are discussed in the next sections.

3.2 Correlations between risks

Methods for calculating the capital requirements for risks that are correlated but are neither fully independent (*ie* uncorrelated) nor fully dependent (*ie* fully correlated) are not required until the Specialist Principles subjects.

However, candidates in the examination should be able to propose some likely correlations between risks.

Some of these are:

- Inflation risk is heavily correlated with expense risk for most long-term financial products.
- Traditionally equity markets have moved in the opposite direction to interest rates, but in recent years this correlation has not been so obvious.
- Falling equity markets are likely to be correlated with increasing lapse rates on unit-linked savings products.
- Operational risk is likely to be weakly correlated with all other risks, because if management are concentrating on some other issue they may not be concentrating on routine operational matters.
- In life insurance the longevity risk on an annuity book is strongly negatively correlated with mortality risk on a term assurance book (not perfect negative correlation because the typical ages are different). An annuity writer can reduce its capital requirements for mortality / longevity by writing term assurances.

3.3 Other aggregation methods

As mentioned above, a full stochastic model is another, but often impractical, way of aggregating risks.

Correlation matrices

Correlation matrices are a simple approach that could be used to aggregate risks that are partially dependent.

A correlation matrix is a collection of correlation factors, C_{ij} , each of which represents the strength of dependency between risks i and j .

The overall capital requirement can then be expressed as:

$$\text{Capital requirement} = \sqrt{\sum_{i=1, j=1}^{n, n} C_{ij} R_i R_j}.$$

The matrix will have size $n \times n$ and will be symmetrical, since $C_{ij} = C_{ji}$.



Question

Explain how the formula above, using a correlation matrix, corresponds to the formulae previously given for the examples where the risks are fully independent and fully dependent.

Solution

If the risks are all fully independent, the correlation matrix is the identity matrix (value of 1 along the leading diagonal, 0 otherwise). Inputting this into the above formula gives the 'square root of sum of squares' formula, as expected.

If the risks are all fully dependent on each other, the correlation matrix values are all 1. Inputting this into the above formula breaks down into the sum of the individual values of R_j as expected.

Correlation matrices are relatively simple to apply. However, they rely on underlying assumptions which may not hold in practice, eg that correlation factors between risks do not vary under different conditions. Other more sophisticated approaches have therefore developed.

Copulas

An alternative way of aggregating risks is to use copulas.

It is possible that an organisation may have information about how the risks it faces operate in isolation, ie it may know approximately the individual probability distributions for each of the risks. In the context of *joint* distribution functions, these individual risk distributions are known as the *marginal* distributions.

The joint distribution combines information from the marginal risk distributions with other information on the way in which the risks interact with or depend on each other.

A copula is a function, which takes as inputs *marginal* cumulative distribution functions, and outputs a *joint* cumulative distribution function.

A copula is another way of reflecting the dependence of the inter-related risks on each other, but rather than being hidden within the joint distribution, it does so explicitly. Effectively, it is a cumulative distribution function in many dimensions.

A copula provides a way of calculating joint probabilities of risks, such as the probability of the return on the equity portfolio and the return on the bond portfolio both falling below certain levels.

Different copulas are used to describe different degrees of dependence between random variables, including dependence in the tails of distributions.

For example, some copulas allow for strong dependence in both tails of distributions, others only in the upper or lower tail.

Copulas are used widely in quantitative finance to model tail risk, which in turn enables organisations to minimise that risk and to optimise portfolios of investments.



Question

Explain why modelling tail risk is particularly important for a financial product provider.

Solution

Capital requirements tend to be assessed in relation to events that would fall into the tails of distributions, *eg* the '1 in 200-year event' mentioned earlier in this section.

Insurance companies are increasingly using copulas in their capital assessment models in order to allow for aggregation between risks.

The mathematical details behind copulas and details of their use are not in the scope of Subject CP1.

4 Risk measures

4.1 Asset risks

For investment portfolios held by financial product providers, methods of quantifying the risks within a portfolio are covered in [Chapter 16](#) on Investment management. Reporting performance against a benchmark is covered in the same chapter.

As a reminder, the active risk measures introduced in the earlier chapter were retrospective or backwards-looking tracking error and forward-looking tracking error.

4.2 Liability risks

The most common way of measuring liability risks is the analysis of experience – in other words, the ratio of the actual occurrences of an event to the occurrences expected when the risk was accepted. Analysis and reporting of experience is dealt with in [Chapter 33](#) as part of the control cycle.

It is important to stress the need for consistent classification and measurement not only of the risk events, but also of the population exposed to risk.

For example, a life insurer might analyse mortality, expense and withdrawal experience. It will be important when analysing decrements to ensure correspondence in the exposed to risk analysis.

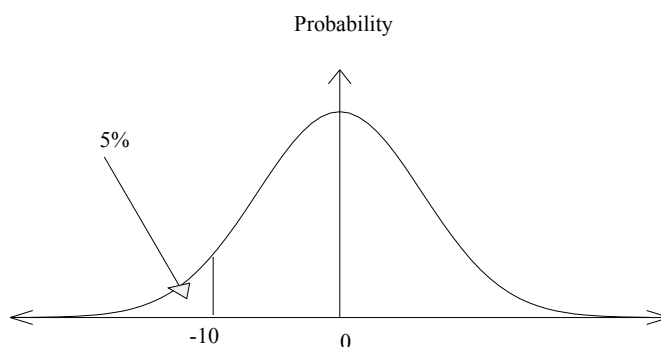
4.3 Value at risk

Value at Risk (VaR) generalises the likelihood of underperforming by providing a statistical measure of downside risk. VaR represents the maximum potential loss on a portfolio over a given future period with a given degree of confidence.

Examples

A 99% one-day VaR is the maximum loss on a portfolio over a one-day period with 99% confidence, ie there is a 1% probability of a greater loss.

A VaR of £10m over the next year with a 95% confidence interval is shown in the diagram below (the x-axis represents underperformance relative to a benchmark).



This means that there is only a 5% expected probability of the underperformance (relative to the benchmark) being greater than £10m over the next year.

VaR can be measured either in absolute terms or relative to a benchmark.

VaR is based on assumptions that may not be immediately apparent. In particular, it is frequently calculated assuming a normal distribution of returns. If the distribution of returns is 'fat-tailed', or skewed, tracking error (with its focus on the standard deviations of returns) may be misleading.

The normal distribution bell cuts off at around three standard deviations from the mean. However, if the underlying distribution is not normal, but skewed, the tail may be much longer than three standard deviations.

Unfortunately, portfolios exposed to credit risk, systematic bias or derivatives may exhibit non-normal distributions. The usefulness of VaR in these situations depends on modelling skewed or fat-tailed distributions of returns, either in the form of statistical distributions or via Monte Carlo simulations. Lack of sufficient data observations within the 'tails' of the distributions means there is increasing subjectivity in the choice of the underlying probability.

Another weakness of VaR is that it does not quantify the size of the 'tail'. An alternative risk measure is the *Tail Value at Risk*, sometimes referred to as Tail VaR or TVaR. This is the expected shortfall below a certain level, given that the shortfall has occurred. For example, if we believe that our average loss on the worst 5% of the possible outcomes for a portfolio is \$5 million, then the Tail VaR is \$5 million for the 5% tail.

5 Risk portfolios / registers

5.1 Risk categorisation and quantification

It is advisable for an individual or company exposed to risk to establish a risk portfolio or risk register. The risk portfolio categorises the various risks to which the business is exposed.

For example, a categorisation based on the types of risk identified in the chapter on Risk identification and classification might be appropriate.

Against each risk would be recorded a quantification of:

- **impact**
- **probability**

as described earlier in this chapter.

The product of the impact and the probability measures gives an idea of the relative importance of the various risks.

Example

A health and safety assessment for a company might include the following categorisations and numerical scores.

Category	Definition	Score
Hazard (H) (Potential severity)	Minor injuries – first aid treatment only	1
	Injury / illness – medical treatment / brief absence	2
	Death or severe injury or illness	3
Likelihood (L) (Potential exposure)	May occur in time – low expectation of occurrence	1
	Likely to occur in time – occasional occurrence	2
	Imminently / regular occurrence – much evidence of previous harm	3
Calculation of rating	Risk = H x L	
<i>Risk rating</i>	1 – 2 Low risk; 3 – 4 Medium risk; 6 – 9 High risk	

Risk 1: Tripping over a loose computer cable. Potential severity low *ie* 1; potential likelihood occasional, *ie* 2. Risk rating $1 \times 2 = 2$ (Low risk).

Risk 2: Fire from faulty electrics. Potential severity high, *ie* 3; potential likelihood low (due to regular electrical checks), *ie* 1. Risk rating $3 \times 1 = 3$ (Medium risk).

5.2 Risk response

The risk portfolio can then be extended to indicate how the risk has been dealt with.

For example:

- avoided
- retained (and how much capital is needed to support it)
- diversified (and a revised assessment of the remaining combination of risks)
- mitigated (and a revised assessment of the remaining risk)
 - by other internal actions
 - by transfer to another party (fully or partially).

5.3 Additional details

For risks that are retained, the risk portfolio becomes a more detailed risk register. It would also include:

- details of control measures
- reassessment of value and impact after controls
- the risk owner
- the Board committee or senior manager with oversight of the risk (key strategic risks overseen by the full Board)
- identification of concentrations of risk and the need for management action in these areas.

The risk portfolio or risk register may be created at the 'Risk identification' stage of the risk management process and then used throughout the process to monitor and report on the risks.

6 Risk reporting

6.1 Importance of risk reporting

The production of regular risk reporting is vital so that management can understand and successfully manage the risks within its business.

The production of regular risk reporting allows the management of a business to:

- identify any new risks faced by the business
- obtain a better understanding of the risks faced by the business in terms of quantifying the materiality and financial impact of individual risks
- determine appropriate risk and control systems to manage specific risks
- proactively monitor and manage the effectiveness of risk and control systems within its business
- assess whether the risks faced by a business are changing over time
- assess the interaction between individual risks
- appropriately price, reserve and determine any capital requirements for its business.

Regular risk reporting is likely to be helpful for other stakeholders as well. For example, it could:

- give shareholders or potential shareholders in a business a greater understanding of the attractiveness of that business for investment
- help credit rating agencies determine an appropriate rating for the business
- give a regulator a greater understanding of the areas within a business which could require more scrutiny.

6.2 Reporting at enterprise level

Chapter 24 on Risk governance discussed the advantages of managing and budgeting for risk at the enterprise level. By budgeting for risk across the whole enterprise, maximum use can be made of diversification benefits, and thus the minimum capital required to support the risks undertaken.

One of the consequences of this approach is that it is necessary to have a system of risk reporting across the whole enterprise. It is important for the Chief Risk Officer to be aware of whether all business units are using the risk allocation that they have been given.

This 'risk allocation' refers to the maximum amount of risk exposure that each business unit is permitted to accept, *ie* the way in which the overall risk appetite is split across the enterprise.

If two business units are allocated risk exposures that diversify away at the enterprise level, but one of the two units does not take on the risk exposure allocated, this could increase the capital requirements of the enterprise. Risk exposures will not be matched, and additional capital will need to be held to cover the unbalanced risks taken on.

Where diversification between business units is used to minimise group capital requirements, the individual business units will need to report data at a much more granular level than their own total capital requirement to the group. Analysing the data from diverse business units can be a costly task, especially for multinational operations. There is a trade-off between the costs of the additional analysis required to minimise capital requirements in this way and the cost of holding additional capital if risk diversification between business units is not assumed.

6.3 Issues relating to reporting risk externally

The usual way for a financial product provider to report on risk is by quantifying the capital required to protect against ruin at a given ruin probability.

As described in a later chapter (Reporting results), the annual report may only address risk issues in a qualitative manner, leaving the quantification of risk capital and solvency requirements to be covered in a separate report.

The above refers to the *external* reporting of risk, rather than in relation to providing *internal* management information.

The annual report accompanies the accounts of an organisation, and may include a qualitative risk report setting out the company's risk appetite, its key risks and its approach to risk management.

Risk-based solvency capital requirements may be reported separately, *eg* to the regulator.

This is normally carried out using a combination of stochastic and deterministic modelling techniques. A common approach is to use a stochastic model to determine the risk event at the required ruin probability, and then to run a deterministic projection using that risk event.

For example, a stochastic asset model might be used to determine that a fall in the domestic equity market of 45% in one year occurs with a 0.5% probability. In assessing a market risk capital requirement with a ruin probability of 0.5%, the company's projection models might be run assuming an equity fall of 45% on day one.

Details of the techniques involved in calculating the capital assessment are covered in subjects SP1, SP2 and SP7, but these are not within the scope of this course.

These are the health insurance, life insurance and general insurance Specialist Principles subjects.

The main issues facing providers of financial benefits in completing the assessment are:

- Should the ruin probability be expressed over a single year or over the whole run-off of the business? In the latter case the ruin probability will be a much higher figure than in the former.

So the Core Reading is saying that the likelihood of ruin will be much higher if we look over a longer time frame, leading to a higher capital assessment over that time frame.

- **As discussed in the earlier chapter on Modelling, a stochastic model with more than two stochastic variables will be impractical to run. Thus, a means of assessing the correlation between the risks assessed needs to be developed. The most common technique uses a correlation matrix. Populating the correlation matrix is a largely subjective exercise.**
- **Interactions between risks may mean that the effect of multiple risk events is greater or less than the sum of the individual risks. A practical technique needs to be developed to address this.**
- **Some risks, particularly operational risk, are still highly subjective in their assessment, particularly when it is necessary to construct a plausible adverse scenario that occurs at a very low probability. The temptation is to think only of risk events that have occurred, which are likely to be more common than the required ruin probability.**

This highlights why risk identification is normally considered to be the most difficult stage of the risk management process.

- **Using past data to estimate future consequences of rare events needs to be undertaken with caution.**

For example, the 1918–1919 Spanish 'flu pandemic has been assessed as an event with a probability of between 0.5% and 1%. However, because of advances in medical science, particularly the discovery of antibiotics, it is estimated that the same number of deaths as in 1918-1919 would now occur only from a much rarer event, perhaps one with 0.1% to 0.2% probability.

The chapter summary starts on the next page so that you can keep all the chapter summaries together for revision purposes.

Chapter 28 Summary

Risk quantification

For all risk events, the probability of occurrence (frequency) and expected loss (severity) need to be assessed. These are normally treated as random variables in models.

Risks are commonly assessed using simple scales which rate frequency and severity from low to high. The product of frequency and severity scales represents the overall score for that risk, enabling them to be ranked. The assessment would be done with and without controls, to assess their efficiency. The assessment may be recorded in a risk register.

It is difficult to model low frequency events due to a lack of data.

Operational risk in particular can be difficult to quantify. Typical approaches are:

- a broadbrush addition to other risks (for capital requirements)
- scenario analysis.

Evaluation of risks

Scenario analysis is useful where it is difficult to fit full probability distributions to risk events.

It involves the following steps:

- grouping of risks into broad categories
- development of a plausible adverse scenario
- calculation of the consequences of the risk event occurring for each scenario
- total costs calculated are taken as the financial cost of all risks represented by the chosen scenario.

Stress testing involves testing for weaknesses in a portfolio by subjecting it to extreme market movements (or credit or liquidity risk events). There are two types of stress test:

- to identify 'weak areas' in the portfolio and investigate the effects of localised stress situations by looking at the effect of different combinations of correlations and volatilities
- to gauge the impact of major market turmoil affecting all model parameters, while ensuring consistency between correlations while they are 'stressed'.

Stress and scenario testing can be combined to determine a *stress scenario*.

Reverse stress testing is the construction of a severe stress scenario that just allows the firm to be able to continue to meet its business plan, eg having insufficient capital to meet solvency requirements or to cover its minimum risk appetite. The scenario may be extreme, but must be plausible.

Stochastic modelling is a natural extension of stress testing but can be complex and impractical in many cases.

The model is often limited by one of following approaches:

- restrict the duration (or time horizon) of the model
- limit the number of variables modelled stochastically and use a deterministic approach for the other variables
- carry out a number of runs with a different single stochastic variable and then a single deterministic run using all the worst case scenarios together.

Aggregating risks

In many regulatory regimes, the capital requirement is set in respect of an event occurring within 12 months with a probability of 0.5% (a '1 in 200-year event'). Individual risks need to be aggregated in order to allow for correlations and inter-actions. This can be done through:

- stochastic modelling – although this may be impractical
- simple formulae if risk events are fully dependent (sum of individual capital requirements) or fully independent (square root of sum of squares)
- correlation matrices
- copulas – functions that take as inputs marginal cumulative distribution functions and output a joint cumulative distribution function.

Different copulas are used to describe different degrees of dependence between random variables, including in the tails of distributions.

Risk measures

Active risk measures for asset risks include historic tracking error and forward-looking tracking error.

Liability risks are commonly measured by carrying out an analysis of actual vs expected experience.

Value at Risk (VaR) represents the maximum potential loss on a portfolio over a given future period with a given degree of confidence. VaR calculations may be based on assumptions such as a normal distribution of returns.

Risk portfolios / registers

An individual or company should establish a risk portfolio or risk register, recording the impact and probability of each risk.

The risk portfolio can then be extended to indicate how the risk was dealt with:

- avoided
- retained (and how much capital is needed to support it)
- diversified (and a revised assessment of the remaining combination of risks)
- mitigated (and a revised assessment of the remaining risk)
 - internally
 - by transfer to another party.

For risks that are retained, the risk portfolio would also contain details of:

- control measures
- reassessment of value and impact after controls
- risk owner
- Board committee / senior manager with oversight of the risk
- identification of concentrations of risk and related actions.

Risk reporting

Regular risk reporting is vital to ensure that the risk management process is effective, including:

- identifying new risks
- quantifying the impact of individual risks
- determining appropriate control systems for specific risks
- monitoring the effectiveness of existing control systems
- assessing changes to risks faced
- assessing the interaction between risks
- assisting with pricing, reserving and determining capital requirements.

Regular risk reporting is also helpful for:

- shareholders and potential shareholders, to understand the attractiveness of the business for investment
- credit rating agencies, to help with determining an appropriate rating
- regulators, to identify areas which could require greater scrutiny.

Risk reporting should be consistent across the enterprise in order to optimise the allocation of risk appetite and to make the best use of diversification for capital efficiency.

It is usual to report externally on risk by quantifying the capital requirements to protect against ruin at a particular ruin probability.

The main issues facing providers of financial benefits in completing the assessment are:

- Should the ruin probability be expressed over a single year or the whole run-off of business?
- A stochastic model with more than two stochastic variables is impractical, so it may be better to use a correlation matrix instead.
- Interactions between risks need to be dealt with.
- Some risks, particularly operational, are highly subjective.
- Using past data to estimate future consequences needs to be undertaken with caution, particularly for low frequency events.



Chapter 28 Practice Questions

28.1 Describe stress tests that management might carry out on:

- a commercial bank
- a life insurance company.

28.2 Describe appropriate approaches to the evaluation of the following risks:

Exam style

- (i) the risk to a general insurer of poor strategic decision-making by the senior management team [3]
- (ii) the risk to a life insurer of an extreme equity market movement [3]
- (iii) the risk to the sponsor of a hybrid benefit scheme (offering defined contribution benefits with a defined benefit underpin) that the underpin bites. [3]

[Total 9]

28.3 Comment on the possible level of correlation between the following pairs of risks for a life insurance company:

Exam style

- (i) withdrawal (or persistency) risk and equity market risk, for unit-linked contracts [2]
- (ii) mortality risk for term assurance contracts and longevity risk for immediate annuity contracts [2]
- (iii) withdrawal (or persistency) risk and operational risk [2]

[Total 6]

28.4 Outline the main advantages and disadvantages of each of the following methods of aggregating capital requirements across individual risks in order to determine the overall capital requirement:

Exam style

- (a) summing the individual capital requirements
- (b) using a correlation matrix
- (c) using stochastic modelling
- (d) using a copula. [8]

28.5 Describe four approaches that can be taken to measuring investment risk.

28.6 Consider an investment portfolio of £100m whose returns per annum follow a continuous uniform distribution with probability density function:

$$f(x) = \frac{1}{0.1} \quad \text{for } -0.05 \leq x \leq 0.05.$$

Calculate the VaR over one year at the 95% confidence interval.

- 28.7 Describe the contents and use of a risk portfolio or risk register.
- 28.8 Outline the main issues a financial product provider should consider when reporting on risk.



Chapter 28 Solutions

28.1 *Commercial bank*

A commercial bank is exposed to substantial amounts of credit risk and market risk (particularly with regards to interest rates). As such, useful stress tests might include:

- testing how the asset and liability values respond to a 3% increase in short- and long-term interest rates
- testing the impact of a worsening of the credit rating of all borrowers
- testing the impact of a widening of credit spreads on assets held.

The assessment should be carried out over long enough periods to take account of cyclical effects linked to the economy.

Life insurance company

Life insurance companies are exposed to market risk (not just from interest rates but from volatility of all asset categories), risk relative to liabilities and credit risk. There are many other tests worthy of carrying out (*eg* for liquidity, mortality, persistency, expense risks), but two examples are:

- testing solvency in the event of a fall in asset prices (*eg* 20% equities, 10% bonds and some allowance for currency depreciation)
- testing solvency in the event of a widening of credit spreads on assets held.

28.2 (i) *Poor strategic decision making*

This risk is difficult to model mathematically and it would be difficult to fit a full probability distribution, given the number of subjective factors involved. [1]

An appropriate approach to evaluation may be to use scenario analysis. [½]

This will involve:

- dividing all risks into broad categories, for example this is a business risk [½]
- deriving a plausible adverse scenario for each risk, *eg* a loss of capital if develop a product which proves unmarketable or bad publicity or fall in share price *etc* [½]
- assessing, for each adverse scenario, the consequences of the risk event occurring, *eg* extent of loss of capital, impact of resulting bad publicity, affect of loss of confidence by shareholders / downgrading by analysts *etc*. [1]

The analysis should involve the senior management team. [½]

[Maximum 3]

(ii) Extreme equity market movement

Financial stress testing can be used to investigate the impact of extreme equity market movements. This involves subjecting assets, or both assets and liabilities, to extreme market movements. [1]

This can be achieved by assuming lower equity values or by changing key assumptions, *eg* the discount rate. [½]

Asset correlations and volatilities should be considered carefully. For example, a fall in the value of equities could also lead to a similar fall in the value of any property holding – so the stress test may be extended to a stress scenario. [1]

In particular, asset correlations and volatilities are often observed to simultaneously increase during extreme market events, *eg* equity values in many countries fall sharply together and exhibit high levels of volatility. [1]

There are two types of stress testing that can be carried out:

- to identify weak areas in the portfolio and investigate the effects of localised stress situations [½]
 - to gauge the impact of major market turmoil affecting all model parameters, while ensuring consistency between correlations while they are being stressed. [½]
- [Maximum 3]

(iii) Risks of an underpin biting

As this is a measurable financial risk, it is likely to be modelled stochastically. [½]

This will help the sponsor understand both the likelihood and cost of the underpin biting. [1]

Given that having many stochastic variables leads to a very complex model, it is likely only one or two key variables (*eg* investment returns, salary growth) will be modelled stochastically. [1]

A deterministic approach will be adopted for other variables. [½]

Alternatively, a number of stochastic runs may be carried out using different single stochastic variables, followed by a single deterministic run using all the worst case scenarios together. [1]

This will determine the effect of interactions between the different variables. [½]

[Maximum 3]

28.3 (i) Withdrawal (or persistency) risk and equity market risk

There is likely to be a positive correlation between the risk of higher withdrawals and the risk of equity market falls. [1]

The correlation is likely to be fairly strong. [½]

This is because when equity markets fall, policyholders can become nervous about the possibility of further falls and therefore choose to 'cash in' their policies by taking a surrender value. [1]

It is also because policyholders may need the cash sum from the surrender value during such periods. For example, if the equity market fall relates to a recession, then more individuals may have become unemployed and therefore lost their salary income. [1]
[Maximum 2]

(ii) **Mortality risk and longevity risk**

There is likely to be a strong negative correlation between these risks. [1]

This is because higher mortality rates, which have an adverse implication for term assurance business (from the company's perspective), would mean *lower* longevity rates, which have a beneficial implication for annuity business. [½]

However, the correlation is not perfect. [½]

This is because term assurance business tends to be sold to those at lower ages (*eg* to provide protection for a young family) whereas immediate annuity business tends to be sold to those at older ages (*eg* to provide pension benefits). [1]

Variation in actual from expected mortality rates may differ at different ages, *eg* mortality improvements might be faster than expected for those at older ages rather than younger ages. [½]
[Maximum 2]

(iii) **Withdrawal (or persistency) risk and operational risk**

There is likely to be a positive correlation between the risk of higher withdrawals and operational risk events happening. [1]

This is because a high number of withdrawals happening at the same time could place pressure on administration teams, making it more likely that errors are made. [1]

Considering the relationship in the other direction, if the company suffers operational risk events (as a result of failed processes, systems *etc*) that result in poor standards of customer service, there could be reputational damage and a consequent increase in policies being withdrawn or transferred to other providers. [1]
[Maximum 2]

28.4 (a) **Summing**

Advantages:

- Very simple and quick to apply. [½]
- No assumptions are needed. [½]
- Appropriate if risks are fully dependent. [½]

Disadvantages:

- Risks are normally only partially dependent (or independent). [½]
- This approach will therefore overstate capital requirements. [½]
- This will result in inefficient use of capital, opportunity cost and increased cost of capital. [1]

(b) ***Correlation matrix***

Advantages:

- Simple to apply. [½]
- Common technique that is well understood. [½]
- Allows for partial dependency between risks. [½]

Disadvantages:

- Populating the matrix requires subjective assessment. [½]
- There are underlying assumptions that may not hold in practice, ... [½]
- ... eg that correlation factors between risks do not vary under different conditions. [½]
- In particular, correlations may change during extreme market events. [½]

(c) ***Stochastic modelling***

Advantages:

- Can allow for partial dependency between risks. [½]
- Provides a distribution of outcomes. [½]
- Allows automatically for programmed correlations between events under each simulation, and these can vary according to the simulated conditions. [1]

Disadvantages:

- Can be impractical due to the long run-time required. [½]
- Requires expertise and resource to build the model. [½]
- Calibration and programming of the correlation rules can be particularly complex. [½]

(d) Copula

Advantages:

- Allows for partial dependency between risks. [½]
- Different forms of copula are available to suit different degrees of dependence. [½]
- Sophisticated way of allowing for dependence in the tails of distributions. [½]
- Therefore helps with minimising tail risk and optimising portfolios. [½]

Disadvantages:

- Expertise is required, as can be mathematically complex. [1]
- The choice of copula and its calibration (or parameterisation) can be difficult. [1]
- Can be difficult to explain to end users of the outputs. [½]

[Maximum 8]

28.5 Four approaches to measuring investment risk*Retrospective / backwards-looking tracking error*

This is the annualised standard deviation of the difference between portfolio return and benchmark return, based on observed relative performance.

Forward-looking tracking error

This is an estimate of the standard deviation of returns (relative to the benchmark) that the portfolio might experience in the future if its current structure were to remain unaltered.

This measure is derived by quantitative modelling techniques and depends on assumptions including:

- the likely future volatility of individual stocks or markets relative to the benchmark
- correlations between different stocks and/or markets.

Liability risks / analysis of experience

This would include investment risks relating to liabilities, eg due to mismatching.

The ratio of the actual to the expected occurrences when the risk was accepted would be monitored.

Value at Risk

Value at Risk (VaR) generalises the likelihood of underperforming by providing a statistical measure of downside risk. VaR represents the maximum potential loss on a portfolio over a given future time period with a given degree of confidence.

It can be measured either in absolute terms or relative to a benchmark.

It is often calculated assuming a normal distribution of returns, but this may be misleading as distributions can be 'fat-tailed' or skewed.

28.6 The VaR is given by t such that:

$$\text{VaR} = \int_{-0.05}^t \frac{1}{0.1} dx = P(X < t) = 0.05$$

$$\int_{-0.05}^t \frac{1}{0.1} dx = 0.05$$

Hence:

$$\left[\frac{1}{0.1} x \right]_{-0.05}^t = 0.05$$

$$\frac{t - (-0.05)}{0.1} = 0.05$$

$$t = -0.045$$

ie the VaR is $0.045 \times £100m = £4.5m$ over the next year.

In other words, we are 95% certain that we will not make a loss of more than £4.5m over the next year.

28.7 The risk portfolio or register provides a means by which to categorise the risks to which the business is exposed.

For example, the risks might be divided into:

- financial risks (credit, liquidity, market and business)
- non-financial risks (operational and external).

For each risk a quantification of both impact and probability will be recorded.

This may be done through a 'brainstorming' approach.

The quantification might simply be a subjective assessment on a scale of 1 to 5 for each risk.

The product of the impact and probability assessments is then calculated, which gives an indication of the relative importance of the different risks.

The risk portfolio can then be extended to indicate how the risk has been dealt with, eg:

- avoided
- accepted (and how much capital is needed to support it)
- diversified (and a revised assessment of the remaining combination of risks)
- mitigated (and a revised assessment of the remaining risk)
 - internally
 - by transfer.

The assessment would be carried out with and without possible risk controls.

This enables the efficiency of risk controls to be assessed against their cost.

For risks that are retained, the risk portfolio becomes a more detailed risk register. It would also include:

- details of control measures and their impact
- the risk owner
- the Board committee or senior manager with oversight of the risk (key strategic risks overseen by the full Board)

The risk portfolio can also help identify any concentrations of risk and highlight the need for management action in these areas.

Regular production and update of the risk register may help the company to:

- obtain a better understanding of the risks faced by the business
- assess how risks are changing over time
- identify new risks facing the business
- determine appropriate control systems.

28.8 ***Issues to consider when reporting on risk***

- The company needs to consider whether the ruin probability should be expressed over a single year or over the whole run-off of the business. In the latter case the ruin probability will be a much higher figure than in the former.
- The company needs to decide how to assess the correlation between the risks. The most common technique uses a correlation matrix. Populating the correlation matrix is a largely subjective exercise.
- The company needs to decide how to take account of the interactions between risks, since these interactions may mean that the effect of multiple risk events is greater or less than the sum of the individual risks. A practical technique needs to be developed to address this.
- The company needs to decide how to deal with risks which are highly subjective (eg operational risks), particularly when it is necessary to construct a plausible adverse scenario that occurs at a very low probability. It is tempting to think of risk events that have occurred, which are therefore likely to be more common than the required ruin probability.
- Using past data to estimate future consequences of rare events needs to be undertaken with caution, since the past may not prove to be a good guide to the future.

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29

Risk transfer

Syllabus objectives

- 7.1 Describe attitudes to and methods of risk acceptance, rejection, transfer and management for stakeholders.
(Covered in part in this chapter.)
- 7.4 Describe the methods of transferring risks.
- 7.7 Discuss the issues surrounding the management of risk for financial product providers.
(Covered in part in this chapter.)
- 14 Have an understanding of the principal terms used in financial services, investments, asset management and risk management.
(Covered in part in this chapter.)

0 Introduction

This chapter starts by setting out the various responses that a stakeholder can make when faced with a risk.

One of these responses is to transfer the risk fully or partially to another party. The rest of the chapter considers tools by which this transfer can be achieved, and in particular:

- reinsurance
- alternative risk transfer (ART).

Reinsurance is an insurance company's own insurance. It involves the insurance company transferring some of its risks to another party – a reinsurer.

Alternative risk transfer methods are non-traditional, non-standardised methods of transferring risk.

These methods are principally used for the transfer of insurance risk. Market risk and some types of credit risk can be transferred to another party through the use of financial derivatives such as options and futures. These standard derivative contracts are not covered in this chapter, but are of relevance to the management of risk for financial product providers, particularly where the products themselves contain embedded financial options and guarantees. The risk management of such features is considered in the next chapter.

1 Responses to risk

1.1 Choice of method of risk control

When faced with a risk each stakeholder can choose whether to:

- avoid the risk altogether
- reduce the risk, *ie* by either reducing the probability of occurrence or the consequences or both
- reject the need for financial coverage of that risk because it is either trivial or largely diversified
- retain all the risk
- transfer all the risk – for example by paying a premium to another party to transfer all the risk to that party
- transfer part of the risk – for example by retaining some of the risk and paying a premium to transfer the balance of risk to another party.



Question

Explain how a risk can be avoided in the case of a financial contract.

Solution

A risk could be avoided by not selling the contract or by re-specifying the design features of the contract to eliminate / exclude a particular risk. For example, many insurance contracts exclude risks, *eg* of terrorism, war.

The stakeholder can also take action to minimise the risk. For some risks, a range of options may be available to do this. Each option for mitigating a risk can be evaluated by assessing:

- the likely effect on frequency, consequence and expected value
- any feasibility and cost of implementing the option
- any 'secondary risks' resulting from the option

A strategy that reduces one element of risk could introduce an additional, but less important, element of risk (*eg* the use of insurance introduces the small risk that the insurer could become insolvent).

- further mitigating actions to respond to secondary risks

For example, insurance could be arranged with a number of insurers instead of just one in order to reduce the exposure to any one insurer defaulting.

- the overall impact of each option on the distribution of net present values (NPVs).

This refers to the net present value (NPV) of profits or revenues (net of costs) arising, for example if the risks relate to a specific project.

The extent to which a stakeholder will choose to pass on all or some of the risk will depend on several factors:

- **how likely the stakeholder believes the risk event is to happen**
- **the stakeholder's risk appetite**
- **the resources that the stakeholder has to finance the cost of the risk event should it happen**
- **the amount required by another party to take on the risk**
- **the willingness of another party to take on the risk.**

Later sections of this chapter and the next chapter cover acceptance, transfer and management of risks in more detail.

2 Reinsurance – benefits and costs

2.1 Introduction

In deciding whether to reinsure and, if so, how much to reinsure, a comparison is made of the benefits of reinsurance with the costs of reinsurance (the reinsurance premiums).



Question

Consider the situation where an insurance company and a reinsurer make the same assumptions about the estimated future claims experience on a block of business to be reinsured. Suppose also that actual experience turns out to be in line with these assumptions.

Assess which would be higher: the reinsurance premiums paid by the insurance company or the reinsurance claim amounts paid by the reinsurer.

Solution

The reinsurance premium would (almost certainly) be higher.

The reinsurer will almost certainly set the reinsurance premium to cover the expected cost of claims *plus* margins for expenses, contingencies and profit. (It is possible that the reinsurer could charge a lower reinsurance premium, *eg* due to competitive pressures and the stage in the underwriting cycle, which is why we can't be completely certain about the result here.)

The reinsurance claims recovered by the insurance company will only be bigger in the event that the experience is somehow 'worse than expected'.

2.2 The benefits of reinsurance

Reinsurance is a way of reducing, or removing, some of the risks.

The main benefits of reinsurance to an insurance company are:

- a reduction in claims volatility and hence:
 - smoother profits
 - reduced capital requirements
 - an increased capacity to write more business and achieve diversification
- the limitation of large losses arising from:
 - a single claim on a single risk
 - a single event
 - cumulative events
 - geographical and portfolio concentrations of risk

and hence:

- a reduced risk of insolvency
- increased capacity to write larger risks
- access to the expertise of the reinsurer.

The benefits that specific reinsurance products achieve are covered in Sections 4 and 5.

Example

If an insurer takes out proportional reinsurance with retained proportion α and if S is the total claim amount payable to policyholders, then:

- the total claim amounts paid by the insurer and reinsurer respective are $S_I = \alpha S$ and $S_R = (1 - \alpha)S$
- the expected total claim amount paid by the insurer is $E[S_I] = \alpha E[S]$
- the variance of the total claim amount paid by the insurer is $\text{var}[S_I] = \alpha^2 \text{var}[S]$.

Since $0 < \alpha < 1$, we can see that a key benefit of reinsurance is a reduction in claims volatility.



Question

Give examples of how large losses may arise from:

- (i) a single claim
- (ii) a single event
- (iii) cumulative events
- (iv) geographical concentrations of risk
- (v) portfolio concentrations of risk

in relation to a household insurance portfolio.

Solution

- (i) A fire at a big property or a liability claim (as public liability cover is often attached to household insurance policies).
 - (ii) A hurricane.
 - (iii) A bad winter leading to lots of freezing and flooding claims.
 - (iv) Subsidence or flooding in an area where the insurer has insured lots of houses.
 - (v) The portfolio may be concentrated towards several properties of one type, *eg* student accommodation, which could be more vulnerable to theft and damage claims.
-

A factor to note in assessing the relative costs of retaining the risk or buying reinsurance is that the reinsurer may be able to offer very competitive terms for administration, actuarial services and other insurance advice if a reinsurance contract is purchased. There is often a financial advantage to many small providers in obtaining reinsurance.

Even large providers are likely to seek reinsurance for this type of assistance when moving into a new area, *eg* an insurance company which has previously sold only life insurance contracts launching a health contract such as critical illness insurance or income protection.



Question

An insurance company is planning to launch a critical illness product.

Suggest areas in which it might seek assistance from a reinsurer.

Solution

Areas in which the insurance company might seek assistance are:

- product design – in particular in deciding which critical illnesses should be included and obtaining details of other products in the market
- pricing – the reinsurer will be able to provide past claims experience data to assist in setting pricing assumptions and may even determine appropriate premium rates for the insurer
- guidance in setting underwriting policies and claims controls
- wording of policy documents, *eg* the definitions of critical illnesses, exclusion clauses
- establishment of suitable administration systems.

Overall, the reinsurer's involvement may be comprehensive and wide-ranging.

This technical assistance is in itself a means of risk management because:

- it reduces business risk, *ie* of pricing being based on inappropriate assumptions
- it can reduce operational risk by transferring certain activities to the reinsurer.

Both of these risks are only *reduced* and not *transferred* – ultimate responsibility still rests with the insurance company.

2.3 The cost of reinsurance

The reinsurer will wish to make a profit from the risks it takes on. Effectively part of the profit from the business is passed to the reinsurer. A decision must be made which balances risks against the costs of mitigating them.

The cost of reinsurance is principally the reinsurance premium(s) payable. However, there will also be costs incurred in putting the reinsurance arrangements into place and their subsequent management (*eg* providing policy and claims details to the reinsurer and managing recoveries).

2.4 Cost vs benefit

In assessing risks and rewards, the actuary can place a realistic estimate on the value of the benefits that would be paid by the reinsurance provider. This is likely to be lower than the cost of the reinsurance, as the reinsurance premium will include loadings for profits and contingencies.

Values will also need to be placed on the *range* of likely benefit costs so that an assessment of the risk can be made in comparison to the cost of the reinsurance.

So the actuary may calculate a realistic point estimate of the net cost of reinsurance (*ie* the reinsurance premium *less* the expected benefits) together with a range over which this net cost may vary depending on experience. This information will assist the insurance company in understanding how reinsurance will affect its position and aid the risk management decision-making process.

In addition to the relative costs and the variability of those costs, the liquidity risk of retaining the risk or buying reinsurance also needs to be considered in making a decision.

This liquidity risk also arises for pension schemes purchasing insurance. Insurance is to pension schemes as reinsurance is to insurance companies.

For example, the purchase of annuities by a pension scheme may in itself create a liquidity risk for the pension scheme.

The purchase of cover for death-in-service lump sums will, however, remove a potentially significant liquidity risk. This may be particularly important for a pension scheme that is immature or small, as the investment income may be low relative to the death benefits.

Holding a larger proportion of liquid assets, *eg* cash, would also reduce the liquidity risk from lump sum death-in-service benefits.

2.5 The effectiveness of reinsurance

There are a variety of ways in which the liabilities arising under a contract can be reinsured. Some types of reinsurance completely remove a risk from the provider. Many others leave the liability with the provider but provide a payment to the provider that is aimed at covering that liability. However, even if a liability is fully matched by a reinsurance arrangement, the provider still bears the counterparty risk that the reinsurer is unable to fulfil its obligations.

3 Reinsurance products – introduction

3.1 Basic product types

There are many variations of the basic types of reinsurance, and contracts are often tailored to meet the particular needs of the ceding company and reinsurer concerned. However, all reinsurance contracts are based on the same underlying principles.

The two main types of reinsurance are *proportional* and *non-proportional*. These two main types are the subject of the next two sections.

Sections 4 and 5 below provide a general indication and examples of the types of contract that the examiners may describe in examination questions. The examiners will not be testing detailed knowledge of such contracts but will expect candidates to be able to apply their understanding of principles to both these basic contract types and to other contracts that may exist independently or where two or more of these basic contract types are combined together as a package.

More detailed knowledge of these reinsurance products and how they vary for different types of insurance is covered in the relevant Specialist Principles subjects.

3.2 Reinsurance terminology

There is quite a lot of specialist language in reinsurance, so it is useful to be familiar with the following terms:

- *cede* – ‘pass on’ or ‘give away’, as in ‘cede some risk to a reinsurer’
- *treaty* – covers a group of policies; the reinsurer is obliged to accept these risks from the insurer, subject to conditions (which are set out in the treaty)
- *direct writer* – an insurer with a direct contract with the policyholders (as opposed to a reinsurer, which has a contract with the direct writer); also called the *primary insurer* or *cedant*.

3.3 Reinsurance contract variations

Reinsurance may be arranged on a case-by-case basis (‘facultative’) or a defined series of risks may be covered (‘treaty’).

For example, facultative reinsurance might be arranged for particularly large risks. The insurer is not obliged to cede these risks to the reinsurer, but neither is the reinsurer obliged to accept them.

4 Proportional reinsurance

4.1 Introduction



Under proportional reinsurance, the reinsurer covers an agreed proportion of each risk. This proportion may:

- **be constant for all risks covered (called quota share reinsurance), or**
- **vary by risk covered (called surplus reinsurance).**

Both forms have to be administered automatically, and therefore require a treaty.

In this section we work through some numerical examples of how proportional reinsurance operates.

4.2 Quota share reinsurance

Under quota share reinsurance a fixed percentage of each and every risk is reinsured.

The treaty will specify this fixed proportion to be ceded to the reinsurer, $R\%$ say. This is often referred to as 'an $R\%$ quota share treaty'.



Question

A general insurer enters into a 25% quota share treaty on its commercial property portfolio. The treaty covers (amongst other risks) the following three properties:

- Property 1 – a large, brand new office block
- Property 2 – a small, modern shop
- Property 3 – a medium-sized, old chemical plant.

The following claims come in under each risk:

- Property 1 – a claim for £5,000,000
- Property 2 – claims for £500,000 and £100,000 respectively
- Property 3 – a claim for £800,000.

Calculate the reinsurance recoveries on each claim under the quota share treaty.

Solution

The reinsurer pays 25% of each claim. The reinsurance recoveries (amounts paid by the reinsurer) under the quota share treaty are:

- Property 1 – £1,250,000
 - Property 2 – £125,000 and £25,000
 - Property 3 – £200,000.
-

Uses of quota share reinsurance

Quota share is widely used by ceding providers to:

- **spread risk**
- **write larger portfolios of risk**
- **encourage reciprocal business.**

Reciprocal quota share reinsurance involves one company reinsuring part of its business to another, in exchange for accepting part of its reinsurer's business. In this way both companies achieve a wider spread of risk and so greater diversification.



Question

Outline the advantages and disadvantages of quota share reinsurance *relative to other forms of reinsurance*.

Solution

The key advantage of quota share reinsurance is simplicity of administration, as it is written by treaty and a constant proportion is ceded for all risks.

It also helps to diversify risk, because the insurer can write more business for the same amount of capital.

The disadvantages of quota share reinsurance are:

- the same proportion of each risk is ceded regardless of its size (large / small)
 - the same proportion of each risk is ceded regardless of its likely volatility / risk profile
 - it does not cap the cost of very large claims.
-

4.3 Surplus reinsurance

Surplus reinsurance gets round the lack of flexibility problems associated with quota share, because it gives the direct writer some discretion in choosing the amount of each risk to retain. This gives the direct writer the ability to *fine-tune its experience*. For example, the direct writer might choose to retain a small proportion of the bigger, more volatile risks and a large proportion of the smaller, less volatile risks.

Surplus reinsurance is *proportional* reinsurance and is written under treaty. The terms of the treaty will give the direct writer the flexibility to choose how much risk to retain, but often within limits.



A surplus reinsurance treaty specifies a retention level and a maximum level of cover available from the reinsurer.

The proportion of risk ceded is then used in the same way as for quota share.

So rather than specify *percentages* of each risk to retain, the direct writer chooses a *retention limit* for the risks. (This may make surplus sound like excess of loss reinsurance, which is covered in the next section. However, there is a difference which we will see in the example below.)

For high volume business such as life assurance or personal lines general insurance, the maximum cover and the retention level are specified in the treaty.

In other words, the direct writer chooses a retention limit that will apply to *all risks*.

For commercial covers, such as commercial property and business interruption, the ceding provider can select, for each individual risk, the retention and the amount to be ceded.

In other words, the direct writer chooses a retention level *for each risk separately*.

Where the ceding provider can select, for each individual risk, the retention and the amount to be ceded, the reinsurer may desire a minimum retention to apply to the provider, to prevent the provider from having too little interest in the risk.

Choosing the retention limit

For each risk covered by the surplus treaty, the direct writer estimates a maximum loss that could occur. For life insurance, there is normally no need to do any estimating, as the claim amount (or sum assured) is known. However, for general insurance, the size of the loss is usually unknown and an estimate must be made.

Example

Let us consider again the three properties described in the question about the quota share treaty. The direct writer has determined the estimated maximum loss (EML) on each property as follows:

- Property 1 – a large, brand new office block – EML of £10,000,000
- Property 2 – a small, modern shop – EML of £400,000
- Property 3 – a medium-sized, old chemical plant – EML of £1,000,000.

Here is a simple example of how a surplus treaty might work. (For those going on to study general insurance, surplus reinsurance will be seen to get more complicated – but for the purposes of Subject CP1, we just need to know the basics.)

1. **Choose retention limit**

The direct writer *chooses a retention limit* for each property. The direct writer might choose to retain a smaller proportion of the larger or more volatile risks (*ie* the large office and the old factory).

Chosen retention limits:

- Property 1 – a large, brand new office block – retention limit of £2,000,000
- Property 2 – a small, modern shop – retention limit of £300,000
- Property 3 – a medium-sized, old chemical plant – retention limit of £300,000.

2. **Determine percentages retained**

The retention limit, together with the estimated maximum loss, is used to *work out the percentage retained* by the direct writer for each risk. The percentage retained will be the retention limit divided by the estimated maximum loss for each property (subject to a maximum of 100%).

Percentage of each risk retained by the direct writer:

- Property 1 – a large, brand new office block – % retained = 20%
- Property 2 – a small, modern shop – % retained = 75%
- Property 3 – a medium-sized, old factory – % retained = 30%.

3. **Split claims between reinsurer and insurer**

Once the percentages have been determined, *each claim* that occurs on a particular property is *split entirely in those percentages*, regardless of its size, *in just the same way as quota share*.

Therefore, if the same claims come in under each risk as for the previous quota share example, the reinsurance recoveries (*ie* the amounts paid by the reinsurer) on each claim under the surplus treaty are:

- Property 1 – £4,000,000 (80% of the claim)
- Property 2 – £125,000 and £25,000 (25% of each claim)
- Property 3 – £560,000 (70% of the claim).

Even though one of the claims (£500,000) on Property 2 is bigger than the estimated maximum loss for that property (£400,000), the claim will still be split in the agreed proportions. This is a risk that the direct writer and the reinsurer accept. However, if the direct writer's underwriting is so bad that it continuously mis-estimates the maximum loss on risks, it is unlikely that the reinsurer will continue to accept business on these terms in the future.



Question

A life insurer takes out surplus reinsurance on a block of term assurance risks.

The reinsurance treaty specifies a retention limit of £100,000 to apply to each risk covered by the treaty.

Two of the risks covered by the treaty die. The sums assured for these two risks are £500,000 and £300,000 respectively.

Calculate the reinsurance recoveries on each claim under the surplus treaty.

Solution

The estimated maximum loss amounts must equal the sums assured.

Therefore the reinsurance recoveries under the surplus treaty are £400,000 (80%) and £200,000 (66.7%) respectively. (This means that the direct writer pays £100,000 (20%) and £100,000 (33.3%) respectively.)

In this case there is no difference between surplus and individual excess of loss reinsurance, as will be described in the next section. This is because, as previously noted, for life insurance products the claims will normally be equal to the estimated maximum loss as they are fixed, known amounts.

Uses of surplus reinsurance



Question

Outline the advantages and disadvantages of surplus reinsurance *relative to other forms of reinsurance*.

Solution

The advantages of surplus reinsurance are:

- it allows the ceding provider to accept risks that would otherwise be too big
- it helps the ceding provider to spread the risk
- it is flexible – the ceding provider does not have to cede the same proportion of every risk, which helps in achieving a well-balanced portfolio of risks.

The main disadvantage is the more complex administration compared to a quota share treaty due to the need to assess and record separately for each risk the amount to be ceded.

Also, as for quota share, surplus reinsurance does not cap the cost of very large claims.

This final disadvantage can be addressed through use of non-proportional reinsurance.

5 Non-proportional (excess of loss) reinsurance

5.1 Excess of loss (XL) reinsurance

Proportional reinsurance does not cap the cost of very large claims that may occur, either as a single claim, or a set of claims from related incidents, or on an insurer's whole account. 'Large' in this context means large relative to the ceding provider's solvency margin or annual premiums.

Under proportional reinsurance, the direct writer might retain 25% say of a particular risk. However, the claim on this risk may potentially be unlimited, so the direct writer's loss (25% of an unlimited amount) is not capped.



Excess of loss (XL) reinsurance is non-proportional cover where the cost to a ceding company of such large claims is capped with the liability above a certain level being passed to a reinsurer. However, if the claim amount exceeds the upper limit of the reinsurance, the excess will revert back to the ceding company.

Variations of this form of reinsurance cover exist to limit a ceding company's losses.

For example, within excess of loss reinsurance:

- the limit might operate on individual claims or on aggregations of claims
- there might be an upper limit, above which the reinsurer's liability ends
- the reinsurer might pay for all claims within the limits or perhaps only a proportion of the claims within the limits, *eg* 90%, in order to ensure that the ceding company retains an interest in the risk
- the limits might be linked to inflation to ensure that cover is not eroded over time.

In this section we describe the different types of non-proportional reinsurance and also work through some numerical examples.

The reinsurer agrees to indemnify the ceding company for the amount of any loss above a stated excess point. More usually, the reinsurer will give cover up to a stated upper limit, with the ceding company purchasing further layers of XL cover, which stack on top of the primary layer, from different reinsurers. The higher layer cover(s) come into operation on any particular loss only when the lower layer cover has been fully used.

The top layer of excess of loss reinsurance might be unlimited (*ie* there may be no upper limit).

The layers of reinsurance should be arranged so that there are no gaps, *ie* the lower limit of the second layer of reinsurance starts at the upper limit of the first excess of loss reinsurance.

The expression generally used to describe the cover provided under an excess of loss reinsurance treaty is:

'Amount of layer in excess of lower limit'.

So a treaty that provides cover for claim amounts between an excess point of £50,000 and an upper limit of £200,000 would be described as:

‘£150,000 in excess of £50,000’.

There are three main types of excess of loss reinsurance:

- **risk XL**
- **aggregate XL**
- **catastrophe XL.**

5.2 Risk excess of loss (Risk XL)



Risk XL is a type of excess of loss reinsurance that relates to individual losses. It affects only one insured risk at any one time.

The direct writer pays a premium to the reinsurer in return for protection against large individual claims on individual risks (eg a large third party liability claim on an individual motor policy).

Distinction between risk XL and surplus reinsurance

Where a risk event can only result in the payment of the full sum insured, or no payment at all, there is no difference between the claim amounts under individual risk XL and surplus reinsurance. This is the case with term assurance on a single life – either the life assured dies within the term or not, and there is no possibility of a claim for less than the full sum insured.

For example, consider two reinsurance treaties:

- a surplus treaty with a retention limit of £250,000
- a risk XL treaty covering £750,000 in excess of £250,000.

For both treaties, a term assurance on a single life with a sum assured of £1,000,000 would result in a reinsurance recovery of £750,000 in the event of death.

However the two types of reinsurance differ if there is a claim for less than the full sum insured.

This is usually the case in general insurance.

For example, consider the same two reinsurance treaties as in the previous example, but this time covering a general insurance risk such as domestic property. For a particular property with an EML of £1,000,000, the proportion retained under the surplus treaty will be 25%.

In the event of a claim for £1,000,000, both treaties would give a reinsurance recovery of £750,000.

However, in the event of a claim for £500,000, the recovery under the surplus treaty would be £375,000 and the recovery under the risk XL treaty would be £250,000.



Question

An insurance company has risk excess of loss insurance arranged on a case-by-case basis on each of the following three risks:

- Property 1 – a claim for £5,000,000, retention limit of £2,000,000
- Property 2 – claims for £500,000 and £100,000, retention limit of £300,000
- Property 3 – a claim for £800,000, retention limit of £300,000.

Calculate the reinsurance recoveries under each claim, assuming that there is no upper limit to these recoveries.

Solution

The reinsurance recoveries (amounts paid by the reinsurer) under the risk excess of loss reinsurance arrangements are:

- Property 1 – £3,000,000
 - Property 2 – £200,000 and £0
 - Property 3 – £500,000.
-

The next question looks at how different layers of excess of loss reinsurance work.



Question

A direct writer has three risk excess of loss treaties covering its employers' liability portfolio:

- £140,000 in excess of £60,000
- £300,000 in excess of £200,000
- £2 million in excess of £700,000.

- (i) Identify the problem with this reinsurance programme.
 - (ii) Calculate how much the direct writer will be able to recover in respect each of the following claims:
 - (a) £80,000
 - (b) £280,000
 - (c) £2,400,000
 - (d) £4,000,000
 - (e) £680,000
 - (f) £50,000
 - (g) £500,000.
-

Solution

(i) Problem with the reinsurance programme

There is a 'gap' in the cover between £500,000 and £700,000. The layers of reinsurance should (generally) be arranged so that there are no gaps.

(ii) Claim recoveries

Recoveries from the treaties are:

Claim	1st layer	2nd layer	3rd layer	Total
(a)	£20,000	–	–	£20,000
(b)	£140,000	£80,000	–	£220,000
(c)	£140,000	£300,000	£1,700,000	£2,140,000
(d)	£140,000	£300,000	£2,000,000	£2,440,000
(e)	£140,000	£300,000	–	£440,000
(f)	–	–	–	–
(g)	£140,000	£300,000	–	£440,000

5.3 Aggregate excess of loss (Aggregate XL)

Events can occur which involve losses to several insured risks within a period of perhaps a year. Such events could lead to an aggregation of claims. Individually, each claim might not be of exceptional size, but collectively the aggregate cost might be damaging to the ceding provider's gross account. A winter influenza epidemic is an example of where aggregation of losses can occur.

The aggregation of claims might be by event (*eg* a motorway pile-up), by peril (*eg* subsidence) or by class of business (*eg* all motor policies).

The conventional risk XL treaty, by treating each claim as a separate loss, will fail to protect the ceding provider adequately against the aggregate cost of such losses.



Aggregate XL covers the aggregate of losses, above an excess point and subject to an upper limit, sustained from a defined peril (or perils) over a defined period, usually one year.

Therefore aggregate XL reinsurance is a very simple extension of Risk XL, but rather than operating on large individual claims, the excess point and the upper limit apply to the aggregation of a number of claims over a specified time period.



When *all* perils are covered for a ceding company's *whole account*, or for a major class of business within the whole account, this is sometimes referred to as Stop Loss reinsurance.



Question

A general insurance company has the following reinsurance arrangements, which operate in the order listed:

- a risk XL treaty covering £200,000 in excess of £150,000
- an aggregate XL treaty covering £1,000,000 in excess of £500,000.

Three policies gave rise to three claims, covered by these treaties, which were for the following amounts:

1. £300,000
2. £500,000
3. £150,000.

Calculate the total claim amount recoverable under each reinsurance treaty.

Solution

Under the Risk XL treaty:

Claim amount	Recovery	Retained
£300,000	£150,000	£150,000
£500,000	£200,000	£300,000
£150,000	£0	£150,000

So, the total retained by the insurance company after the operation of this treaty is £600,000.

Therefore the recovery from the aggregate XL treaty is £100,000, leaving the direct writer with a final retention of £500,000.

5.4 Catastrophe excess of loss (Catastrophe XL)

This is a form of aggregate excess of loss reinsurance providing coverage for very high aggregate losses arising from a single event. The losses may be spread over a number of hours following the initial event – 24 or 72 hours is common.



The aim of catastrophe reinsurance is to reduce the potential loss, to the ceding company, due to any non-independence of the risks insured.

The cover is usually only available on a yearly basis and has to be renegotiated each year.

The reinsuring company will agree to pay out if a 'catastrophe', as defined in the reinsurance contract, occurs. There is no standard definition of what constitutes a catastrophe.

The reinsurance contract will also specify how much the reinsuring company will pay if a catastrophe occurs. Typically this might be the excess of the total claim amount over the ceding provider's catastrophe retention level. The reinsuring company's liability in respect of a single catastrophe claim would be subject to a maximum amount and any amount above this would fall back on the ceding company.

5.5 Uses of non-proportional reinsurance

Non-proportional reinsurance enables the provider to accept risks that might give rise to large claims.

Non-proportional reinsurance also stabilises the technical results of the ceding provider by reducing claims fluctuations.

By reducing claims fluctuations, the annual profits of the ceding provider will be less volatile. This stabilising of results might be considered especially desirable by a proprietary insurance company, as shareholders prefer to have relatively stable dividends.

With lower volatility of claims outgo, the ceding provider can also make more efficient use of its capital. High volatility of claims outgo means that the company must hold large free assets. If the volatility is reduced, lower free assets are required. This means that the company can write the same amount of business with less capital by using excess of loss reinsurance.

The other purpose of excess of loss reinsurance is to reduce the risk of insolvency from a catastrophe, a large claim or an aggregation of claims.



Question

Outline the advantages and disadvantages of excess of loss reinsurance.

Solution

Advantages of excess of loss reinsurance:

- caps losses, hence allows the cedant to take on risks that could produce very large claims
- protects the cedant against individual or aggregate large claims
- helps stabilise profits from year to year
- helps make more efficient use of capital by reducing the variance of the claim payments.

Disadvantages of excess of loss reinsurance:

- The ceding provider will pay a premium to the reinsurer which, in the long run, will be greater than the expected recoveries under the treaty as it must include loadings for the reinsurer's expenses and profit.
 - From time to time, excess of loss premiums may be considerably greater than the pure risk premium for the cover. For example, after reinsurers have had a few years of poor results, the supply of reinsurance falls and premiums rise, as reinsurers attempt to restore their solvency positions (*ie* the underwriting cycle operates).
-

6 Alternative risk transfer

6.1 Introduction

Alternative risk transfer (ART) is an umbrella term for non-traditional methods by which organisations can transfer risk to third parties. Broadly, these products combine traditional insurance and reinsurance protection with financial risk protection, often utilising the capital markets.

Alternative risk transfer (ART) is a phrase coined in the USA. The roots of ART lie in the 1960s, when the booming oil industry was in search of multiple insurance protection. Alternative risk transfer may lead to easier and cheaper ways of transferring risk than using traditional reinsurance.



ART often uses both banking and insurance techniques, producing tailor-made solutions for risks that the conventional market would regard as uninsurable.

ART contracts serve to expand the list of organisations that accept risks from financial product providers away from traditional reinsurance companies. The banking and capital markets are used because of capacity issues. The risks involved in ART transactions are typically ones with which the banking and capital markets are more comfortable, such as catastrophe risk.

There are many types of ART contract, including:

- integrated risk covers
- securitisation
- post loss funding
- insurance derivatives
- swaps.

We discuss each of these in turn below.

6.2 Integrated risk covers

These are typically arranged between insurers and reinsurers.

Integrated risk covers are reinsurance arrangements that typically cover several lines (or classes) of general insurance business for several years. For example, rather than reinsuring property damage risks separately from liability risks and from business interruption risks, the risks are aggregated and reinsured in one block. Additionally, it is common for such arrangements to include cover of financial risks (credit and market risks), which traditional reinsurance does not. There will be an excess point and upper limit in relation to the aggregated risks rather than separate limits for each risk.

They are often written as multi-year, multi-line covers and will give premium savings due to cost savings and to greater stability of results over longer time periods and across more (uncorrelated) lines.

The cost savings arise because there is no longer the need to negotiate several separate reinsurance arrangements and also because integrated risk covers are multi-year arrangements that do not need to be renegotiated each year.

The greater stability of results arises due to the diversification by:

- type of risk insured
- time.

For example, in any one year it is very difficult to predict whether there will be a bad flood or storm. However, insurance companies can be more certain about the likelihood of a flood or storm occurring at some point over a five-year period.

They are used to:

- **avoid buying excessive cover**
- **smooth results**
- **lock into attractive terms.**

They can be used as a substitute for debt or equity in the investment portfolio of the original insurer.

The above benefits of integrated risk covers reduce the need for capital and can thus be seen as a substitute for raising capital through more the traditional means of debt and equity.



Question

Suggest possible disadvantages to the insurer of integrated risk covers.

Solution

Disadvantages of integrated risk covers include:

- credit risk in relation to the cover provider
 - lack of availability
 - expenses arising from the *taylor-made* aspect of the deal, as the cover provider would need full insight into the dealings of the insurer seeking cover
 - difficulty in structuring the provider's risk management programme in a *holistic, multi-line* way – as typically separate risk managers would be used for separate risk types.
-

6.3 Securitisation

Securitisation is one of the more common forms of ART.

This is the transfer of insurance risk to the banking and capital markets. Among other things it is used for managing risks associated with catastrophes, as the financial markets are large and capable of absorbing catastrophe risk.

Securitisation involves turning a risk into a financial security, *eg* as in a catastrophe bond.

In simple terms, this works as follows:

1. An investor purchases a bond from the insurance company and therefore provides a sum of money to the insurer.
2. The repayment of capital (and possibly of interest) is contingent on a specified event *not* happening, *eg* an earthquake measuring 6.5 on the Richter scale *not* happening.
3. If the event does happen, *eg* the aforementioned earthquake, the insurer uses the sum of money provided from the investor (in purchasing the bond) to cover the cost of claims arising from the earthquake. The investor may get part of their capital (and interest) back depending on the severity of the claim.
4. If the event does not occur, the investor gets their interest and capital back in the normal way.

In practice, the direct link between the investor and the issuer is broken by a special purpose vehicle (SPV), which is a separate legal entity that sits between the parties.

This is a particularly high-risk investment – there is a probability that the return will be zero. However, as long as the expected return on the investment is commensurate with the investor's required rate of return, then a market for such an investment will exist.

The rationale is that insurance catastrophe risk is not correlated with market (systematic) risk and so there is a benefit to investors.

Because of the low correlation of catastrophe risk with the more usual market-related risks of a bank, the banking market is more comfortable taking on catastrophe risk than an insurance company would be as it diversifies their risk exposure.

There may also be greater overall capacity to accept this risk within the banking and capital markets than in the reinsurance market.

To date the pricing of such contracts has been similar to that for traditional catastrophe reinsurance and much more expensive than similarly rated corporate bonds.

6.4 Post loss funding

Post loss funding (or contingent capital) is a way of raising capital to cover the losses from a risk *after* the risk event has happened. It therefore goes against the traditional methods of reinsurance whereby the insurer pays premiums to the reinsurer *before* the loss event happening.

Very often when a catastrophe occurs, it can be difficult for the insurance company to subsequently raise capital. In particular, not only will it be difficult to raise capital but any such capital will often have to be raised on unfavourable terms.

Post loss funding can help by securing the terms in advance under which capital can be raised following a catastrophe. The funding is typically provided by a bank.

Post loss funding guarantees that, in exchange for a commitment fee, funding will be provided on the occurrence of a specific loss. The funding is often a loan on pre-arranged terms or equity.

Equity funding may take the form of the opportunity to raise equity capital on pre-agreed terms. Alternatively, the insurer can purchase a put option on its own share price. Therefore, if the share price plummets following the catastrophe, the insurance company has secured in advance the option to sell its shares at a pre-specified (higher) price and hence raise capital.

The commitment fee will be lower than the equivalent insurance cost (because the cost of the funding will in the most part be borne after the event has happened). Thus, before the loss happens the contract appears cheaper than conventional insurance.

The equivalent insurance cost would be the premium payable by the insurance company to the reinsurer.

6.5 Insurance derivatives

Insurance derivatives have become more actively traded in recent years.

Examples include catastrophe or weather options.

In the energy, utility and large-scale agriculture sectors there is a real risk of being adversely affected by natural disasters or bad weather, and therefore these derivatives have become increasingly used. Use of these instruments within the insurance sector has been modest to date, but they offer a lot of potential in many other sectors such as building companies, tourist attractions, shops, restaurants, which can all be adversely affected by the weather.

The majority of the market for such derivatives is over-the-counter (OTC) although exchange-traded contracts (*eg* based on temperature, frost or snowfall in various major cities) also exist. A fictitious example is given below.

Example

An energy company is worried about the risk of a very mild winter, as its customers will turn down their heating, thereby reducing the company's revenues. The energy company decides to buy an OTC *weather* put option, which is tailored to the needs of the company and is designed to work as follows:

- Let A be the average between the highest and lowest temperature on a given day, calculated in degrees Celsius ($^{\circ}\text{C}$).
- Let T be the daily temperature unit, calculated as $\max(0, 20 - A)$. The colder the winter, the higher the value of T ; the milder the winter, the lower the value of T .
- Let I be the cumulative daily temperature index, calculated as the sum of the daily temperature units T over a period of three months.
- The energy company buys a put option on the temperature index at the beginning of the three-month period with an exercise price of $I = 1,350$ temperature units.
- The payment rate for the option is calculated as \$10,000 per temperature unit. The option premium is \$20,000.

At the end of the three months, on the expiry date of the option, the *actual* value of the temperature index is $I = 1,200$ temperature units, *ie* the winter has been considerably milder than expected.

As the energy company bought a *put* option, this means that it has the right to *sell* at the exercise price of $I = 1,350$.

The payoff from the option on expiry will be:

$$\$10,000 (1,350 - 1,200) - \$20,000 = \$1.48m.$$

The profit from the option should offset the loss that the energy company will have incurred from reduced revenues from its customers.

6.6 Swaps

Organisations with matching, but negatively correlated risks can swap packages of risk so that each organisation has a greater risk diversification.

If organisations can't find *negatively correlated* risks to swap, then swapping *uncorrelated* risks would provide some risk diversification.

Example 1 – reinsurance swap

For example, a reinsurer with exposure to Japanese earthquakes may swap some of this risk with a reinsurer with exposure to hurricanes in Florida.

This is an example of a swap of uncorrelated risks.

Example 2 – longevity swap

With increasing volumes of annuities as the post-war 'baby boom' generation in developed countries ages, longevity swaps are becoming popular.

The arrangement may be set up in the form of a traditional swap, with the 'fixed leg' being based on expected annuity payments and the 'floating leg' being the actual annuity payments.

Example 3 – weather swap

Swaps can also be set up between non-insurance organisations with opposite risks.

For example, energy companies dislike warm weather as consumers use less of their product. Conversely, household insurers dislike cold weather as it leads to insurance claims. The two organisations can, however, swap their risks.

This is an example of a swap of negatively correlated risks.

A *unit of trading* will be required. This could typically be a given sum assured in insurance swaps, *eg* £1m sum assured of property risk, classified by location and peril. Therefore, the swap might be X units of property risk for Y units of some other risk. For non-insurance swaps, the unit of trading may be an amount of revenue or profits.

6.7 Reasons for using ART

Reasons why providers take out ART contracts include:

- **provision of cover that might otherwise be unavailable**
- **stabilisation of results**
- **cheaper cover**
- **tax advantages**
- **greater security of payment**
- **management of solvency margins**
- **more effective provision of risk management**
- **as a source of capital.**

Chapter 29 Summary

Responses to risk

When faced with a risk, each stakeholder needs to decide whether to:

- avoid the risk altogether
- reduce the risk (probability, severity, both)
- reject the need for financial coverage, *eg* if risk is trivial or largely diversified
- retain in full
- transfer in full (through payment of a premium)
- partly retain and partly transfer.

The choice of mitigation approach will depend on:

- impact on frequency and severity of the risk
- feasibility of implementation
- cost and impact on profit
- secondary risks arising and how they might be dealt with.

The extent of risk transfer will depend on the:

- probability of the risk occurring
- risk appetite and existing resources to finance the risk event if it happens
- cost of transferring the risk
- willingness of a third party to accept the risk.

Reinsurance – benefits and costs

The benefits of reinsurance have to be weighed up against the cost. The reinsurance premium will include loadings for profits and contingencies.

The benefits of reinsurance include:

- a reduction in claims volatility and hence
 - smoother profits
 - reduced capital requirements
 - an increased capacity to write more business and achieve diversification
- the limitation of large losses arising from:
 - a single claim on a single risk
 - a single event
 - cumulative events
 - geographical and portfolio concentrations of risk

and hence:

- a reduced risk of insolvency
- increased capacity to write larger risks
- access to the expertise of the reinsurer.

Types of reinsurance

The two main types of reinsurance are *proportional* and *non-proportional* reinsurance. Reinsurance may be arranged on a case-by-case, non-obligatory basis ('facultative') or an obligatory basis using a treaty.

Proportional reinsurance

Under proportional reinsurance, the reinsurer covers an agreed proportion of each risk. This proportion may:

- be constant for all risks covered (*ie* quota share)
- vary by risk covered (*ie* surplus).

Both forms have to be administered automatically, and therefore require a treaty.

Quota share reinsurance is widely used by ceding providers to spread risk, write larger portfolios of risk and encourage reciprocal business.

It is simple to administer. However, quota share cedes the same proportion of low variance and high variance risks, and of small and large risks. It also does not cap the cost of very large claims.

A *surplus reinsurance* treaty specifies a retention limit and a maximum level of cover available from the reinsurer. The proportion of risk ceded is then used in the same way as for quota share. The retention limit may be fixed for all risks or variable at the discretion of the cedant.

Surplus cover enables a ceding provider to write larger risks, which might otherwise be beyond its writing capacity. It is flexible and enables the ceding provider to 'fine-tune' its experience for the class concerned.

Non-proportional reinsurance

Under excess of loss reinsurance the reinsurer agrees to indemnify the ceding company for the amount of any loss above a stated excess point. Usually, the reinsurer will give cover up to a stated upper limit, with the insurer purchasing further layers of XL cover, which stack on top of the primary layer, from different reinsurers.

There are different forms of non-proportional (*ie* excess of loss, XL) reinsurance:

- risk XL – relates to individual losses and affects only one insured risk at any one time
- aggregate XL – covers the aggregate of losses, above an excess point and subject to an upper limit, sustained from defined peril (or perils) over a defined period, usually one year
- stop loss – a form of aggregate XL that provides cover based on total claims, from all perils on a ceding company's whole account (or a major class of business)
- catastrophe XL – pays out if a 'catastrophe', as defined in the reinsurance contract, occurs (there is no standard definition of what constitutes a catastrophe).

The main uses of excess of loss reinsurance are:

- to permit a ceding provider to accept risks that could lead to large claims
- to stabilise the results of the ceding provider by reducing claims fluctuations
- to reduce the risk of insolvency from large losses.

Alternative risk transfer (ART)

ART is an alternative to traditional reinsurance. It involves tailor-made solutions for risks that the conventional reinsurance market would regard as uninsurable or does not have the capacity to absorb.

Examples of ART contracts include:

- integrated risk covers
- securitisation (*eg* catastrophe bonds)
- post loss funding
- insurance derivatives
- swaps.

Reasons why providers take out ART contracts include:

- provision of cover that might otherwise be unavailable
- stabilisation of results
- cheaper cover
- tax advantages
- greater security of payment
- management of solvency margins
- more effective provision of risk management
- as a source of capital.

This page has been left blank so that you can keep the chapter summaries together for revision purposes.



Chapter 29 Practice Questions

- 29.1 (i) Outline six options open to a stakeholder when faced with a risk.
 (ii) State the factors affecting the approach taken to dealing with a risk.
- 29.2 Outline the features of the following types of reinsurance arrangement:
- (i) quota share
 - (ii) surplus
 - (iii) risk excess of loss
 - (iv) catastrophe excess of loss
 - (v) stop loss.
- 29.3 List the elements of a reinsurance treaty that would need to be negotiated between the primary insurer and the reinsurer.
- 29.4 Outline how an insurance company could assess the costs and benefits of its proposed reinsurance arrangements.
- 29.5 A general insurance company has the following (unusual) reinsurance arrangements, which operate in the order listed.

This means that each reinsurance arrangement works on the balance of the claim amount after the preceding arrangements have taken effect.

- (a) Surplus: retention limit £50k.
- (b) Quota share: 40% of the risk is retained, covers all risks.
- (c) Risk excess of loss: £20k in excess of £30k on individual claims, covers all risks.
- (d) Aggregate excess of loss: £30k in excess of £50k based on aggregate claims.

Three policies gave rise to claims, which were as follows:

- (i) Estimated maximum loss: £100k Claim: £60k
- (ii) Estimated maximum loss: £250k Claim: £400k
- (iii) Estimated maximum loss: £150k Claim: £300k

Calculate the total claim amount recoverable from each reinsurer and the final amount retained by the cedant.

29.6 (i) State the reasons why an insurance company might wish to purchase reinsurance. [5]

Exam style (ii) Discuss the issues which an insurer should consider when assessing the security of a reinsurer. [5]

[Total 10]

29.7 A UK general insurance company writes marine business. This covers damage or loss to the hull, cargo or to third parties due to perils of the sea.

Exam style (i) Outline the key risks to the insurance company under this type of insurance. [3]

The insurer is considering the following:

- (a) Taking out no reinsurance cover, and instead its parent company (a US general insurer) will provide a capital injection in the case that it has difficulties meeting its liabilities.
 - (b) Purchasing a quota share treaty reinsurance policy, under which the insurer would pay the reinsurer 50% of all premiums and in return the reinsurer would meet the cost of 50% of all claims.
 - (c) Purchasing an excess of loss treaty reinsurance policy, under which the insurer pays the reinsurer a premium and in return the reinsurer meets all individual claims that fall between two pre-specified limits, which are yet to be decided.
- (ii) Describe the risks avoided and accepted by the insurer in opting for approach (a). [3]
- (iii) Discuss the advantages and disadvantages of opting for each of approaches (b) and (c), compared with approach (a). [5]

[Total 11]

29.8 A general insurance company which writes a large variety of domestic and commercial lines of business has just reported its year end results. The results were worse than the results achieved by comparable insurance companies.

Exam style The company believes that this is as a result of poor claims experience throughout the market, a large claim in respect of fire damage at one of the commercial buildings it insures and a bad storm during the year.

- (i) Comment on the likelihood of these explanations. [3]
- (ii) Explain, using examples where appropriate, how the company might have produced better results through use of suitable reinsurance arrangements. [4]

[Total 7]

29.9 A medium-sized general insurance company writes only personal motor business. The company is developing a model that can be used to test the impact on profitability and solvency of changing its reinsurance cover. The existing reinsurance programme has for the last five years consisted of quota share reinsurance and individual excess of loss reinsurance.

Exam style

(i) Discuss the factors that the company should consider when deciding upon an appropriate reinsurance programme. [8]

(ii) Describe how the model would be constructed. [7]

[Total 15]

29.10 A large industrial company wishes to ensure that it has appropriate insurance arrangements to manage the risks involved in its business.

Exam style

A large multinational general insurance company provides most forms of insurance cover. The company already insures some of the industrial company's risks and those of some other industrial companies with global operations.

(i) Suggest factors that the general insurance company would consider when assessing the extent to which it can insure the remainder of the industrial company's various insurable risks. [7]

(ii) Discuss the reinsurance protection that could be appropriate for the general insurer, if it decides to go ahead with offering this additional insurance cover. [6]

[Total 13]

29.11 (i) Describe five types of alternative risk transfer (ART) contracts.

(ii) Explain, using examples of the types of contracts that might be used, why insurance companies may use ART contracts to manage risk.

The solutions start on the next page so that you can
separate the questions and solutions.



Chapter 29 Solutions

29.1 (i) *Options for dealing with risk*

When faced with a risk each stakeholder can choose whether to:

- avoid the risk altogether
- reduce or control the risk, either by reducing the probability of occurrence, the consequences of occurrence, or both
- reject the need for financial coverage of that risk because it is either trivial or largely diversified
- retain all the risk
- pay a premium to another party to transfer all the risk to that party
- retain some of the risk and pay a premium to transfer the balance of risk to another party.

(ii) *Factors affecting approach to dealing with risk*

- the likely effect of the approach on the frequency and severity of the risk
- the feasibility and cost of the approach
- the overall impact on profits
- any secondary risks resulting from the approach and how these might be mitigated
- how likely the risk event is to happen
- risk appetite
- the existing resources that the stakeholder has to meet the cost of the risk event should it happen
- the amount required by another party to take on the risk
- the willingness of another party to take on the risk.

29.2 (i) Quota share

- proportional – the reinsurer covers an agreed proportion of each risk
- the proportion is constant for every risk is reinsured
- written by treaty
- used to spread risks, *ie* for diversification
- used to write larger portfolios of risk
- may be designed as a reciprocal arrangement between two insurers looking to swap uncorrelated packages of risk
- simple administration
- provides the same proportionate cover for all risks, irrespective of their size or variability so not suitable for heterogeneous risks
- does not cap the cost of very large claims.

(ii) Surplus

- proportional – the reinsurer covers an agreed proportion of each risk
- the proportion can vary by each risk reinsured
- written by treaty
- for high volume business, such as life insurance or personal lines general insurance, the maximum cover and the retention limit are specified in the treaty
- for commercial covers, the cedant can decide on the proportion to cede for each individual risk
- flexible – enables amount ceded to be tailored to the size and variability of individual risks
- suitable for reinsuring heterogeneous risks
- more efficient way of ceding premium than quota share as only pay for precise cover required (subject to limits on proportions imposed by treaty)
- able to fine-tune exposure
- used to write larger risks
- used to spread risk
- administration more difficult than quota share
- does not cap the cost of very large claims.

(iii) ***Risk excess of loss***

- non-proportional – so claim split not pre-defined
- applies to individual claims
- reinsurer pays excess over pre-determined limit (excess point) up to upper limit
- reinsurer may only pay a proportion of the claims, eg 80% within this layer
- there may be several layers operating for each risk
- used to protect cedant against a single large claim, eg a liability claim
- does not cover groups of related claims
- used to smooth profits by reducing claims fluctuations
- used to write larger risks.

(iv) ***Catastrophe excess of loss***

- non-proportional – so claim split not pre-defined
- a type of aggregate excess of loss
- reinsurer pays for aggregate claims from one defined catastrophic event, above a retention limit and up to an upper limit
- cedant may be required to pay a proportion of each claim so as to retain an interest in the risk
- written by treaty, typically on a yearly basis, and renegotiated each year
- treaty defines a catastrophe
- used to protect cedant against an accumulation of risk due to non-independence of the risks insured.

(v) ***Stop loss***

- non-proportional – so claim split not pre-defined
- a type of aggregate excess of loss
- reinsurer pays for aggregate claims from all events caused by *all perils* covered by the direct written policy, above a retention limit and up to an upper limit
- used to cover the cedant's whole account or a major class of business
- cedant may be required to pay a proportion of each claim so as to retain an interest in the risk
- used to limit the cedant's exposure to risk and to smooth profits.

29.3 ***Elements of a reinsurance treaty requiring negotiation***

- the type of reinsurance arrangement, *eg* quota share
- the retention of the insurer, *eg* the lower / upper limits for excess of loss
- the amount of cover to be granted automatically by the reinsurer
- the dates the treaty starts and ends
- the classes of business covered / excluded
- the perils covered / excluded
- the territorial scope of the treaty
- how and when reinsurance premiums are to be paid
- commission arrangements
- how and when claims will be paid (including any special provisions for large claims)
- cancellation terms
- arbitration clauses
- any other data requirements of either party.

29.4 ***Costs of a proposed reinsurance arrangement***

The cost of the reinsurance arrangements would be assessed as the value of the reinsurance premiums that would be paid to put them in place.

To this should be added the present value of any expenses that are incurred in putting the arrangements in place and in their subsequent management (*eg* providing policy and claims details to the reinsurer and managing claims recoveries).

The assessment might also make allowance for the cost of capital requirements held against additional risks that are incurred through taking out reinsurance, *eg* counterparty risk, liquidity risk.

Benefits of a proposed reinsurance arrangement

A realistic estimate can be made of the value of the benefits that would be paid under the arrangements by the reinsurer.

This would involve making realistic assumptions about the likely future experience of the reinsured business and, in particular, the distributions of claim rates and claim sizes.

The value of the benefits is likely to be lower than the cost of the reinsurance, as the reinsurance premium will include loadings for profits and contingencies.

However, an indirect benefit of reinsurance is the greater certainty over the insurance company's outgo, *eg* it will not suffer such big losses in the event of an accumulation of claims or a catastrophe.

This benefit could be quantified by, for example, assessing how much lower the company's capital requirement is as a result of the arrangement arrangements.

In addition to the direct benefits of reinsurance recoveries, a further factor to consider in assessing the benefits of reinsurance is any advantageous terms that the reinsurer may be able to offer, *eg* for administration, actuarial services and other insurance advice.

If these terms are available only in association with the reinsurance arrangement, then the saving they offer compared to the standard cost to the insurance company of these services should also be included in the assessment of the benefits of the reinsurance.

29.5 **Multiple reinsurance arrangements**

<i>£k</i>	Amount recovered from reinsurers:			<i>Amount retained by cedant after (c)</i>
	<i>(a) Surplus</i>	<i>(b) Quota share</i>	<i>(c) Risk excess of loss</i>	
Claim (i)	$\frac{50}{100} \times 60 = 30$	$60\% \times 30 = 18$	0	12
Claim (ii)	$\frac{200}{250} \times 400 = 320$	$60\% \times 80 = 48$	2	30
Claim (iii)	$\frac{100}{150} \times 300 = 200$	$60\% \times 100 = 60$	10	30
Total	550	126	12	72

Finally, the aggregate excess of loss policy (d) will pay out £22k, leaving the cedant with a retention of £50k.

29.6 (i) **Reasons for purchasing reinsurance**

The main purposes for which reinsurance is arranged are as follows:

- a reduction in claims volatility and hence [½]
 - smoother profits [½]
 - reduced capital requirements [½]
 - an increased capacity to write more business and achieve diversification [1]
- the limitation of large losses arising from:
 - a single claim on a single risk [½]
 - a single event [½]
 - cumulative events [½]
 - geographical and portfolio concentrations of risk [1]

and hence:

- a reduced risk of insolvency [½]
 - increased capacity to write larger risks [½]
 - access to the expertise of the reinsurer. [½]
- [Maximum 5]

(ii) **Assessing the security of a reinsurer**

Part (ii) is harder than part (i), requiring breadth of thought on the issues to consider. We recommend thinking practically here: how would we actually do this if it were our job? We would probably start by looking at the documentation on the reinsurer (accounts, regulatory reports, financial press). We should also consider aspects relating to the reinsurer's own risk management processes.

The insurer should start by looking at the financial strength of the reinsurer. [½]

The reinsurer's published accounts and statutory returns would be a good starting point. [1]

The insurer should look at the reinsurer's:

- solvency position, ie the level of free assets [½]
- types of assets held – match for liabilities, cashflow, volatility, diversification, marketability and liquidity [1]
- borrowings – level of gearing, income and asset cover. [1]

The legislative environment in which the reinsurer operates will also affect solvency. [½]

The type of business that the reinsurer writes will affect the security of the reinsurer. [½]

With regard to the reinsurer's liabilities, the insurer should look at:

- the diversity by class, geographical region and cedant [1]
- exposures to any risk accumulations / catastrophes [1]
- any particularly large, unusual or volatile risks covered by the reinsurer [1]
- the size of the liabilities and future plans for development / expansion [1]
- whether the reinsurer itself has reinsurance. [½]

The insurer should examine the reputation of the reinsurer, for example:

- its market share [½]
 - its previous claims history [½]
 - the ability of the management [½]
 - whether the reinsurer has a parent company or is associated with other companies and how financially strong these are [1]
 - its credit rating [½]
 - the views of others in the industry: other insurers, analysts, the regulator *etc.* [1]
- [Maximum 5]

29.7 (i) **Marine insurance risks**

The key risk under any general insurance policy is claims being higher than expected in frequency and/or amount. [1]

For marine insurance, this could be due to:

- large individual claims – for example, the loss of a large ship at sea [1]
- catastrophes – for example, a tanker runs aground and causes wide-spread pollution [1]
- accumulations – for example, a storm hits a harbour and many insured ships are damaged. [1]

There is also a risk of variable claims experience in general, since claims experience is heavily dependent upon the weather. [1]

The currency of claims will not be known with certainty, since ships may sail throughout the world. [1]

[Maximum 3]

(ii) **No reinsurance cover**

By opting for approach (a) the insurer hopes to avoid the risk of insolvency arising from very poor or variable claims experience by taking a capital injection from the parent company. [1]

Such an approach avoids the company bearing all of the claims risk from its own funds. [½]

The extent of protection provided will depend on the financial strength and attitude of the parent company. [1]

However certain risks are accepted under option (a), for example:

- There is a risk that the parent company is unable or unwilling to provide a capital injection when necessary. [½]
 - In particular, since the parent company is also a general insurer, there is a risk that both insurers suffer poor experience at the same time, so that just when the insurer needs a cash injection the parent company is unable to provide it. [1]
 - The risk to the *group as a whole* is not removed by this option, *ie* the group's results as a whole are not protected by this use of internal insurance. [½]
 - Accumulations or a catastrophe may be so significant that a cash injection from the parent company would be insufficient to meet the cost. [1]
- [Maximum 3]

(iii) **Comparison with reinsurance contracts**

Quota share reinsurance – approach (b)

This arrangement shares the risk with the reinsurer. [½]

Therefore, by only holding 50% of the risk under each policy, the insurer can write twice as much business for the same capital and hence achieve greater diversification. [1]

This type of reinsurance reduces all claims but does not cap claims, *ie* even 50% of a very large individual claim could be an unacceptable risk to the insurer. [1]

Excess of loss reinsurance – approach (c)

This arrangement passes individual risks above a certain level to the reinsurer. [½]

An excess of loss reinsurance contract protects the insurer against large individual claims. [½]

However, this type of reinsurance doesn't protect against the risk of a generally poor year of experience. [½]

Under both types of reinsurance:

- The insurer is not exposed to the inability or unwillingness of the parent company in making a payment, but ... [½]
 - ... there is a risk that the reinsurer can default. [½]
 - The insurer is likely to be ceding some of its profits to the reinsurer, which wouldn't be the case under (a). [1]
 - The profits of this insurer, and hence the group as a whole will be smoothed. [1]
- [Maximum 5]

29.8 (i) **Comment on explanations**

Generally poor claims experience throughout the whole market

This cannot be the sole cause of the poor results as this company has performed less well than comparable companies. [½]

However, it may still be one of the factors, particularly if the poor experience relates to a class of business in which the company is heavily exposed compared to other companies. [1]

Individual large claim

A single large claim would explain at least part of the *relatively* poor performance. [½]

Bad storm

A bad storm could have constituted a catastrophe, helping to explain the poor result. [½]

As with the generally poor claims experience, this cannot be the only reason unless there was some reason why this company was affected more than others. [1]
[Maximum 3]

(ii) **Suitable reinsurance arrangements**

Generally poor claims experience throughout the whole market

The types of reinsurance that might have helped here are as follows:

- Quota share: if the company had been heavily exposed to *eg* motor business, it might have agreed to share some of its portfolio with another insurer in exchange for a share in another class. [1]
- Stop loss: a reinsurance agreement that would cover the company if the total loss from all perils from a given class or classes exceeded an agreed level. This reinsurance would certainly have been helpful in this circumstance, but such arrangements are rare in practice and/or very expensive. [2]

Individual large claim

Layers of individual excess of loss reinsurance would have helped here. [½]

Another type of reinsurance that would have been suitable for large properties would have been surplus. [½]

Under a surplus arrangement, the company would have retained only a proportion of the risk. [½]

Bad storm

Catastrophe excess of loss reinsurance would have been appropriate. [½]

For example, suppose the company had catastrophe excess of loss reinsurance cover of £40m in excess of £20m and there was a storm which gave rise to total claims of £50m, then the company could have recovered £30m from the reinsurer. [1]

Also quota share with reciprocity would have been useful for helping to widen the spread of the business. [½]
[Maximum 4]

29.9 (i) **Factors to consider**

Hint: a good place to start this question would be to consider the various benefits of reinsurance and how each might be relevant to this general insurance company. Cost will also be relevant.

- The extent to which each type or level of reinsurance would reduce claims volatility and hence smooth profits. [1]
Stability of profits will affect ability to pay stable dividends (which shareholders may prefer). [½]
For example, more excess of loss protection (*ie* lower excess point) may result in more stable results. [½]
- Capital requirements and statutory solvency: the extent to which changing the reinsurance protection would impact the statutory solvency position. [1]
- Company strategy in relation to new business plans, *eg* whether planning to expand the business, ... [½]
... and how much of a strain new business places on capital. [½]
- The ability of the company to withstand large losses, ... [½]
... including the size of the company's free assets or available capital. [½]
- Senior management and shareholders' attitude to risk. [1]
- The potential for accumulations of claims. [½]
For example, whether there is high exposure in one geographical area. [½]
If so, individual excess of loss will not address this and so the company may decide that it needs more quota share in order to write a wider range of risks but maintain similar levels of net exposure. [1]
Alternatively, it might decide that it needs to purchase aggregate excess of loss reinsurance. [½]
- Whether the company benefits from technical assistance from existing reinsurers and whether a change in the reinsurance programme would affect this arrangement. [1]
- The cost and value for money of reinsurance available in the market. [1]
- Market reputation: how investors, analysts, brokers and customers will react to any significant change in reinsurance programme. [1]
- Security status and counterparty exposure: reinsurers with better security may charge more for the cover. [1]
[Maximum 8]

(ii) **Construction of the model**

Hint: think about the different aspects of building a model and the decisions that need to be made, including the basis, cashflows, time period of projection and outputs.

The model needs to project reinsurance premiums and reinsurance recoveries. [1]

Projections need to be realistic so the assumptions used must be on a best estimate basis. [1]

The future gross (*ie* pre-insurance) claims expected should be determined using individual claims data for the last five to ten years, say, gross of reinsurance. [1]

These should be adjusted for:

- claims inflation [½]
- changes to policy terms and conditions (*eg* changes to claims definitions, cover provided, the amount of any loss met by the policyholder) [1]
- external factors [½]
- changes to claims handling or settlement costs, *etc.* [½]

Claims frequency and amount distributions should be modelled separately so that trends can be allowed for appropriately in either. [1]

A combined claims distribution function should be derived from the separate claims frequency and amount distributions. [½]

Expense and investment cashflows should also be modelled. [1]

The model should project cashflows over a reasonable period, say five to ten years. [1]

The model needs to calculate net claims, allowing for the modelled reinsurance arrangement. [½]

The type of reinsurance may be varied and/or the retention proportion or level (or excess point) may be varied. [1]

Under each variation, the reinsurance premiums should be compared with modelled reinsurance recoveries. [½]

The model should output the impact on profits and on the solvency balance sheet. [½]

[Maximum 7]

29.10 (i) **Factors to consider**

Factors in relation to writing new business are:

- availability of capital to cover the costs, provisions and capital requirements in respect of the new business [1]
- availability of relevant data with which to price and subsequently establish provisions for the new business [1]
- experience in the risks to be covered [½]
- profitability of the new business [½]
- ability to extend classes of business written to the new classes of business (legal, administrative requirements) [1]
- ability to get reinsurance on the new business [½]
- competition – the commercial risk of offering competitive enough rates to secure the business but at the same time profitable rates. [1]

Factors in relation to taking on more business from the industrial company are:

- concentration of risk, by company, class, geographical area [1]
- relationship with the industrial company and past profitability [1]
- desire to maintain this relationship [½]
- risk attitude of the insurer. [½]

Factors in relation to the fit with existing business are:

- diversification by source of business [½]
- diversification by risk / class type [½]
- fit with existing reinsurance treaties [½]
- the insurer's business strategy and desire to accept this business. [½]

[Maximum 7]

(ii) **Reinsurance protection needed**

Hint: in order to determine what reinsurance protection would be appropriate, it might be useful to start with a list of all the different reinsurance products we have discussed in this chapter. Then, for each of these products, give reasons why it may or may not be needed to provide protection to this general insurer.

Assuming that it decides to provide insurance cover for all the industrial company's needs, the insurer will review its reinsurance arrangements:

- Quota share is unlikely to be used, as the insurer is a large company. [1]
- Surplus may be needed for large commercial property risks if the insurer does not write much of this business. [1]
- The retention for each risk will need to be determined. [½]

The insurer is likely to use the full range of non-proportional reinsurance products:

- excess of loss policies to cover the insured for losses arising above a pre-specified lower limit up to a pre-specified upper limit [1]
- risk excess of loss to cover large single claims from risks [1]
- aggregate excess of loss to cover accumulations on multiple risks, due to a single event, cumulative events, geographical or portfolio concentration [1]
- catastrophe excess of loss to cover very severe losses arising within a pre-determined time span from pre-specified events [1]
- *eg to cover against specific pre-defined events, such as hurricane, earthquake, etc* [½]
- stop loss to cover the whole account from all perils. [1]

The insurer should place business with different reinsurers to spread risk of reinsurer default. [1]

If the risks fall under existing treaties then they will be automatically covered. [½]
[Maximum 6]

29.11 (i) ***Types of alternative risk transfer contract***

Integrated risk covers

These are reinsurance arrangements covering several lines of a general insurer's business over several years, with lower and upper limits on the reinsurance being triggered by aggregate claims.

Securitisation

This can involve a transfer of insurance risk to the higher capacity banking sector and capital markets.

It is particularly useful for managing risks associated with catastrophes.

It involves the repackaging of insurance risk into a financial security with payments being contingent on the risk.

Post loss funding

This is a method of securing borrowing terms that would be available post-catastrophe, in advance of the specified event occurring. These guaranteed borrowing terms are provided in return for a commitment fee.

Insurance derivatives

Insurance derivatives could include catastrophe or weather-related derivatives.

Such financial instruments can be used to hedge against the losses that might arise on the occurrence of an adverse event, *ie* provide payments at just the time when an insurer's claim experience may worsen.

Swaps

Swaps involve organisations swapping packages of risk in order to reduce, for example, geographical concentrations of risk.

The risks that are swapped should be matching but uncorrelated (or negatively correlated).

Swaps can also be used by other organisations, *eg* energy companies, to swap risks.

(ii) *Reasons why insurers take out ART contracts*

Diversification

- An insurance company could use a swap contract to swap uncorrelated packages of risk with another insurer in order to gain diversification.
- Diversification is also achieved through exposure to counterparties other than reinsurers. For example, securitisation uses the capital markets and post loss funding could be arranged with a bank.

Provision of cover that might otherwise be unavailable

- The traditional reinsurance market may be saturated. Some forms of ART, *eg* securitisation, post-loss funding, swaps, derivatives are arranged through other markets.

Smoothing of results

- Integrated risk covers provide multi-line, multi-year reinsurance, which stabilises the cedant's results.
- Increased diversification (as discussed above) will also act to reduce volatility.

Cheaper cover

- Securitisation is arranged through the capital markets. Since insurance risk is uncorrelated with typical market-related risks, the capital markets may require a lower return on capital than reinsurers.
- Using integrated risk covers, an insurer can help ensure that it is not over-insured.

Additionally, since the reinsurer is obtaining a multi-line (diversified) portfolio of business, it may be happy to offer more favourable terms than if the individual risks were priced separately.

Cost savings arise because there is no longer the need to negotiate several separate reinsurance arrangements, and because the covers do not need to be renegotiated every year.

- For post loss funding, the commitment fee is lower than the equivalent insurance cost.

Tax advantages

- It is possible that any of the products could be structured to exploit tax loopholes.

Greater security of payment

- The capacity of the capital markets tends to be greater than that of reinsurers, resulting in a lower likelihood of default.
- Under securitisation, *eg* a catastrophe bond, the capital is provided to the insurer up-front.

Solvency

- Using integrated risk cover to stabilise the insurer's experience over time may ease the statutory solvency requirements that the insurer needs to meet.
- In all cases, reduction of risk allows a lower risk-based capital requirement to be held.

More efficient risk management

- ART products, such as integrated risk covers, can be tailored to the requirements of the insurer, and over-insurance is avoided.
- Insurance derivatives can be used to hedge against unusual risks, *eg* the risk of bad weather.

Source of capital

- Post-loss funding can be used as a source of capital – the terms for raising the capital are agreed prior to a specific loss event occurring.
- Securitisation could be a source of capital, if the jurisdiction is such that the liability does not have to be accounted for in the statutory returns.

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Other risk controls

Syllabus objectives

- 7.1 Describe attitudes to and methods of risk acceptance, rejection, transfer and management for stakeholders.
(Covered in part in this chapter.)
- 7.5 Analyse the risk management aspects of a particular business issue and recommend an appropriate risk management strategy.
- 7.6 Describe the tools that can be used to aid the management and control of risk.
- 7.7 Discuss the issues surrounding the management of risk for financial product providers.
(Covered in part in this chapter.)
- 7.8 Describe how risks with low likelihood but high impact might be managed.
- 12.5 Discuss the issues surrounding the management of options and guarantees.
(Covered in part in this chapter.)

0 Introduction

Having looked at reinsurance and ART in the previous chapter, *ie* two tools for *transferring* risk, we now turn to considering tools and techniques for managing and controlling the risks that are *retained* by a financial product provider.

The following can be used to aid the management and control of risk for a financial product provider:

- **diversification**
- **underwriting at the proposal stage – this ensures a fair price is paid for the risk**
- **claims control procedures – these mitigate the consequences of a risk event that has occurred**
- **management control systems – these reduce the exposure to risk.**

Each of these is covered in more detail in the first sections of the chapter.

We then consider the risk management and control techniques that are appropriate for specific types or sources of risk:

- risks relating to any financial options and guarantees that have been offered
- low likelihood, high impact risks.

The chapter finishes our consideration of the risk management control cycle with a section that revisits the concept of risk financing (particularly the need to hold capital in respect of retained risks) and then a section containing a worked example from the Core Reading. This illustrates what might be expected under the syllabus objective that requires analysis of the risk management aspects of a particular business issue and recommendation of an appropriate strategy to deal with them.

1 Diversification



Risk can be diversified within the following:

- lines of business
- geographical areas of business
- providers of reinsurance
- investments – asset classes
- investments – assets held within a class.

Diversification of business lines can be achieved by marketing a wide range of contracts insuring a wide range of risks. However, this would be expensive in terms of administrative systems, staff training etc. It also means that all companies are generalists and there is little scope for niche players in the market.

It is possible for a company to turn the fact that it is a generalist, offering a wide range of products, into a positive marketing message. Such a company could present itself as a *one-stop shop* – able to meet all of its customers' needs. Conversely, niche players can also make this a marketing advantage, playing on expertise in a particular area and a strong, focussed brand image.

To deal with the disadvantage, companies can use reciprocal quota share reinsurance, where one company reinsures part of its business to another in exchange for accepting part of its reinsurer's business. In this way each company can concentrate its marketing, sales and administrative effort on its chosen segment of the market, while still writing a wide spread of risks.

If two companies enter into a reciprocal arrangement they are each spreading their exposure over a wider group of risks, which should naturally reduce the claims volatility they face. For example, a company exposed to 100% of five risks faces greater claims volatility than one exposed to 50% of ten risks.

Furthermore, if Company A is a specialist annuity provider and Company B specialises in the protection market (*eg* term assurance), they have opposite exposures to mortality risks. It may be beneficial for each company to reinsure a proportion of its business with the other. They would both maintain their niche player status, but would have the effective diversification of a wider range of business. Similar arrangements could also be set up between two companies selling business in different geographical areas.

2 Underwriting at the proposal stage

2.1 What is underwriting?



Underwriting generally refers to the assessment of potential risks so that each can be charged an appropriate premium.

This process of consideration of a risk includes the assessment of whether the risk is acceptable *at all* as well as the appropriate premium and any special terms and conditions of the cover if it is acceptable.

The basic objective of a provider may be to take on all proposals at appropriate premium rates. In attempting to do this, the provider is exposed to two potential types of risk:

1. the premium rates are not appropriate to the risks concerned
2. the premium rates permit selection against the provider.

2.2 Underwriting as a risk management tool

Underwriting can be used to manage these risks in the following ways:

- **It can protect a provider from anti-selection.**

Anti-selection is not fraudulent or illegal. It involves the proposer not disclosing certain information to the insurer that would enable the insurer to better price the risk, *because the insurer did not ask for it*. Deliberate non-disclosure in response to a question asked is fraudulent.

In particular, anti-selection enables a provider to decline really severe risks, *eg* those in extremely poor health who would have to be declined life insurance cover.



Question

'If underwriting is the assessment of potential risks so that each can be charged an appropriate premium, I don't see how declining an applicant would be the most appropriate cause of action. Why not just charge a sufficiently high premium?'

Comment on this observation.

Solution

The statement is true for most potential risks – the provider will want the applicant's business, albeit subject to them paying an appropriate premium.

However, it is not true for the very bad risks. The reasons for this are:

- it may be much more difficult to rate them accurately
- the risk of claim may be so high that there is little hope of recouping the initial expenses involved

- the appropriate premium might be so high that there is no realistic hope of actually selling the policy.

- **It will enable a provider to classify risks into homogenous groups for which a standard premium can be charged. For life assurance the groups will be determined by at least age and gender; for general assurance a whole range of rating factors is used to determine granular data regarding the risk.**

Although insurance risk experience differs by gender, equality legislation in some countries means that the insurance company may not be permitted to charge a different premium to males and females.

Adequate risk classification within the underwriting process will help to ensure that all risks are rated fairly.

- **Underwriting will enable a provider to identify risks for which special terms need to be quoted. A provider will normally aim to accept a large proportion of the business it accepts at its standard rates of premium.**

Accepting a large proportion of the business at standard rates makes all aspects of the administration easier, *eg* premium collection, valuation, claims handling (as the company does not have to check for exclusion clauses). It may also be easier to present to customers, who would probably dislike being classed as 'substandard' risks.

Particularly in general insurance, the insurer may simply decline risks that do not fit into its rating matrix.

- **For substandard risks, the underwriting process will identify the most suitable approach and level for the special terms to be offered.**

Possible special terms include:

- increasing the premium for a given level of benefit
- decreasing the benefit for a given level of premium
- exclusion clauses
- deferring the cover until more information is known
- declining cover.

- **It will help in ensuring that claim experience does not depart too far from that assumed in the pricing of the contracts being sold.**

We want the underwriting procedure to ensure that, on average, the insured risks enjoy the same experience as those risks underlying the experience on which current premium rates are based. Normally, companies would consider their pricing assumptions and underwriting procedures hand-in-hand.

- **For larger proposals, the financial underwriting procedures will help to reduce the risk from over-insurance.**

Financial underwriting is an assessment of whether the proposed benefits are reasonable relative to the financial loss the insured will suffer if the insured event(s) occur.

Financial underwriting will alert the insurer to attempted anti-selection by a potential policyholder. For example, suspicions would be raised if someone of average wealth applied to take out a massive life insurance policy. A standard check to apply in underwriting term assurance would be the ratio of sum assured to the salary of the applicant. Similarly in general insurance, suspiciously high valuations of buildings to be insured would be investigated.



Question

Describe the characteristics of a class of insurance that would make underwriting important for that class.

Solution

Underwriting is important for those products where the potential risk to the provider is large. This is the case when:

- the size of the policy is large
 - the gains to be made from anti-selection are large (*eg* there is more to be gained from anti-selection on a term assurance contract than an endowment assurance contract, so it is more important to underwrite the term assurance)
 - cover is optional rather than compulsory, as there is more of an anti-selection risk on voluntary insurance. For example, more comprehensive forms of motor insurance present a greater risk of anti-selection than those offering only the minimum legal level of cover.
-

2.3 Life insurance underwriting process

The underwriting process for a life insurer is outlined in this section.

It involves:

- medical underwriting – assessing the applicant's health
- lifestyle underwriting – assessing the impact of lifestyle (*eg* occupation, leisure pursuits, country of residence) on the level of risk
- financial underwriting – to reduce the risk of over-insurance, as described above.

Medical evidence

Where the company is at risk on death or sickness under a contract, it will obtain evidence about the health of the applicant so as to assess whether he or she attains the company's required standard of health and, if not, what their state of health is relative to that standard.

For annuities and other contracts where there is only a longevity risk, the same could be done, but with a different emphasis, if the company intends to differentiate according to the health of the applicant in the terms it offers.

For example, *ill-health* (or *impaired lives*) annuities are now increasingly common, *eg* in the UK and the USA. The emphasis of these contracts is more to improve the marketability and fairness of the contracts than to control risk.

For example, a person who is in poor health would not consider applying for an annuity unless some special rates were to be offered. In this case, the insurer would grant a higher level of annuity payment on the expectation that the payments would continue for a shorter time.

An example would be an annuity contract where better rates were to be offered to smokers than to non-smokers.



Question

Explain the risks of offering preferential annuity rates to smokers.

Solution

The main risk is that the policyholders deemed to be unhealthy improve in health – *ie* in this instance, smokers giving up smoking. There is also the risk of non-smokers declaring themselves as heavy smokers when they apply for an annuity.

There is also a possible moral dimension to this, because the company is rewarding people for indulging in an injurious habit. The company would need to consider whether any proposed underwriting practice was ethical before proceeding. (Remember the control cycle: here we have an example of ethical, *ie* professional, considerations possibly affecting a decision.)

An insurer will assess the longevity and health risks of a prospective policyholder by:

- asking questions on the proposal form
- obtaining reports from a policyholder's doctor(s)
- carrying out a medical examination
- performing specialist tests on the applicant.



Question

Discuss the extent to which applicant dishonesty when answering proposal form questions could be a risk to an insurer.

Solution

The extent to which this is a potential problem depends in part on the sales method used. It is easier to give misleading answers about height and weight if filling in a direct marketing form for posting to the insurer than it is if a salesperson or financial adviser is involved in the sale. It also depends on the degree of underwriting, as strict underwriting acts as a deterrent and there is less likelihood of fraudulent applications.

Dishonesty is not in any event a major problem for the insurer if the premiums charged allow for it correctly. This will happen automatically if premiums are based on the company's mortality experience for its own policyholders, and they displayed the same degree of dishonesty in answering their original proposal form questions. (Strictly this is true only if there is no change in the *mix* of business, if different groups display different degrees of dishonesty.)

So dishonesty will only be a problem if:

- it is increasing, or
- the insurer's premiums are based on some other group of lives (*eg* from reinsurers' data) and underwriting procedures were stricter for these lives.

In addition, dishonesty will be less of a problem if it can be picked up at the claims control stage or for products where the mortality or morbidity risk is only small.

The more information an insurer obtains about each applicant, the greater the proportion of high-risk applicants that will be identified. This means that more extra premiums will be received for the same policyholders, but at a higher underwriting cost.

Therefore the insurer must weigh the advantages of medical underwriting against the extra costs involved.

The insurer would normally look at market practice in setting the medical limits at which the various tests are triggered or seek its reinsurer's advice.

Lifestyle underwriting

Besides the medical state of health of the applicant, other factors that can affect the mortality or sickness risk need to be investigated, namely any risks associated with the:

- **applicant's occupation**
- **leisure pursuits of the applicant**
- **applicant's normal country of residence.**



Question

Suggest factors relating to the applicant's normal country of residence that might influence mortality risk.

Solution

The expected level of mortality may be affected by:

- standard of living
 - diet and lifestyle
 - climate
 - prevalent diseases
 - access to medical care and the quality of care
 - levels of violent crime
 - terrorism / war risk.
-

Financial underwriting

To counter the risk of over-insurance, details of the *financial* health of the applicant may be obtained.

For example, questions may be asked about the applicant's level of income – particularly for an income protection insurance policy.

Interpretation of the evidence

The evidence obtained needs to be interpreted in terms of the standard of health required by the life insurance company. This will be done by specialist underwriters employed by the company.

The proposal form will be initially reviewed by administrative staff. They will look through the answers, converting the numerical fields (such as height and weight, or units of alcohol consumed) into 'OK / not OK' by reference to some simple tables prepared by the company's specialist underwriters. Most proposals will be 'OK' on all fronts, and can then be processed immediately.

Those proposals for which queries have been raised will be passed on for further consideration. Many of the proposals may then be dealt with by an underwriter making reference to a (paper or computer-based) manual from a reinsurer. Such manuals are a good example of the types of technical assistance that reinsurers provide. Particularly unusual or large cases may be referred to a doctor employed by the provider for this purpose.

Specification of terms

Applicants whose state of health reaches the required standard can be offered the company's normal terms for the particular contract.

Other applicants will be offered special terms, unless their state of health is such that the company will not accept them on any terms, in which case they will be declined – at least temporarily.



Question

'If someone is a bad risk they will still be a bad risk at the end of the period they are declined for, and so temporarily declining does not help.'

Comment on this statement.

Solution

Although it will be true for some cases, it is not necessarily true for all.

A temporary refusal of acceptance is in effect a deferral of the underwriting decision to a later date. This could be appropriate when the applicant's level of risk is too *uncertain* at the present time to assess it with adequate precision, but at a future time may be clearer. An example would be a person who has recently undergone an operation, and whose prognosis is currently unclear. In a few months' time it may be possible to assess the person's risk with much more confidence; hence a deferral of any decision to this later date would be the correct *current* decision to take.

The main ways in which the special terms can be specified are as follows:

- **An addition may be made to the premium that would have been charged to an applicant who did meet the required standard, commensurate with the degree of extra risk.**
- **A deduction may be made from the benefit, which would have been paid to an applicant who did meet the required standard, again commensurate with the degree of extra risk.**
- **An exclusion clause may be appended to the contract, which excludes payment of benefit claims that arise due to specified causes.**

The exclusion clause will normally be the least preferred option, since if a policyholder requires cover for some reason, such as providing an income for a widow(er) and family, a policy with an exclusion clause would not be meeting fully the policyholder's insurance need. In fact, the policy is providing no cover for what is almost certainly going to be the most likely cause of death, and it is likely that adverse publicity would follow the enforcement of exclusion clauses in practice.

Another significant difficulty with exclusions is that they are very *difficult to enforce* at the time of claim. Officially recorded causes of death can be vague or ambiguous.



Question

Discuss the special terms that are likely to be the most suitable for the following contracts:

- (i) regular premium endowment assurance
 - (ii) regular premium income protection insurance.
-

Solution

(i) *Regular premium endowment assurance*

The product is a savings vehicle, where policyholders generally decide what premiums they can afford to pay, and then see what eventual benefit they get at maturity. If this is so, then an approach which involves only reducing the death benefit would probably be most suitable.

It also means that policyholders who do, in the end, survive to the end of the term and hence have not contributed in any way to any mortality loss, receive the same benefit for the same premium as an unimpaired life. This seems fair, and appears to meet most policyholders' needs from this contract.

However, if the product has been purchased in order to repay an interest only loan (*eg* mortgage) then reducing the death benefit might not be appropriate and an increase in premium could be preferred.

(ii) *Regular premium income protection insurance*

In this case, the policyholder normally decides on some necessary level of cover (*eg* 75% of salary) and then pays the required premiums. So it will generally be more appropriate to increase premiums, rather than to reduce the cover from what the policyholder originally wanted.

Use of an exclusion clause is a possible alternative, depending on the perceived balance between any reduction in marketability it would cause and the addition to premiums that is the alternative.

3 Claims control systems



Claims control systems mitigate the consequences of a financial risk that has occurred. They guard against fraudulent or excessive claims.



Question

Describe claims control systems that a life insurer can implement at the claims stage.

Solution

For death claims, the insurer can check, for example by reviewing the death certificate, that the claim is genuine (not a fake death), and that the details declared at policy proposal were correct. For instance, if a declared 'no dangerous hobbies' policyholder dies from a parachuting accident, the life insurer might decide not to pay out (although the potential bad publicity that such a decision could cause would be a consideration).

However, life insurance claims control is more important for sickness contracts, where it is a continuous process (*eg* as well as checking the validity of the claim initially, the life insurer may want to check on the continuing validity of the claim at regular intervals) and where the basis for claiming can be more subjective.

However the costs of implementing and maintaining a control system must be compared with the benefits gained from it.

For example:

- **Most general insurers will accept small claims on the basis of a claim form and a single estimate for the necessary repairs.**
- **Above a monetary limit the insurer may wish to see two or three estimates, including one from a company approved by the insurer.**
- **At a further level, the insurer might require that damage is inspected by one of its employees or agents before remedial work is authorised.**
- **For the larger claims the insurer might appoint a firm of loss adjusters to manage the whole remedial programme on its behalf.**

Another example of a claims control system is the need to manage income protection or permanent health insurance claims. Here, claims management applies both at inception of the claim and during the claim:

- **Before starting to make any claim payments, the insurer will need to assess the illness (or disability) of the insured to ensure it meets the conditions of the insurance contract.**
- **During payment of the claim, the insurer will need to regularly reassess the illness (or disability) to ensure it remains a valid claim.**

The claimant needs to have a strong incentive to return to work. While the claim payments fulfil an important need, it is equally important that the claimant does not see the additional income as a justification for not working.

It is therefore important that the amount of claim is an appropriate proportion of the policyholder's normal income levels, *eg* a maximum of 75%.

The insurer may also wish to help the policyholder recover from their illness, which may be possible by allowing partial return to work. This may benefit not only the insurer in terms of reduced claims, but also the longer-term health of the insured may be improved by entering active employment again.

This may be part of a wider 'rehabilitation service' offered by the insurer, designed to give the policyholder support and advice to encourage their timely return to work.

4 Management control systems

Examples of management control systems include:

- **Data recording**

It is important that the company holds good quality data on all the risks it insures, with particular emphasis on the risk factors identified when the product was designed or when the risk was underwritten. While this cannot change the provider's exposure to the business risks underwritten, it can assist in ensuring that adequate provisions are established for those risks, and reduce the operational risks from having poor data.

- **Accounting and auditing**

Again good accounting and audit procedures cannot change the risks accepted, but enable proper provisions to be established, regular premiums to be collected, and the providers of finance to the provider to be reassured as to its financial position.

- **Monitoring of liabilities taken on**

It is important to monitor the liabilities taken on by a company to protect against aggregation of risks of a specific type to an unacceptable level. Where the acceptance of risks involves the provider in new business strain, it is important to quantify the amount of new business to ensure that it is within the provider's resources.

A direct management control that could be put in place for a product that generates new business strain is to impose a maximum limit on the amount of new business volume accepted.

In addition, premium rating may involve cross-subsidies from one type or class of business to another. If the business mix expected in the premium rates is not achieved in practice, the profitability of the contract may be at risk.

It is particularly important that systems or procedures are in place to enable monitoring across business areas, *ie* at the enterprise level. For example, a composite insurance company's exposure to a large corporate customer might encompass life business (group life term insurance) and general insurance (property and liability insurances).

- **Options and guarantees**

Care is required to monitor any options and guarantees and in particular to determine whether the options or guarantees are likely to bite.

Options and guarantees are said to 'bite' if they come "into the money", *ie* they have value and so are likely to be exercised (in the case of options) or provide higher benefits than otherwise (in the case of guarantees).

As described in the chapter on Financial product and benefit scheme risks, offering options and guarantees generates additional risk. In the next section we consider the techniques that management might use in order to control such risks.

Another example of a management control is the performance of due diligence before entering into an agreement with a counterparty, such as an outsourcing company, in order to reduce credit risk. Due diligence involves performing a comprehensive review and appraisal of the organisation in order to assess its ability to perform the agreed services.

5 Managing the risk associated with options and guarantees

Risk management techniques can be used to protect the provider against the possible adverse effects of options and guarantees given in contracts.

Liability hedging can be used to manage options and guarantees. Liability hedging involves choosing assets which match the liabilities so that they move consistently with each other, thus hedging the underlying market risk that arises from the existence of the option or guarantee.

For example, the value of liabilities may be linked to some external index, such as under 'guaranteed' contracts where the movement of one or more market indices determines the amount of benefit payable in some way. To hedge such liabilities, use can be made of derivatives linked to the same index or indices. Another example would be a guaranteed minimum benefit under a unit-linked or with-profits product, which can be hedged using appropriate put options.



Question

Consider a single premium, five-year term, guaranteed equity bond linked to the FTSE 100 that at maturity will pay out the higher of 90% of the growth in the FTSE 100 over the five years or a return of the single premium.

Suggest two possible sets of assets that could be used to hedge this guarantee.

Solution

The guarantee could be backed by either:

1. a zero-coupon bond and a call option on the FTSE 100
2. shares (to track the FTSE 100) and a put option.

Use is often made of over-the-counter derivatives for hedging purposes, thereby avoiding the uncertainty and expense of 'rolling-over' short-term exchange-traded derivatives over the lifetime of the underlying contract.

For example, the provider may use over-the-counter (*ie* privately negotiated) derivatives because the longest available term of, for example, a FTSE 100 option on an exchange is only two years.

Also, if a contract was based on a different index, *eg* the Transylvanian Tiny Companies Index, then over-the-counter derivatives may have to be used due to a lack of suitable exchange-traded (*ie* standardised) derivatives.

Guarantees and options can be hedged dynamically, that is by rebalancing the underlying hedging portfolio as market conditions change.

Dynamic hedging of liabilities refers to a strategy whereby the underlying assets (here, derivatives) are changed on a regular basis in order to retain close matching as economic conditions evolve.

This can be problematic to implement in practice, particularly when conditions change very rapidly, and the transaction costs resulting from dynamic hedging can be material.

Hedging techniques for options and guarantees are made more difficult because the theoretical matching assets are not always available.

It may not even be possible to obtain over-the-counter derivatives that match the liabilities that arise under the option or guarantee.

Another control that can be used to manage risks arising from options is the restriction of eligibility criteria, *eg* only allowing an option to be exercised on a limited number of dates.

6 Low likelihood, high impact risks

Dealing with low likelihood but high impact risks is a particular issue that may arise as part of the 'Risk control' stage of the risk management process.

The risk portfolio analysis described in [Chapter 28](#) will have identified a range of high impact but low probability risks. These are among the most difficult to manage; they are likely to include both risks related to normal business activities and operational risks.

It is important to manage such risks in a measured way. Because credit rating agencies and regulatory authorities pay significant attention to the ability of a company to withstand rare events, there is a temptation for management to concentrate unduly on such risks at the expense of the broad range of risks accepted.

Low probability, high impact risks:

- can only be diversified in a limited way – for example production of a major product line on two sites diversifies the risk of a total loss of business premises by fire, but has attendant additional costs if a total loss by fire does not occur
- can be passed to an insurer or reinsurer, usually by some form of catastrophe insurance or whole account aggregate excess of loss cover (commonly called 'stop loss' cover)
- can be mitigated by management control procedures, such as disaster recovery planning.

Some such risks can only be accepted as part of the consequences of the business undertaken, and the management issue then becomes how to determine the amount of capital that it is necessary to hold against the risk event. The techniques of scenario analysis, stress testing and stochastic modelling discussed in [Chapter 28](#) enable this to be done.

Finally, a company will have determined its own risk tolerance – for example, the ability to withstand an event that might occur with a 0.5% probability within one year. This means that the company accepts that it might be ruined by a rarer event, and has decided not to take such events into account in its risk management.



Question

A company is considering purchasing farms in South America for the production of biofuels. Explain how the company might manage the following risks:

- government collapse
- fire damage to crops.

Solution

- Government collapse – diversify by investing in more than one South American country, foster close links with governments to make event less likely.
- Fire damage to crops – insurance to mitigate consequences of event, health and safety measures to reduce likelihood of event.

7 Risk financing

7.1 Issues relating to the management of retained risk

This chapter and the previous one have discussed mitigating risks.

This section considers the issues surrounding the risks that the individual or organisation chooses to retain or accept, and in particular how they are *financed*.

Having decided to retain or acquire certain risks, it is necessary to ensure that the price accepted for the risks taken on is adequate, allows the risk-taker to continue in business, and contributes to profit.

This is part of 'Risk financing', one of the components of the risk management control cycle. Ensuring that the price of accepted risks is adequate was also considered in the chapter on Accepting risk.

Evaluating and pricing risk is the key issue. However, it is also necessary to ensure that all risks are actively managed, so that the expected profit materialises.

Having taken actions to control risks, it is then necessary to determine the amount of capital to hold against the risks accepted.

This is also part of 'Risk financing'.

7.2 Adequacy of available financial resources

To the extent that risks are accepted or retained, capital needs to be held to protect against adverse outcomes. (Capital requirements are covered further in a later chapter.)

This might be expressed by reference to a ruin probability over a specified period, or a ruin probability over the entire run-off of the existing portfolio.

For example, a company may want to hold sufficient capital so that the probability of ruin over the next year is less than $\frac{1}{200}$. In other words, insolvency will occur in less than five out of 1,000 simulations.

The shorter the period chosen, the lower the ruin probability must be.

Example

Suppose a company wants to hold sufficient capital, £X, that the probability of ruin over a five-year time period is below $\frac{1}{40}$.

Imagine the company uses a model that considers a one-year projection period. Ruin is much less likely to occur over a one-year period than over a five-year period. In other words, only an amount of capital £Y (where $Y < X$) would be needed to keep the probability of ruin over a one-year time period below $\frac{1}{40}$. Therefore, in order for the one-year model to determine the higher amount, £X, of capital required, a lower probability of ruin must be used.

For example, a ruin probability of $\frac{1}{200}$ over a one-year period may be considered to be equivalent to a ruin probability of $\frac{1}{40}$ over a five-year period.

This could also be expressed as a confidence level of 99.5% over a one-year period being considered equivalent to a confidence level of 97.5% over a five-year period.

When financial products provide benefits on future contingent events, there is little that the product provider can do to prevent the primary business risk events occurring.

General insurers can contribute to public education campaigns about security of buildings and reducing the risk of fire, and a health insurer could offer incentives to stay healthy eg free gym membership. However, there is little scope for a life insurer or benefit scheme to reduce the likelihood of the underlying risk event happening.

That is, there is limited scope for a life insurer or benefit scheme to affect the likelihood of death.

However, all companies can implement control systems to reduce the likelihood of operational risks such as financial fraud.

Financial product providers need to have a comprehensive approach to risk management to ensure that they have adequate resources to meet their obligations.

A comprehensive approach to risk management includes making sure that *all* staff (eg underwriters, actuaries, claims handlers and marketing and IT experts) are engaged in risk management, not just the designated risk team.

The risk management process will ensure that not only is sufficient capital available, but also that the capital is being used efficiently and that the organisation is creating value for shareholders and/or other stakeholders.

Another important aspect is that the risk management programme should also reduce the total cost of risk, ie the cost to the entity of all costs incurred to deal with risk including expected loss costs, disruption to business, insurance premiums, risk managers' salaries, and other items.

8 Analysis of business issues

This syllabus objective requires the use of techniques covered in this and previous chapters to discuss a particular scenario. One example is given here.

Other examples can be found in the practice questions at the end of this chapter.



Core Reading Question

A large motor insurer has noted that claims management expenses as a proportion of claims costs have been increasing steadily over recent years. The proportion is now 6.25% of claims costs compared with 5% five years ago.

- (i) Discuss why this increase may have occurred.**
- (ii) Discuss possible actions the company can take to reverse the position.**

It has been suggested to the company that it can reduce both claims management expenses and the costs of carrying out vehicle repairs, by acquiring a chain of vehicle repair garages and requiring that repairs are carried out at the insurer's own garages.

- (iii) Describe how this approach may reduce costs.**
 - (iv) Outline the issues the company will need to consider before proceeding with the acquisition.**
-

Hints

Parts (i) and (ii) are about a claims control system to manage risk. The system is designed to control the cost of claims and to mitigate the risk of fraudulent claims.

In answering this question, the starting point is therefore to consider the balance between the benefits and costs of claims control systems, as described earlier in this chapter.

The instruction verb 'Discuss' indicates that there may be uncertainties so that it is not possible to give definitive reasons or actions, and that different viewpoints may need to be considered.

There is a link between parts (i) and (ii): it might be possible to generate ideas for actions by considering each of the underlying reasons.

Parts (iii) and (iv) involve analysing the business risks behind a proposal.

For part (iv), we also need to consider factors that would be relevant for any purchase of a company by another company, including practical issues.

Solution

(i) Increased proportion of claims management expenses

- The key point is that the observed increase in costs may actually be planned and may be a good thing. By spending more on claims management, fraudulent and excessive claims may have been reduced or eliminated. Claims management costs as a proportion of claims may have increased, but the overall claims ratio (claims, including management costs, as a proportion of premium income) may have reduced. The question does not give the data to determine whether or not this is the case.
- Costs for the different categories may have escalated differently over the period. For example, staff costs may have escalated differently as claims management activities are carried out by clerical and professional staff and vehicle repairs are carried out by manual workers.
- Claims volumes may have fallen and no action been taken on claims department staffing.
- The mix of claims may have changed, with a greater proportion of either large or small claims. For example, claims expenses, as a percentage of claims, may be greater for larger claims. Small claims may be admitted with negligible investigation, whereas large claims will involve professional loss adjusters. Alternatively, many small claims could lead to a greater burden of fixed claims management overheads.

(ii) Actions the company can take – assuming that it wants to reverse the position

- The company is likely to have fixed limits for various levels of claims management eg only involve loss adjusters for claims above £1,000. If these amounts have not been increased in line with inflation, then a greater proportion of claims will have been categorised as larger and incurred higher expenses.
- The company can review any fixed limits for levels of claims management in line with inflation. It could also increase limits in excess of inflation or change the structure in some other way to reduce claims management costs.
- However, this type of action may increase fraudulent or overstated claims, and thus increase rather than reduce overall costs.
- The company may have statistical data relating fraudulent claims to the level of claims management, but it may be out of date or not exist. The company would have to keep a close watch on costs and be prepared to reverse the position if necessary.
- Claims department staffing levels and/or the efficiency of staff could be reviewed.
- Operational improvements for efficiency could be introduced.

(iii) Use of own repair garages to reduce costs

- Independent garages may overestimate the costs of repairs to increase their own profits.
- With a subsidiary chain of garages, multiple estimates will not be required, and loss adjusters will generally not be used. Estimates for smaller claims will be accepted without question.

- Independent garages may agree to doing additional repairs not caused by the incident and including them in the claim. The management controls available if the garages were a subsidiary chain could prevent these abuses and reduce costs.
- A large chain of garages may achieve economies of scale.
- A subsidiary chain of garages can either be non-profit making, or can pass any profits to the insurer through dividends.

(iv) *Risk considerations and other issues before proceeding*

- Does the chain of garages have nationwide coverage, or what arrangements can be made in uncovered areas?
- Will any disclosure of this claims practice in advance be required, and if so will it affect sales volumes or customer satisfaction?
- Will the practice impact vehicle warranties or manufacturers' recommendations?
- Will the garages be able to cope with the additional workload?
- Apart from these specific items, the insurer will have to assess the acquisition as it would any other equity type investment (as they will effectively be buying shares in the garage chain). A full risk / reward analysis will be carried out.
- It would have to review profitability, operational methods, staff contracts and costs. It would also have to consider premises costs and the capital requirements of holding stocks of parts and equipment.
- All these assessments would use past data from the garages, adjusted for the changed circumstances and the additional work generated. Consideration would be given to the actions (and reactions) of competitors.
- The insurer would need to consider whether the benefits justify the costs involved, particularly bearing in mind that running garages is not a core activity for an insurance company.

The chapter summary starts on the next page so that you can keep all the chapter summaries together for revision purposes.

Chapter 30 Summary

Diversification

Risk can be managed through diversification within the following:

- lines of business
- geographical areas of business
- providers of reinsurance
- investments – asset classes
- investments – assets held within a class.

Diversification can also be achieved by entering into reciprocal reinsurance arrangements.

Underwriting at the proposal stage

Underwriting generally refers to the assessment of potential risks so that each can be charged an appropriate premium. It can be used to manage risk in the following ways:

- It can protect a provider from anti-selection.
- It enables a provider to classify risks into homogenous groups for which a standard premium can be charged, and thus helps to ensure that all risks are rated fairly.
- It enables a provider to identify risks for which special terms need to be quoted.
- For substandard risks, the underwriting process identifies the most suitable approach and level for the special terms to be offered.
- It helps in ensuring that claim experience does not depart too far from that assumed in the pricing of the contracts being sold.
- For larger proposals, it will help to reduce the risk from over-insurance.

Life insurance initial underwriting is likely to involve the following:

- medical underwriting – assessing the applicant's health
- lifestyle underwriting – assessing the impact of lifestyle (*eg* occupation, leisure pursuits, country of residence) on the level of risk
- financial underwriting – to reduce the risk of over-insurance.

The evidence needs to be interpreted by specialist underwriters. Applicants whose state of health reaches the required standard can be offered the company's standard terms for the particular contract. Other applicants will be offered special terms, which might include:

- an addition to the premium
- a reduction to the benefit
- an exclusion clause
- declining the applicant (either on a temporary or permanent basis).

Claims control systems

Claims control systems mitigate the consequences of a financial risk that has occurred by guarding against fraudulent or excessive claims.

For some products (*eg* income protection) claims management continues during claim.

Management control systems

Management control systems include:

- data recording
- accounting and auditing
- monitoring of liabilities taken on
- management of options and guarantees.

Techniques for managing options and guarantees include:

- liability hedging and asset / liability matching, including the use of derivatives and dynamic hedging
- restricting option eligibility conditions.

Low likelihood, high impact risks

Such risks are among the most difficult to manage, and:

- can only be diversified in a limited way
- can be transferred to an insurer or reinsurer
- can be mitigated by management control procedures, *eg* disaster recovery planning.

In order to determine the capital necessary to hold for such risks and the extent to which mitigation is necessary, the company will consider its own risk tolerance, *eg* withstand a 0.5% probability risk event over a period of one year.

Risk financing

The price accepted for a risk must be adequate, allowing the risk taker to continue in business and also to provide a contribution to profit.

It is then necessary to determine the amount of capital to hold against the risks accepted or retained, *eg* to target a ruin probability over a specified period.

Risk management should be co-ordinated in order to be capital efficient and to reduce the total cost of risk.



Chapter 30 Practice Questions

- 30.1 Explain the reasons for underwriting life insurance proposals.
- 30.2 Describe the effect that the standard of a general insurance company's underwriting will have on the pricing of its contracts.
- 30.3 List questions that would be asked on a typical life insurance proposal form. (*Hint: think about questions relating to medical information, lifestyle and financial information.*)
- 30.4 A life insurance company initially underwrites applications for term assurance business based on the details provided on the proposal form. It has been suggested that the form should be simplified by reducing the number of questions asked.

Exam style

Discuss the possible implications for the life insurance company of this proposed change. [8]

- 30.5 A life insurance company's underwriting process has shown that an applicant has recently been diagnosed with a particular disease. 90% of individuals contracting this disease die from it, with death occurring around twenty years from the date of diagnosis. The 10% who survive the disease cease to show any symptoms within three years from diagnosis.

Exam style

Discuss the terms that might be offered in respect of each of the following contracts:

- (a) 10-year term assurance
- (b) 10-year convertible term assurance
- (c) 20-year endowment assurance
- (d) whole life assurance
- (e) waiver of premium benefit on a pension contract. [6]

- 30.6 'Good management control systems can reduce a general insurance company's exposure to risk.'

Describe four types of management control system.

- 30.7 A company has been carrying out a risk assessment exercise. It has identified one risk as being the total loss of the business infrastructure due to an earthquake hitting the region in which the company operates. This is assessed to happen on average once every 400 years.

Discuss the key considerations when managing such a risk.

- 30.8 A life insurer is looking to launch a 25-year regular premium with-profit endowment assurance policy.

Exam style

- (i) Outline the key characteristics of this type of business. [3]
- (ii) Describe the risks that it may pose to the insurer. [8]
- (iii) Suggest ways in which the insurer can mitigate these risks. [12]

[Total 23]

30.9 A life insurance company has written mainly annuity business for the last fifteen years. The company now considers that its exposure to longevity risk is too great. As annuities are the company's main source of new business, it does not believe that it can withdraw from the annuity market without damaging its reputation irreversibly.

Exam style

Outline alternative ways in which the company can control its exposure to longevity risk. [5]

30.10 A coal-fired power station is carrying out a risk assessment and management exercise.

Exam style

(i) Identify important risks to which the company is exposed. [7]

(ii) State the main purposes of risk controls. [3]

(iii) Outline a suitable approach to managing each of the risks identified in part (i). [10]

[Total 20]

30.11 A general insurance company has been asked to quote premium rates by a large country-wide motor dealer for residual value insurance on loans arranged by the motor dealer for car purchase. The loans would typically have a term of five years. The insurance is offered at point of sale of a car to the car buyer. The cover provided is the difference between the amount required to pay off the loan and the amount recoverable under the policyholder's motor insurance policy if a car is written off as a total loss through accident or theft.

Exam style

Outline the risks arising from this contract and how to mitigate them. [6]

30.12 Describe the risk management control cycle, including the tools and techniques that should be used at each stage. [15]

Exam style



Chapter 30 Solutions

30.1 The key purpose of underwriting is to ensure that the provider charges a fair premium for the risks that it is taking.

If the premium charged is too low, then the provider will make a loss on the contract.

If it is too high then the provider will lose the business.

In particular, the provider wishes to:

- protect itself against anti-selection
- identify lives in such poor health that it should not give them cover
- classify other lives appropriately, to reduce heterogeneity – this helps to ensure a fair premium but also makes data easier to analyse and reduces the variance of claims
- identify risks for which special terms need to be quoted
- identify the level and type of loading appropriate for extra risks – the provider may however aim to accept a large proportion of the business it accepts at its standard premium rates
- ensure that claim experience does not depart too far from that assumed in the pricing of the contracts being sold
- combat over-insurance using financial underwriting.

30.2 The critical thing is the connection between the level of underwriting and the claims experience.

The stricter the underwriting, the lighter the expected claims experience, *ie* bad risks are likely to be deterred by high levels of underwriting and hence the company should attract a greater proportion of good risks.

The stricter the underwriting, the higher the underwriting expenses.

The level of underwriting may affect the level of anti-selection the company faces and the target market to which the company's products will appear attractive.

The level of underwriting may also affect the level of selective withdrawals, *ie* good risks being more likely to let their cover lapse if they can successfully meet underwriting criteria to get cheaper cover elsewhere.

Underwriting may also affect the provisions. The better the risk management process, the lower the level of global provisions that may be required, and this the lower the charge for cost of capital / provisions within pricing.

30.3 Typical proposal forms include questions about:

- age and gender
- height and weight
- smoking and drinking habits
- current health and details of any current treatment being received
- personal medical history (any major illnesses or operations)
- family medical history (check for hereditary ailments like heart disease)
- occupation
- salary
- sum assured
- address (country of residence)
- potentially dangerous leisure pursuits.

30.4 Sales of these policies may rise, ... [½]

... which would, all else being equal, increase profits. [½]

Underwriting costs may be slightly lower because there are fewer answers on the proposal form to analyse. [½]

The company could pass on some or all of this saving to customers through lower premiums, making the product more competitive. [1]

Processing of policies should also now be faster, which is popular with policyholders. [½]

Also, a simpler and shorter form will encourage proposals because people don't like too many questions on proposal forms. [½]

However, this may cause lapse and re-entry problems from lives that were originally, for example, charged extra due to the answers given to the now-removed questions. [½]

Higher sales may put a strain on the capital resources of the company due to new business strain. [½]

There may now be greater selection against the office. [½]

For example, there may be lots of proposals from applicants who would now have a greater chance of being accepted at standard rates, despite being non-standard risks. [½]

So the mortality experience may rise, meaning that the premium rates should increase considerably. [1]

This may cause the good lives to leave, leading to a spiral of worsening experience (as the company is left with poor lives, so mortality experience worsens *etc*). [1]

This depends on competitors' rates and underwriting procedures. [1]

There is less chance for the underwriter to get the premium rate right as there will be less medical data on which to judge the expected mortality experience. [½]

This uncertainty alone may lead to higher premiums, since bigger margins for risk may be appropriate within the pricing basis. [1]

It may also lead to higher provisions, putting additional strain on capital. [½]

In any case, profitability will need to be monitored by analysing mortality experience, which may be particularly difficult to do in the early years due to lack of data. [1]

Alternatively, more policies may be rejected – which could negate the earlier point about higher sales. [1]

It may be that, for example, the thresholds for medical exams are lowered, to compensate for the lower amount of underwriting on the proposal form. [½]

This would lead to higher costs. [½]

Alternatively, it may be that more policies are rejected at the proposal form stage based on the answers to the remaining questions. This may include good lives, which could then lead to bad publicity and disgruntled customers. [1]

The extent of all of these effects depends on which questions are removed and their importance for the assessment of mortality risk. [½]

It may be that the form was over-complex in the first place. In this case, reducing the number of questions may not reduce the amount of useful information the company obtains. [1]

[Maximum 8]

30.5 *Hints: the main factors that need to be considered in relation to each contract are:*

- *What is (are) the main event(s) that lead to a claim being made?*
- *Is this (are these) event(s) affected by the existence of this disease during the term of the contract?*
- *If so, what is the likely impact, ie is it significant enough to consider setting special terms, and what terms would be appropriate to both the insurance company and the applicant?*

(a) **10-year term assurance**

This risk could be accepted at ordinary rates since the disease should not affect mortality during the life of the contract. [1]

(b) **10-year convertible term assurance**

This risk could be accepted at ordinary rates but with restrictions imposed on the conversion options if symptoms still exist at the time of conversion. [1]

(c) 20-year endowment assurance

This risk could be accepted at ordinary rates as the sum at risk is likely to be small at the time of expected death from the disease. [1]

(d) Whole life assurance

For this risk either an extra premium could be charged or the sum assured could be reduced (eg to equate the policy to a 20-year endowment). [1]

Alternatively, it could be accepted at ordinary rates but with an appropriate exclusion clause included (although this could be difficult to enforce). [1]

Alternatively, acceptance could be deferred with the suggestion that the applicant takes out a three-year term assurance and reapplies for the whole life assurance if and when they are clear of the disease. [1]

(e) Waiver of premium benefit

For this risk the correct decision is not obvious from the information given since we are not told whether the disease impacts health during the 20 years before expected death. [1]

If it does not significantly impact health then ordinary rates will be appropriate. [1]

However, if it does then the nature of the expected health problems will indicate whether the proposal should be declined or accepted on special terms. [1]

[Maximum 6]

30.6 *Data recording systems* – it is important that the company holds good quality data on all the risks it insures, with particular emphasis on the risk factors identified when the product was designed or when the risk was underwritten.

While this cannot change the company's exposure to the business risks underwritten, it can assist in ensuring adequate provisions are established for those risks, and reduce the operational risks from having poor data.

Accounting and auditing systems – again good procedures cannot change the risks accepted, but they can enable proper provisions to be established and regular premiums to be collected.

These procedures may also be required by regulation.

The company's providers of finance and others, eg reinsurers, will expect to see appropriate systems in place to be reassured as to its financial position.

Monitoring of liabilities taken on – it is important to monitor the liabilities taken on by the company to protect it against aggregation of risks of a specific type to an unacceptable level.

Where the acceptance of risks requires the provider to set aside material capital requirements, it is important to quantify and potentially limit the amount of new business to ensure that it is within the company's available capital resources.

In addition, premium rating may involve cross-subsidies from one type or class of business to another. If the business mix expected in the premium rates is not achieved in practice, the profitability of the contract may be at risk.

Options and guarantees – offering options and guarantees introduces additional risks, which may be managed using controls such as eligibility criteria and asset / liability matching (eg use of derivatives).

30.7 Such a low likelihood, high impact risk can be difficult to manage.

Care needs to be taken to ensure not too much weight is placed on such a risk at the expense of dealing with other more common risks to the business, eg poor business decisions.

There are three main ways of dealing with this risk:

- diversification, eg run the business from several locations, although this may not be practical
- pass the risk to an insurance company – the company is likely to retain some risk (the excess) and then insure the rest of the risk to cap the loss
- implement management control procedures, eg a disaster recovery plan.

Alternatively the business could consider relocating to another territory which is lower risk, but the cost / benefits of such a major step would need to be evaluated.

The company will have determined its own risk tolerance. As a result the company might accept that it might be ruined by such a rare event, and has decided not to take such events into account in its risk management.

30.8 (i) **Key characteristics of the business**

This product offers a basic guaranteed sum assured together with bonuses payable at maturity or earlier death. [1]

There may also be surrender benefits. [½]

The business is long-term in nature; it may be 25 years before a benefit is paid to an individual customer. [½]

Furthermore, since it is a with-profit contract there is generally some smoothing of payments across generations of policyholders. [½]

The insurer will need to set aside appropriate provisions (reserves) to meet the future payments. [½]

This area is likely to be regulated. [½]

The policy does offer some guarantees to policyholders, since the product will provide a guaranteed minimum payment on maturity or earlier death. [1]

[Maximum 3]

(ii) **Risks**

Investment (market) risk – investment returns may be lower than expected. [½]

For competitive reasons and to meet policyholders' expectations, bonuses may be paid that are greater than can be justified by the investment returns achieved. [1]

In a *worst case* scenario investment returns may be insufficient to provide the guaranteed minimum benefits. [½]

Mortality risk – there is a risk that more policyholders die than expected during the term. [½]

In particular, a risk of higher than expected early deaths where the benefit may far exceed the premiums paid to date. [½]

Anti-selection / underwriting risk – there is a risk of inadequate underwriting and of more anti-selection (*ie* unhealthy lives selecting against the insurer) than expected. [1]

Persistency (withdrawal risk) – there is a risk that more policyholders surrender their policies than expected. [½]

This is of particular concern if the surrender values are generous (perhaps prescribed by legislation). [½]

In particular there is a risk of too many early surrenders, meaning the initial expenses are not recouped. [1]

Expense risk – there is a risk that expenses, fixed and/or variable, are greater than expected. [½]

This may be due to inflation being higher than expected. [½]

New business risk – there is a risk that:

- volumes are too low, meaning that the fixed costs that need to be recouped per policy are too high [1]
- average policy size is smaller than expected, with the same fixed cost impact [½]
- volumes are too high, leading to capital (or administration) strain. [1]

As this is a new class, the volume and mix of business and the characteristics of the typical policyholder will be difficult to gauge in advance. [1]

Operational risk – it may be deemed at a later date that policies were mis-sold to individuals leading to the insurer having to pay redress. [½]

Errors may be made in the payment of claims and/or addition of bonuses. [½]

External risk – there is a risk that payouts on the policies are lower than those of competitors. This could result in selling less new business than expected. [1]

There is also a risk of regulatory or tax changes making this type of policy less attractive. [1]
[Maximum 8]

(iii) **Risk mitigation***Investment risk*

- Choose investments that match the guaranteed benefits as closely as possible. [½]
- Manage policyholders' expectations as to the level of bonuses, *eg* by: [½]
 - disclosing information on investment strategy [½]
 - making sure that illustrations / projections are not too optimistic. [½]
- Don't deviate too much from what competitors are investing in. [½]
- Regularly monitor actual investment returns against expected and take corrective action if necessary, *eg* review premium rates. [1]

Mortality and anti-selection risk

- Keep the guaranteed level of the benefit on death low (although this may make the product unattractive to customers). [½]
- Review underwriting procedures (make sure that they are consistent with those of competitors) and carefully underwrite the risks involved. [1]
- Make sure that the risk classification is appropriate to reduce the risk of anti-selection. [½]
- Regularly monitor actual mortality against expected and revise mortality assumptions as required, *eg* review premium rates. [½]

Persistency (withdrawal) risk

- Keep any guaranteed surrender values to a minimum. [½]
- If possible, have a zero surrender value in the first few years until the initial expenses are recouped. [½]
- Regularly monitor actual withdrawals against expected and revise persistency assumptions as required, *eg* review premium rates. [½]
- In particular, monitor withdrawals by sales channel and sales agent and stop selling through channels where withdrawals are high, or through agents who are deliberately 'churning' business. [1]
- Pay regular rather than initial commission to sales agents to encourage persistency. [½]
- Require that a certain amount of commission be 'clawed back' from the agent on early withdrawal. [½]

Expense risk

- Regularly monitor actual expenses against expected and revise expense assumptions as required, *eg* review premium rates. [½]
- Carry out expense budgeting and ensure that expense controls are in operation. [½]
- Regularly review sales volumes and mix of business, to ensure that fixed expenses are being spread appropriately. [½]
- Reduce the extent of expense cross-subsidies. [½]

New business risk

- Use reinsurance to help with new business strain. [½]
- Monitor levels of new business sold and stop selling if volumes are too high, or take remedial action (*eg* further advertising, training of sales agents, redesign the product) if volumes are too low. [1]
- Make sure that bonuses and investment strategy are not out of line with competitors. [1]

Operational risk

- Ensure that sales agents and administrators are adequately trained. [1]
 - Make sure that policy literature is clear and understandable, and explains the risks associated with the product. [1]
 - Make sure that projections show a range of values and are not overly optimistic. [½]
 - Carry out spot checks on the sales process and on bonus calculations *etc.* [½]
 - Provide regular policy reviews, *eg* annual updates on the value of the policy. [½]
- [Maximum 12]

30.9 Control of exposure to longevity risk

The company should monitor its mortality experience and update its annuity rates regularly to allow for the latest mortality experience, ... [1]

... including expectations of future improving longevity rates. [½]

Pricing should include a margin for prudence / risk. [½]

As an insurance company, the company has the opportunity to diversify its longevity risk exposure by trying to move into other markets with new products that have mainly mortality risk. [1]

For the best match, it is necessary to look for products that match the age and duration of the annuitant longevity risk. Therefore selling whole life assurance products to those at retirement age might be appropriate. [1]

For example, the company could launch a range of funeral cost plans. [½]

The company could pass risk to a reinsurer or enter into a reciprocal arrangement with another insurer. [1]

It could use a form of ART such as:

- longevity swap
- longevity bond
- (another form of) securitisation. [½ each]

The company could underwrite its annuities, *eg* differentiating by smoker status. [1]
[Maximum 5]

30.10 (i) **Important risks**

Other sensible examples under these headings would also be given credit.

Market

A fall in the value of any assets held and in particular relative to the liabilities, *eg* a fall in the value of machinery owned. [1]

Credit

Failure of or switch to other power stations by major customers (*ie* energy supply companies). [½]

Failure of suppliers of coal to make required deliveries for which payment has been made. [½]

Liquidity

The company may have insufficient funds to meet immediate outgo. For example in a warm winter there may be less demand for energy and inflow of funds may be insufficient to meet fixed expenses in the short term. [1]

Business

Failure to sell much energy, *eg* due to: [½]

- warmer winters [½]
- increased competition from other energy sources, *eg* nuclear, wind farms. [1]

Depletion of coal stock leading to difficulty in obtaining and/or a higher price. [½]

Costs within company of producing energy rise more quickly than expected. [½]

Operational

Failures of people, processes or systems linked to the production of energy. [1]

Dominance of single individual, perhaps the managing director in running the business. [1]

Reliance on third parties, perhaps railway to deliver the coal. [1]

Inadequate recovery plans in place to recover from an external event, *eg* inadequate insurance in place against the risk of an explosion at the power station. [1]

External

Examples include:

- fire
- explosion
- terrorist attack. [½ per point, maximum 1]
[Maximum 7]

(ii) Risk control purposes

The main purposes are to:

- reduce the likelihood of a risk event occurring [1]
- limit the severity of the effects of a risk event that does occur [1]
- limit the financial consequences of a risk [1]
- reduce the wider consequences of a risk event that does occur, *eg* by ensuring continued trading. [1]
[Maximum 3]

(iii) Suitable approaches to managing risk

Credit would be given for sensible suggestions linked to part (ii) for the risks generated in part (i).

Risk	Managing the risk
A fall in the value of any assets held.	Ongoing monitoring of asset values, understand how depreciate, consistent valuation with liabilities.
Failure of / switch of major energy provider who buys the product.	Ensure have several customers, maintain good business relations with customers.
Failure of suppliers of coal to make required deliveries.	Use several sources of fuel, keep a reserve of coal so can continue with production for short periods when delivery fails.
Company may have insufficient funds to meet immediate outgo.	Careful management of cash so have funds available to meet needs, arrange banking facilities to ease issues linked to timing of cashflows.
Failure to sell much energy due to warmer winters.	Appreciate cyclical nature of business, maybe employ hedging techniques, <i>eg</i> temperature-related derivatives.
Increased competition from other energy sources, <i>eg</i> nuclear, wind farms.	Ongoing monitoring, consider diversification into these new areas.

Depletion of coal stock leading to difficulty in obtaining and/or a higher price.	Arrange fixed-price contracts well in advance to mitigate effect, consider diversifying business to other fuel sources.
Production costs within company rise more quickly than expected.	Ongoing monitoring, expense efficiency exercises.
Failures of people, processes or systems.	Ongoing monitoring, examine best practice in the industry, ensure good standards of training, systems testing and documentation.
Dominance of single individual.	Ensure strict reporting procedures in place, good corporate governance arrangements, have non-executive board members.
Reliance on third parties, perhaps railway.	Ensure contracts in place so poor performance leads to penalties for the third party and recompense for the company, diversify, ie deliveries by road and rail.
Inadequate recovery plans in place.	Carry out an extensive risk assessment exercise and identify best way of managing each risk.
Fire, explosion, terrorist attack.	Appropriate insurance contracts.

[1 per risk for good examples of managing the risk]

[Maximum 10]

30.11 This is part of a past CA1 exam question.

Risk	Risk mitigation
Claim amounts are higher than expected due to: (a) lower than expected recovery amounts (b) higher than expected loan amounts outstanding	• Monitor recovery amounts regularly and reprice if necessary • Transfer the risk of negotiating recovery amounts away from the policyholder (who has no financial incentive) to the car dealer (who may be keen to maintain a good relationship with the insurance company) or to the insurer itself • Use reinsurance • Review the business mix / risk classification • Monitor the residual value (<i>ie</i> the gap between loan amount outstanding and recovery amount) and how this varies for different car types and seek to reprice if necessary
Claim frequency higher than expected	• Monitor claim frequency regularly and reprice if necessary • Use reinsurance
Moral hazard, <i>eg</i> car owners leave their cars unlocked	• Tighten the policy wording and introduce exclusion clauses
Expenses higher than expected	• Look for cost savings / improvements in efficiency • Monitor expenses and expense inflation and reprice if necessary
Business volumes too high (capital strain)	• Cap the amount of business written, <i>eg</i> agree a pre-determined limit with the car dealer
Business volumes too low (fixed expenses not covered)	• Look at competitiveness of premium rates and reprice if necessary • Have an agreement with the car dealer to cease insuring them if they are not passing on enough business
Business mix not as expected	• Avoid cross-subsidies in the pricing basis • Monitor the mix carefully
Motor dealer goes out of business	• Diversify by looking to cover other dealers
Operational risks, <i>eg</i> fraud, systems failure	• Auditing, data checks, monitoring

Lack of past data	• Use reinsurer expertise or industry data • Monitor experience frequently early on and reprice if necessary

[½ per risk, ½ for good example of managing the risk]

[Maximum 6]

30.12 **Risk identification**

This is the process of recognising which risks might threaten the income or assets of the organisation and therefore make it unable to meet its objectives. [1]

Techniques that might be used to identify these risks include:

- use of risk checklists [½]
- experience of staff joining from similar organisations, consultants, experts [1]
- high level analysis to quickly identify significant risks [½]
- brainstorming [½]
- desktop analysis [½]
- collating the information gathered into a risk matrix or risk register. [½]

The organisation needs to consider whether each risk is systematic or diversifiable. [½]

It might make an initial identification of possible risk control processes. [½]

It is also important to identify opportunities to exploit risks and gain a competitive advantage. [1]

Risk classification

The company should then classify the identified risks into groups in order to ensure full coverage and aid analysis, including assessing diversification opportunities. [1]

The organisation should ensure that it has considered all sources of risk, both financial and non-financial, *eg* market risk, credit risk, liquidity risk, business risk, operational risk, external risk. [1]

A risk 'owner' should be allocated to each risk, having responsibility for the control processes for that risk. [1]

Risk measurement

This is the process of estimating the probability of each risk event occurring and its likely severity. [1]

Interdependencies between risks should also be assessed. [½]

A common approach to risk assessment is a simple scoring scale, under which the scores for each of probability and severity are multiplied in order to rank risk events. [1]

Risks could then be quantified more accurately by using appropriate risk measures, for example tracking errors, Value at Risk (VaR), conditional expected shortfall (or conditional Tail VaR), an analysis of actual versus expected experience *etc.* [1]

Techniques used to evaluate risks include:

- stress testing [½]
- scenario tests / analysis [½]
- reverse stress testing [½]
- stochastic modelling. [½]

Existing control measures should be allowed for in the measurement. [½]

An overall risk assessment should be performed at a whole company level. [½]

When modelling risks in aggregate, allowance needs to be made for diversification or inter-relationships between risks, *eg* by using correlation matrices, stochastic modelling, copulas. [1]

The company also needs to assess / determine its risk appetite. [½]

Risk control

The organisation should implement measures that aim to reduce the likelihood of an event occurring, its severity or consequences. [1]

The extent to which an organisation controls its risk will depend on:

- its risk tolerance level / risk appetite [½]
- the cost / benefit ratio of any control measures. [½]

Types of risk controls include:

- insurance and/or reinsurance [½]
- alternative risk transfer tools [½]
- underwriting [½]
- claims controls [½]
- management control systems, *eg* contingency planning [½]
- diversification. [½]

Particular care should be taken to control those risks with a significant financial impact but which have a low probability of occurrence. [½]

Risk financing

Risk financing involves determining the likely cost of each risk including the cost of any mitigations, the expected losses and the cost of capital arising from retained risks. [1]

The organisation should hold enough capital to cover the residual risks which remain after implementing its risk controls. [½]

Tools that may be used to manage the organisation's capital include banking products, subordinated debt, retaining earnings. (These will be covered further in the later chapter on Capital management.) [1]

Risk monitoring

The organisation should review all the identified risks on a regular basis, *eg* through using the risk register or risk portfolio. [1]

It should also conduct regular overall business reviews to identify new risks, or risks that were omitted from the previous exercise. [1]

The organisation should ensure it has sufficient, accurate data in order to be able to:

- update assumptions [½]
- monitor any adverse trends so as to take corrective actions [½]
- provide management information. [½]

It needs to implement a risk reporting process that provides information at a level to enable the company's managers to make informed decisions. [½]

This includes establishing clear management responsibility for each risk. [½]

Ideally reporting should be done at enterprise level, in order to allow appropriate for diversification benefits and to use capital most effectively. [1]

[Maximum 15]

End of Part 8

What next?

1. Briefly **review** the key areas of Part 8 and/or re-read the **summaries** at the end of Chapters **28** to **30**.
2. Ensure you have attempted some of the **Practice Questions** at the end of each chapter in Part 8. If you don't have time to do them all, you could save the remainder for use as part of your revision.
3. Attempt **Assignment X4**.

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Provisions

Syllabus objectives

- 11.7.1 Discuss the different reasons for the valuation of the benefits from financial products and the impact on the choice of methodology and assumptions.
- 11.7.2 Discuss how to determine values for provisions in terms of:
- the need for placing values on provisions and the extent to which values should reflect risk management strategy
 - the reasons why the assumptions used may differ in different circumstances
 - and be able to perform calculations to demonstrate an understanding of the valuation methods.

0 Introduction

Actuaries need to value benefits for a variety of reasons, one important such reason being to calculate provisions.

Provisions are the calculated amounts that need to be set aside to meet a provider's future liabilities. The value of the provisions will depend on the assumptions used to value the future expected cashflows.

For example, the provision for a without-profit life insurance contract is typically calculated as the present value of future benefits plus expenses, minus future premiums if relevant.

In an actuarial context, you may also have heard provisions referred to as *reserves*. The debate as to whether provisions and reserves are actually equivalent is outlined in the Glossary as follows:

A potential source of confusion is the term used to denote the value assigned to the liabilities. It has been the practice of accountants to use the word 'provision' to denote the value of a liability that is known or assumed to exist at the accounting date, and to confine the term 'reserve' to any amount, over and above the provisions, that is available to meet additional liabilities, either in respect of future events or in respect of past events for which the provisions may prove to be inadequate. However, among insurers, and also among actuaries, there has been a long established practice of applying the term 'reserve' to both categories.

For the purposes of this chapter, we will use the terms provisions and reserves interchangeably.

Section 1 considers the main reasons for calculating provisions.

In Section 2 we set out some numerical calculations as a reminder of the basic valuation approaches that may be used for life insurance, general insurance and benefit schemes.

In order to determine the appropriate provisions, the actuary will need to:

- choose a valuation *method*, and
- make *assumptions* about the future.

Collectively the assumptions are known as the *basis*. Section 3 investigates the different assumptions that we might use in setting a basis and in Section 4 we consider the key factors that affect the strength of the basis and potentially also the valuation method.

In Sections 5 and 6 we discuss in more detail how the assumptions used to value the future expected cashflows will depend critically both on the *purpose* of the valuation and the *client* for whom the calculation is being performed.

1 Reasons for calculating provisions

1.1 The need for provisions

The reasons for calculating the provisions needed by a provider include the following:

- to determine the liabilities to be shown in the provider's published accounts and reports
- if separate accounts and reports are prepared for the purpose of supervision of solvency, to determine the liabilities to be shown in those accounts
- to determine the liabilities to be shown in internal management accounts and reports of the provider
- to value the provider for merger or acquisition
- to determine the excess of assets over liabilities and whether any discretionary benefits can be awarded
- to set future contributions to a benefit scheme
- to value benefit improvements for a benefit scheme
- to calculate discontinuance / surrender benefits
- to influence investment strategy
- to provide disclosure information for beneficiaries.

1.2 The need for 'global' provisions

As well as establishing provisions for each individual contract undertaken by the provider, or for each member of a benefit scheme, it is frequently necessary to make global provisions looking at the provider's liabilities in aggregate, if solvency is to be demonstrated unambiguously.

A provider will be exposed to a range of financial and non-financial risks, which may merit an additional provision in excess of the sum of the provisions for each contract or member.

For example, an additional provision may be necessary to cover the risks from any mismatching of assets and liabilities.



Question

- (i) Describe the risks relating to mismatching of assets and liabilities.
 - (ii) Explain why an additional provision for mismatching would likely need to be established on a group rather than on an individual contract level.
-

Solution

- (i) The risks relating to mismatching are that changes in investment conditions may result in the liability cashflows increasing by more than the asset cashflows. This will affect the ability of the provider to meet the liabilities as they fall due and the solvency position of the provider.
 - (ii) It is rare, for investment purposes, that the liabilities of each individual contract are looked at separately and assets *earmarked* to each contract. It is much more likely that the investment strategy is determined by looking at the group of contracts as a whole. Therefore, in the same way, the risk of mismatching is a *global* rather than an *individual* issue and hence provisions should be established on a global basis.
-

Other examples of financial and non-financial risks for which global provisions might be required include:

- credit risk, *eg* default of a third party such as a reinsurer
- operational risk, *eg* anti-selection, regulatory fines or compensation for mis-selling.

Provisions for guarantees may also be set globally. We consider guarantees in more detail in the next chapter.

The provider's risk management strategy will be an important influence on the level of provision required for these additional risks. A detailed and effective risk analysis and management system, that is regularly monitored and updated, will reduce exposure to some financial and non-financial risks, and can thus justify holding a lower level of provision against these risks.

It may also be the case that the supervisory authority may impose a less stringent regulatory solvency requirement where there is a comprehensive risk management programme in place.

Such considerations help to explain why financial providers are so concerned about controlling risk. The better the risk management process, the lower the level of provisions and required capital that need to be held, and therefore more capital is available for alternative uses, *eg* writing new business.

Risk appetite is also a key element of risk management strategy that influences the level of provisioning for risks. This is covered further in Section 6 of this chapter.

2 Numerical calculations of provisions

This section looks at some simple numerical calculations for setting provisions in the case of each of life insurance, general insurance and benefit schemes.

The purpose of these examples is to help students who find that numerical examples make a subject more *concrete*. Also the syllabus does require that we are able to perform calculations to show understanding of the valuation methods. These methods are covered in the earlier subjects.

2.1 Life insurance

In life insurance, reserves are typically calculated using either a formula or a discounted cashflow approach. We look at an example of a formula approach.



Question

A 10-year annual premium term assurance policy is issued to a group of lives aged 40 exactly. The sum assured is £20,000 and is payable at the end of the year of death. The annual premium is £100 and expenses are assumed to be zero.

Write down an expression for the reserve immediately before the sixth premium is due.

Solution

Since expenses are being ignored, the reserve can be calculated as the expected present value at the end of the fifth year of the outstanding benefits less the outstanding premiums.

This gives:

$${}_5V_{45:\overline{5}|}^1 = 20,000 A_{45:\overline{5}|}^1 - 100 \ddot{a}_{45:\overline{5}|}.$$

2.2 General insurance

Outstanding claims reserves in a general insurance context are normally calculated using statistical (*eg* run-off triangle) methods or case estimates. We look at an example of a run-off triangle.



Question

The table below shows the claim payments on a household insurance portfolio in each development year, for accident years from year X to year $X+3$.

Claim payments (£'000)		Development year			
		0	1	2	3
Accident year	X	17,500	5,000	2,250	750
	$X+1$	21,000	6,200	2,750	
	$X+2$	18,800	5,500		
	$X+3$	21,300			

Estimate the outstanding claims reserve at the end of year $X+3$, in respect of accidents occurring between the start of year X and the end of year $X+3$, using the basic chain ladder method.

Solution

The procedure is to:

1. produce a table of cumulative claim payments
2. determine the development factors for successive development years
3. use the development factors to project the cumulative claim payments
4. determine the outstanding claims reserve by subtracting, for each accident year, the claims paid to date (leading diagonal figures) from the total projected claims (last column figures).

If we write the development factors over the appropriate columns, the table of cumulative claim payments looks like this:

$\times 1.2914$ $\times 1.1006$ $\times 1.0303$

Cumulative claim payments (£'000)		<i>Development year</i>			
		<i>0</i>	<i>1</i>	<i>2</i>	<i>3</i>
<i>Accident year</i>	2014	17,500	22,500	24,750	25,500
	2015	21,000	27,200	29,950	30,858
	2016	18,800	24,300	26,745	27,555
	2017	21,300	27,508	30,275	31,193

The outstanding claims reserve is:

$$(25,500 - 25,500) + (30,858 - 29,950) + (27,555 - 24,300) + (31,193 - 21,300) = \text{£}14.1m.$$

2.3 Benefit schemes

The method used to value the benefits of a benefit scheme will depend on whether the scheme is defined contribution or defined benefit in nature.

For a defined contribution scheme, the value of the main benefits is equivalent to the amount of the accumulated contributions net of charges.

For a defined benefit scheme, the benefits are defined by a formula, and we can use a discounted cashflow approach to value the benefits. We now look at an example of valuing defined benefit scheme death benefits.



Question

Derive a formula to value a death-in-service benefit of a multiple of four times the salary at date of death for a member aged 30 exactly at the valuation date.

Assume that normal retirement age is 60 and ignore expenses and all other possible exits from the scheme. State any additional assumptions that you need to make.

Solution

We define the following terms:

S is the member's salary received in the year immediately preceding the valuation date (*ie* between exact ages 29 and 30)

s_x is an index representing the member's salary in the year starting at exact age x .

The value of the death benefit will be determined by looking at the expected present value of the death benefit if the member dies in each future year t and then by summing over t .

The expression will be of the form:

$$\begin{aligned}
 \text{Value} &= \sum_{t=0}^{t=29} 4 \times \text{salary in year } t \times \text{probability of surviving to the start of year } t \\
 &\quad \times \text{probability of death in year } t \times \text{discount factor} \\
 &= \sum_{t=0}^{t=29} 4 \times S \times \frac{s_{30+t}}{s_{29}} \times {}_t p_{30} \times q_{30+t} \times v^{t+0.5}
 \end{aligned}$$

Additional assumptions that have been made include:

- deaths are assumed to occur uniformly over the year of age, so the member is assumed to die halfway through the year on average
 - salaries are only reviewed once a year on the valuation date.
-

3 Different bases

3.1 The best estimate basis

As the timing and level of benefits, contributions and asset income is not certain, an actuary can never be certain that a set of assumptions will be correct.

The actuary can consider information and apply judgement to produce a set of assumptions that they feel to be their 'best estimate' of future experience. This can be defined as the set of assumptions that has equal probability of overstating or understating the values.

Although a best estimate basis gives an equal probability of overstating and understating the values, it is not necessarily a *unique* basis, depending on who is doing the valuation and why. This important idea is explored further in the rest of this chapter.



Question

- (i) List the key assumptions the actuary will need to make to value the benefits from an employer-sponsored medical benefits scheme.
- (ii) Suggest sources of information that the actuary could use to set a best estimate basis to value these benefits.

Solution

- (i) Key assumptions required to value a medical benefits scheme:
 - discount rate (used to discount the liabilities to their present day value)
 - inflation of medical benefits (which may be higher than price inflation)
 - incidence of sickness and likely duration of illness, split by age, gender and different types of illness
 - mortality rates
 - discontinuance rates (*ie* likelihood of members leaving the scheme)
 - future entry rates to the scheme and likely entry age / gender of employees (if the contribution rate for the future is being set too).

(ii) Information that could be used to set the assumptions:

- past experience of the scheme
- past experience of similar schemes, perhaps from industry-wide statistics
- population statistics, for example from the national healthcare system
- discussions with the company as to its future intentions (for example whether it has an intention to perform a redundancy exercise)
- projections of investment returns, for example based on the views of investment analysts or derived from market yields
- projections of indices relating to the inflation of medical benefits.

However, a 'best estimate' value is not necessarily the most suitable.

3.2 Bases other than best estimate

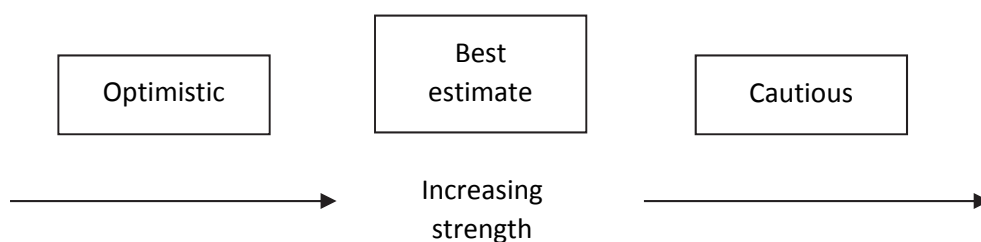
Actual assumptions may differ from the best estimate basis because a more cautious or more optimistic view may be regarded as suitable.

There is a range of 'non-best estimate' bases that could be used, including:

- *optimistic* (or *weak*) – assumptions are chosen which result in a high value of assets and/or a low value of liabilities
- *cautious* (or *prudent* or *conservative* or *strong*) – assumptions are chosen which result in a low value of assets and/or a high value of liabilities.

It is worth noting that, in practice, different people may interpret terms such as 'prudent' or 'cautious' etc as meaning different things, *ie* one being more prudent than another. This illustrates how important it is to clarify what is meant when communicating results.

Therefore, in order of increasing strength the bases will be:



The ratio of total liability value to total asset value will increase as the strength of the basis increases.

4 Factors affecting the choice of basis and method

4.1 Purpose and client

The following factors will usually dictate the strength of the basis on which values should be produced:

- **the reason a value needs to be determined**
For example, a valuation for accounting purposes might be on a best estimate basis, but a valuation to demonstrate financial strength and security might be on a more prudent basis.
- **the needs of the client**
For example, the client may be the beneficiaries, trustees, regulator, shareholders *etc.*
- **the requirements of any legislative or regulatory authority.**

In some cases, the valuation *method* may also be prescribed.

In many cases presentation of a range of values, or values for alternative scenarios, may be more useful to the client in making any necessary decisions.

For example, before making a long-term financial commitment a retirement benefit scheme's sponsor may wish to know the actuary's 'best estimate' of the costs and also the costs assuming a worse scenario for future experience.

4.2 Nature of the assets

There are occasions when, to determine the value of the liabilities, it will be appropriate to take account of the nature of the assets. Examples are:

- **when the liabilities are specifically linked to the underlying assets, such as a unit trust or internal investment fund**
- **when the covenant of the sponsor has no value, eg when a pension fund is set up by a sponsor, but the sponsor makes no commitment to provide funds to make up any shortfall should the assets held turn out to be insufficient to meet the benefits promised. In this situation the benefits paid may need to be reduced to reflect the actual assets available.**
- **for the market-consistent valuation of liabilities in relation to financial guarantees on life insurance contracts, since the value will depend on the volatility of returns on the assets held.**

The influence of assets on the liability valuation method is considered further in the next chapter.

5 Setting the assumptions with regard to the purpose

We listed the reasons for calculating provisions earlier in this chapter. We now look at how the purpose of the provisioning exercise affects the assumptions used.

The regulators, beneficiaries and shareholders referred to in the following sections could be associated with a benefit scheme (in which case the shareholders are those of the sponsoring company) or an insurance company (in which case the beneficiaries are the policyholders).

5.1 Assumptions used for published accounts (decisions by shareholders)

Shareholders and potential shareholders make decisions using information in a company's accounts. It is, therefore, preferable for values to be included in the accounts that represent an actuary's 'best estimate' of the future experience. The use of assumptions that are more likely to overstate or understate the liabilities or assets may lead to wrong decisions being made.

The assumptions to be made in determining the liabilities to be shown in a provider's published accounts and reports should have regard to the legislation and accounting principles governing the preparation of those accounts in the country concerned.

Matters to be considered include:

- **whether the accounts and reports are to be prepared on a *going concern* basis**
- **whether the accounts and reports are required to show a *true and fair view***
- **whether provisions are required to be assessed as best estimates or on some other basis, and precisely how the terms used are to be interpreted.**

Another important consideration is *consistency* in approach from year to year.

Going concern vs break-up basis – insurance companies

A *going concern* basis (or *funding* basis) is defined in the Glossary as:

The accounting basis normally required for an insurer's published accounts, that is based on the assumption that the insurer will continue to trade as normal for the long-term future.

A *break-up* basis (or *discontinuance* or *wind-up* basis) is defined in the Glossary as:

A valuation basis that assumes that the writing of new business ceases and cover on current policies is terminated. In relation to general insurance policies, current policyholders would normally be entitled to a proportionate return of the original gross premium. Deferred acquisition costs would probably have to be written off. Also known as a wind-up basis.

Going concern vs break-up basis – benefit schemes

A *going concern basis* usually assumes that the benefit scheme will be continuing. Funding valuations are conducted to assess:

- whether the assets of the scheme are sufficient to cover the liabilities on a continuing basis
- the contribution rate for the scheme (to cover future benefit accrual and rectify any shortfall within the scheme)
- an appropriate investment policy.

A *break-up basis* assumes that the scheme ceases to accrue future benefits on the valuation date.

Different approaches to discontinuance are discussed in a later chapter.

For a discontinuance valuation, if the liabilities are bought out by another provider or are transferred to another scheme, then a *market value* approach is often used for valuing the assets of the scheme.

5.2 Assumptions used for demonstrating supervisory solvency (decisions by regulators)

Regulators may wish to consider values that present a realistic picture of a provider's finances. Alternatively, they may wish to consider values that intentionally understate (or perhaps overstate) the financial strength of the provider.

For example, pension schemes may have to carry out a *maximum funding test* to demonstrate that they are not holding too much money relative to their liabilities (perhaps the sponsor is using the scheme as a tax haven).

The basis used will be intentionally cautious so as to understate the financial strength of the scheme (*ie* places a low value on assets and a high value on liabilities). This means that the scheme only fails the test if there is far too much surplus money in the scheme, or in other words the scheme is genuinely overfunded.

The assumptions used may be dictated by legislation or left to actuarial judgement with a requirement for disclosure of the assumptions used.

Supervisory solvency

One area of particular concern to regulators will be the demonstration of solvency of providers.

The key considerations when setting provisions for demonstrating supervisory solvency are:

- the degree of prudence
- prescription of methods / assumptions by the supervisory authority.

Different territories have different approaches to establishing provisions used to demonstrate the solvency of product providers.

In some territories the basis for assessing provisions for individual contracts takes a best estimate of future experience, with few margins. This type of basis is normally coupled with a requirement for the insurance company to maintain a significant excess of assets over liabilities (referred to as solvency capital) to demonstrate solvency.

In other territories the individual contract basis is very prudent, with significant margins, but the company is required to hold little or no solvency capital in excess of the individual policy provisions.

The overall effect of the two approaches is designed to be similar.

If separate accounts and reports are required as part of the process of supervision of solvency, the rules governing the preparation of those separate accounts and reports may or may not be the same as those that apply to the other accounts and reports. They may, for example, be required to be prepared on a going concern basis or on a discontinuance basis.

Other rules governing the preparation of these accounts and reports might concern the:

- method of valuation used to value both the assets and the liabilities, *eg* market-based, discounted cashflow
- assumptions used to value both the assets and the liabilities
- types of assets that can be held
- level of global provisions to hold.

Reference should be made to the rules and any guidance that may have been issued as to their interpretation.

5.3 Assumptions used for internal accounts

Internal accounts are often used as a basis for decision making by the directors of the provider or the trustees (for a benefit scheme). The basis will be discussed with the provider but is likely to use best estimate assumptions.

5.4 Assumptions used for liability transfers

Reasons for liability transfers

It may become necessary to transfer liabilities and assets from one provider to another.

For example, liabilities could be transferred between companies as the result of a merger or acquisition.

A general insurer that has stopped writing employers' liability business, say, may wish to transfer the outstanding liabilities on that business to another general insurer, along with sufficient assets to cover the expected cost.

Benefit scheme liabilities could be transferred between providers as the result of a risk management decision or discontinuance of the scheme.

In each case, the amount of assets to be transferred with the liabilities will depend on the valuation of those liabilities and hence on the method and basis used to determine the provision amount.

In such cases, the values being placed on benefits and assets have a monetary worth. It is important that both the transferring and receiving parties view the terms of the transfer as being fair.

Setting the assumptions

In many cases, the need to be fair or the need to agree with another actuary will mean that the assumptions used will be a 'best estimate' of future experience.

A best estimate basis can be thought of as fair to both the party transferred from and the party receiving the transfer, since if actual experience is in line with the best estimate assumptions then the transfer will be cost neutral to both parties.

However, it need not always be the case that a best estimate basis is used.

Where a negotiation is taking place, the agreement reached between the two sides may be influenced by the relative power of the parties for whom the actuaries are acting. For example, one party may have more desire for the transfer to go ahead than another.



Question

Company X is taking over Company Y and the existing liabilities (and enough assets to cover them) of Company Y's pension scheme are to be transferred into Company X's scheme.

Explain which strength of basis Company X would prefer: optimistic, best estimate or prudent.

Solution

Company X will prefer a prudent basis to be used. This will place a high value on the liabilities of Company Y's scheme and hence result in a large amount of assets being transferred into Company X's scheme.

However, the transfer needs to be considered in the light of the overall deal. For example, allowances may be made in other areas of the deal. The agreement reached must also be acceptable to both sets of scheme trustees and be in line with the schemes' rules.

It is also possible that the two sides agree that the transfer amount should not reflect a 'best estimate' of future costs, perhaps because of recognition of a need to hold a margin to protect the security of the benefits.

5.5 Assumptions used to determine whether discretionary benefits can be awarded

For example, this could be benefit improvements in a benefit scheme or the declaration of a bonus on with-profit contracts.

The provider may want to use assumptions that do not overestimate the surplus available in order to avoid being pressurised into distributing it as discretionary benefits. This is because such benefits may prove in practice to be more expensive than had been anticipated.

5.6 Assumptions used in setting contributions to a benefit scheme

The assumptions used will depend on the objectives of the parties involved.

The trustees are primarily concerned with the security of members' rights, so they might want to overstate future contribution requirements – *ie* use a cautious basis. However, this must be balanced against the basis not being so cautious that it would discourage the employer from providing the scheme because the contributions were so high.

The sponsor pays contributions, so won't want to pay more than necessary unless they are particularly paternalistic. However, there may be other short-, medium- and long-term objectives, *eg* they might not want to have to find extra resources in future (so happy to overpay now – cautious) or might have alternative uses of capital (so happy to underpay now – optimistic). Flexibility over future contributions may be another key requirement.

For benefit schemes, the structure of the membership can have an effect on the assumptions used.

For example, a scheme that is closed to new members will have a membership that will grow older as members retire, leave or die. This will have to be taken into account in assessing future contributions.

Conversely, in an open scheme with a large active membership, it is likely that leavers will be replaced with new recruits, and thus that the average age of the active membership will be broadly unchanged. This assumption may generate a different future contribution rate than for the closed scheme.

5.7 Assumptions used to calculate discontinuance / surrender benefits

When setting discontinuance benefits it may be appropriate to use a best estimate basis. This means that the discontinuance benefit will reflect the realistic value of the benefits.

However, other bases may also be appropriate, depending on the circumstances.

5.8 Assumptions used to set investment strategy

It will be necessary for a provider to value its liabilities so that it can choose which assets to invest in. For this, a best estimate basis might be the most appropriate, together with sensitivity and scenario testing.

A decision relating to financing, including any investments held to meet future liabilities, will involve the consideration of realistic and cautious values for a potentially large number of options. It is likely that a stochastic approach can add significant value in assessing the risks and values under each possible strategy.



Question

Explain why a stochastic approach can *add significant value* in assessing investment strategies.

Solution

A stochastic approach can be useful, since it can more closely replicate the pattern of investment returns in the real world.

In addition, the output of running the model indicates the range of likely outcomes with associated probabilities, therefore providing additional information.

5.9 Communication of information to beneficiaries (decisions by individuals)

Individuals may need to make decisions about the level of benefits required, the return that they gain on contributions and the security of benefit provision.

In order to make decisions relating to their benefit and contribution needs, they will need to consider values that take account of their individual circumstances. These values may be most informative if they present a realistic picture. However, the uncertainty of the values should be communicated so that the individual is aware of the risks of under- and over- contributing.



Question

Outline the risks to the individual of over-contributing.

Solution

The risks of over-contributing are that:

- the individual may not make the best use of their money, *ie* the individual may really need the money for other purposes
 - the individual may breach regulatory limits if, for example, there is a maximum benefit payment that is allowed.
-

For example, where an individual is averse to the risk of under-provision, it may be appropriate to take a cautious approach to the valuation of future contribution needs.

6 Setting the assumptions with regard to the client

Different clients may have different purposes or reasons for a liability valuation, so the considerations in the previous section are relevant.

However, even if the basic purpose of the valuation is the same, different stakeholders may require a different level of strength of basis. Risk management strategy and risk appetite is a key influence on this.

A provider's risk appetite will also influence the level of provisioning for risks. In managing the liabilities, there may be a desire to reduce the risk of the provisions set aside being insufficient to meet the benefits promised. A person or company responsible for the management of the provision may therefore wish to consider values that are cautious. The 50% probability of under-provision created by using 'best estimate' assumptions may be too great.

The main clients to consider in the case of a benefit scheme are trustees and beneficiaries (including employee beneficiaries), and the sponsor.

The 50% probability of under-provision created by using 'best estimate' assumptions may be considered too great by trustees responsible for the funding decisions under a benefit scheme, particularly if the benefits being valued are discontinuance rights.

However, trustees and beneficiaries must also note the views of the sponsor. It would not be in the interests of the beneficiaries if a cautious approach to funding led to a sponsor reducing benefits due to excessive projected cost.

A cautious approach will lead to higher recommended contributions. If the sponsor feels that this level of contributions is unaffordable, they may reduce the benefits in order to cut cost. In the extreme case they may decide to close the scheme.

In the case of an employer sponsor, a cautious approach could also lead to other cuts in the business, or perhaps insolvency. These may also not be in the interests of employee beneficiaries.

The basis preferred by the sponsor will depend on a variety of factors, including security, opportunity cost, use of capital in the business, tax *etc.* For example, an optimistic approach may be appropriate if the sponsor has alternative uses for capital *currently* and so would prefer low contributions *now*. In future, however, a more cautious basis might be used to compensate.

Chapter 31 Summary

Provisions

Provisions are amounts set aside to meet future liabilities.

The value placed on the provisions is highly dependent on the assumptions used, which, in turn, will be highly dependent on the reason(s) for calculating the provisions.

Calculating individual provisions

Reasons for calculating individual provisions include:

- determining the value of liabilities for published accounts
- demonstrating supervisory solvency
- determining the value of liabilities for internal management accounts
- valuing the provider for merger or acquisition (or transferring liabilities)
- determining whether discretionary benefits can be awarded
- setting future contribution levels for a benefit scheme
- valuing benefit improvements for a pension scheme
- calculating discontinuance benefits
- influencing investment strategy
- providing disclosure information to beneficiaries.

Calculating global provisions

As well as calculating provisions in respect of each individual contract, there may be a requirement to calculate an additional *global* provision. The purpose of this global provision may be to:

- act as additional protection against insolvency
- cover risks, both financial and non-financial, that cannot necessarily be attributed to individual contracts
- reflect the degree of mismatching of assets and liabilities.

The provider's risk management strategy is an important influence on provision for risks.

Different bases

The bases in order of increasing strength are: optimistic, best estimate and cautious.

A *best estimate* basis is a basis with an equal probability of overstating or understating values.

Factors affecting the choice of basis and valuation method

The strength of the basis used depends upon:

- the reason for (or purpose of) the valuation
- the needs of the client
- regulation and legislation.

The nature of the assets may also need to be taken into account when valuing liabilities.

Setting assumptions with regard to purpose

- *Published accounts* – the assumptions will reflect legislation and accounting principles. Matters to be considered include:
 - using a going concern or break-up basis
 - reflecting a true and fair view
 - whether best estimate or prudent.
- *Supervisory solvency* – need to consider the degree of prudence and any prescribed methods / assumptions to be followed, or whether left to actuarial judgement with a disclosure requirement.
- *Internal accounts* – a best estimate basis is typically used.
- *Liability transfers* – a best estimate basis might be used to calculate the value of liabilities to be transferred so as to achieve fairness for all parties and to achieve agreement between actuaries acting for different parties. However, a different basis might be used:
 - due to a power imbalance between the parties concerned
 - because of a stronger desire to proceed by one party
 - to recognise the need to hold margins to protect security.
- *Determining whether discretionary benefits can be awarded* – likely to err on the side of caution so that surplus is not over-stated.
- *Setting contribution levels* – the assumptions used will depend on the objectives of the parties concerned and on the structure of the membership.
- *Calculating discontinuance benefits* – a best estimate basis may be considered to be fair but other bases may be appropriate.
- *Setting investment strategy* – a realistic set of assumptions is typically used, with sensitivity and scenario testing. A stochastic approach can add significant value.
- *Disclosure information for beneficiaries* – the assumptions will reflect legislation, but a realistic basis will typically be used, with a range of results also provided.

Setting assumptions with regard to the client

As well as considerations relating to different clients having different purposes, need to consider the client's risk appetite and the interactions with other stakeholders.



Chapter 31 Practice Questions

- 31.1 (i) Define the term 'provisions'.
- (ii) Outline the reasons for a provider calculating provisions.
- 31.2 (i) Explain why the best estimate assumptions might differ between the following two employer-sponsored benefit schemes:
- Scheme 1 – a new benefit scheme offered by a small company that manufactures steel
 - Scheme 2 – a long-established benefit scheme offered by a large financial company.
- (ii) Explain why Scheme 1 might take a more cautious view than Scheme 2 when setting the assumptions.
- 31.3 Explain why, under certain circumstances, the use of cautious assumptions to value a benefit scheme may be beneficial to the sponsor.
- 31.4 Explain how the assets held may affect the value placed on a provider's liabilities.
- 31.5 Give examples of how the assumptions used for valuing liabilities for an insurance company's published accounts might differ according to whether a *going concern* or a *break-up basis* is used.
- 31.6 Discuss the advantages and disadvantages of the assumptions for valuing a benefit scheme being:
- Exam style

- prescribed by legislation
 - left to actuarial judgement with a requirement for disclosure. [4]
- 31.7 Company A is to take over a subsidiary of Company B. As part of the takeover there will be a transfer of the existing pension liabilities from Scheme B to Scheme A in respect of the employees moving from Company B.
- Describe the factors that will affect the basis used for the transfer between the two schemes.
- 31.8 Outline the factors that will influence the choice of valuation method and assumptions when determining the value of an insurer's liabilities. [6]
- Exam style

31.9 Describe how the values placed on provisions could reflect the risk management strategy of the provider.

- 31.10 A proprietary life insurance company (Company A) writes predominantly term assurance business.

Exam style

However, it also has a block of unit-linked regular premium endowment assurance policies that were written between four and ten years ago. It has no other unit-linked business, and does not wish to re-enter the unit-linked market.

The computer systems on which the unit-linked business is administered are no longer supported and are approaching the end of their useful life.

The company has been introduced to Company B, which has expressed interest in acquiring the unit-linked business. Company B writes a wide range of unit-linked business.

Outline the main items that would be considered by Company A and Company B in determining:

- (i) an appropriate basis for assessing the transfer [3]
- (ii) whether to proceed with the transfer of business. [6]

[Total 9]



Chapter 31 Solutions

31.1 (i) ***Definition of provisions***

Provisions are the calculated amounts that need to be set aside to meet a provider's future liabilities. (The value of the provisions will depend on the assumptions used to value the future expected cashflows.)

(ii) ***Reasons for calculating provisions***

- to determine the liabilities to be shown in the provider's published accounts and reports
- if separate accounts and reports have to be prepared for the purpose of supervision of solvency, to determine the liabilities to be shown in those accounts
- to determine the liabilities to be shown in internal management accounts and reports of the provider
- to value the provider for merger or acquisition
- to determine the excess of assets over liabilities and whether any discretionary benefits can be awarded
- to set future contributions to a benefits scheme
- to value benefit improvements for a benefits scheme
- to calculate discontinuance / surrender benefits
- to influence investment strategy
- to provide disclosure information for beneficiaries.

31.2 (i) ***Differing best estimate assumptions***

Scheme 1 is smaller – this means that it is less able to benefit from economies of scale and it may not have the investment opportunities open to it that would be available to the larger Scheme 2. This could result in Scheme 1 having higher assumed expenses and a lower investment return assumption to use for discounting the liabilities.

Scheme 1 is a manufacturing company, whereas all of Scheme 2's members will be 'white-collar' (administrative) workers. This may result in different expected mortality experience, and hence different mortality assumptions.

The schemes' benefits may be linked to earnings. The two sets of employees may have different expected rates of future salary increases and hence different salary increase assumptions.

The demographics of the schemes may differ, for example the level of staff turnover may vary between the two schemes. This will affect the rates of entry into and exit from the scheme.

The schemes may be valued by different actuaries. The setting of best estimate assumptions requires judgement, and it is to be expected that judgement will differ somewhat.

(ii) ***Relative levels of caution***

The valuation of smaller schemes tends to be more cautious since (all else being equal) the scheme is going to be affected to a greater degree by adverse experience.

In addition Scheme 1 is a newly established scheme. This means that there is no direct past experience on which the actuary can base assumptions. The actuary may therefore aim to err slightly on the cautious side, since it will be more difficult to determine the best estimate than for Scheme 2.

(However, there is also an argument for being less cautious with a new scheme, since there is a longer time until a significant amount of benefits are paid, *ie* a longer time to sort out any adverse experience.)

- 31.3 If higher contributions are paid at the current time, this means that lower contributions can be payable in the future, *ie* it will increase the flexibility of the future contribution rate.

The use of cautious assumptions will reduce the likelihood of underfunding in the future and hence the risk of sudden demands at a later date to make good any shortfall.

There can be tax advantages, in a regime where contributions to the benefit scheme are exempt from tax, or taxed at a lower rate than the sponsor's rate of tax on the business.

Better investment returns may be achievable within the scheme than within the business at the current time. In future years, if the position reverses, the company could pay less into the scheme and use money within the business.

The use of a cautious basis will also increase the security of members' benefits, and hence meets the company's wish to be paternalistic.

- 31.4 It will be appropriate to consider the nature of the assets when the:

- liabilities are directly linked to the value of the underlying assets, *eg* a unit trust
- sponsor of a pension scheme has not made a promise to inject further assets if there are insufficient funds to meet the defined benefits, so that if the assets are subsequently insufficient to meet the benefits then the liabilities will need to be adjusted to reflect the actual assets available
- valuation method uses the investment return on the assets to determine the discount rate to be used to value the future liabilities.

A stochastic liability valuation approach which has investment returns as the stochastic variable (*eg* valuation of a financial guarantee) would take into account the volatility of returns on the underlying assets.

- 31.5 Examples of how the assumptions of the valuation might differ according to whether a *going concern* or a *break-up basis* is being used include:

- *Discount rate used to value future cashflows* – the company is more likely to use longer-term investment assumptions for a going concern valuation, shorter-term (market value) for a break-up valuation.

- *Expenses* – for a break-up valuation, the future liability cashflows will need to include the expenses associated with discontinuing or terminating the business. Also, per policy expenses may be higher for the break-up valuation due to there being no assumed new business across which to share fixed expenses.
- *Discontinuance rate assumptions* – withdrawals might be assumed to increase if a provider breaks up, as customers become worried about the security of their benefits.
- *Liability transfer* – a break-up basis may assume that the insurance company is wound up and that its liabilities are bought out by other insurers. The value of these liabilities will therefore be the price charged by the other insurers to take on the liabilities.

31.6 Prescription:

- + ensures consistency between different schemes
- + ensures consistency between actuaries
- + ensures consistency over time
- + may aim to ensure that appropriate assumptions are used
- the assumptions may not be suitable for valuing all schemes
- the assumptions may become outdated over time
- it takes time to change regulation, so it can be difficult to ensure the assumptions are up-to-date.

Allowing actuarial judgement with disclosure:

- + allows actuaries to include factors that are specific to the individual scheme
- + allows actuaries to exercise their professional judgement
- + can easily be updated over time
- + the requirement for disclosure ensures accountability
- assumptions may not be appropriate and may be manipulated
- there will be costs if the regulator checks the appropriateness of the assumptions used.

[½ each, maximum 4]

31.7 The most important factor is that the transfer terms are viewed as being fair to the beneficiaries of both schemes.

The actuaries representing the two companies will need to determine the basis between them:

- The actuary of Scheme B will be keen for an optimistic basis to be used so that a low value is paid to Scheme A in respect of the transferring liabilities.
- The actuary of Scheme A will be keen for a prudent basis to be used so that Scheme A receives a payment that places a high value on the transferring liabilities.

A realistic basis can be thought of as being fair to both parties, so the actuaries may start with a basis close to best estimate.

The extent to which the basis moves away from best estimate will reflect which party has the greater negotiating strength. It also will reflect any concessions made elsewhere in the overall deal.

The basis needs to reflect the membership who are transferring. For example, if they have a different profile from the membership of the scheme as a whole then this needs to be reflected in the assumptions.

The basis needs to allow for the expenses associated with the transfer, *eg* the cost of setting up new records on Company A's administration systems, or of managing / merging any differences between the two schemes.

31.8 Factors include:

- the purpose of the valuation, *eg* supervisory provisions, published accounts, internal accounts *etc* [1]
- any legislation, regulation or accounting principles that may apply (will depend on the purpose) [1]
- if being valued for supervisory solvency purposes, the size of the solvency capital (*eg* the larger the solvency capital the less significant the margins in the individual provisions may be) [1]
- the type of business being considered and its expected future experience [1]
- the risk characteristics of the business and the risk management strategy of the provider [1]
- quality and quantity of the data used (affects the extent of margins required) [1]
- the client for whom the valuation is being performed, and their risk appetite [1]
- possibly, the nature of the assets [½]
- if for a transfer of liabilities, the relative negotiating power of the parties [½]
- whether the valuation assumes a *going concern* or a *break-up* basis. [½]

[Maximum 6]

31.9 A provider will be exposed to market, credit and operational risks, which may merit a global provision. In particular, an additional provision may be necessary to cover the risks from any mismatching of assets and liabilities.

The provider's risk management strategy will be an important influence on the level of provision needed for these additional risks.

A provider with a detailed and effective risk analysis and management system, that is regularly monitored and updated, can be confident that exposure to operational, credit and market risks is reduced, and can thus justify holding a lower level of provision against these risks.

A provider's risk appetite will also influence the level of provisioning for risks.

In managing the liabilities, there may be a desire to reduce the risk of the provisions set aside being insufficient to meet the benefits promised. A person or company responsible for the management of the provision may therefore wish to consider values that are cautious. The 50% probability of under-provision created by using 'best estimate' assumptions may be considered to be too great.

31.10 (i) ***Appropriate basis for the transfer***

The basis used will be very important since a monetary transaction would take place, *ie* liabilities and assets have a real monetary worth. [1]

It is important to set a basis that both the transferring and receiving parties view as being fair. [1]

A best estimate basis might be viewed as fair to both parties ... [½]

... but there are other factors to consider, for example the relative negotiating strength of the two parties ... [½]

... and the desire by Company A to off-load the liabilities and by Company B to take the liabilities on. [½]

There may also be recognition of a need to hold a margin to protect the security of the benefits. [½]

[Maximum 3]

(ii) ***Whether to proceed with the transfer***

A company would wish for the transfer to proceed if it felt that it offered good financial value. [½]

For example, for Company B the amount received to take on the liabilities should at least compensate for the expected cost of those liabilities. [1]

Company B should also consider whether there are any alternative better uses for the funds. [½]

Company A may be keen to proceed with the transfer since:

- if the transfer does not go ahead, a new administration system will need to be developed or purchased ... [1]
... and the costs of this will have to be spread over the existing (and diminishing) unit-linked policies [1]
- it will receive a lump sum in cash, which will include an allowance for the value of future profits from the business [1]
- the statutory solvency position may improve (depending on the regulations in the territory concerned) [1]
- if the business is retained then over time it will have fewer policies under administration, and therefore overhead expenses will have to spread over a smaller number of policies. [1]

Company B may be keen to proceed with the transfer since:

- it offers synergies, *eg* Company B is likely to already have the necessary robust administration systems to administer the unit-linked business [1]
- it is likely to benefit from economies of scale in the administration of additional business, so that overheads can be spread more thinly. [1]

[Maximum 6]

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Valuation of liabilities

Syllabus objectives

11.7.2 Discuss how to determine values for provisions in terms of:

- the principles of 'fair valuation' of assets and liabilities and other 'market-consistent' methods of valuing the liabilities
- the reasons why the assumptions and methods used to place a value on guarantees and options may differ from those used for calculating the accounting provisions needed
- how sensitivity analysis can be used to check the appropriateness of the values

and be able to perform calculations to demonstrate an understanding of the valuation methods.

11.7.3 Describe different methods of allowing for risk in cashflows.

11.7.4 Discuss different methods of allowing for uncertainty in present values of liabilities.

11.7.5 Discuss the purpose of and uses for equalisation reserves.

11.7.6 Describe the influence of comparisons with market values.

0 Introduction

In this chapter we look at different approaches to the valuation of liabilities, including different approaches to how the discount rate would be set.

Sections 1 and 2 examine the different approaches that can be taken to determine the value of liabilities, particularly what is meant by the 'fair value' of liabilities.

Section 3 covers the particular considerations that are relevant when valuing liabilities relating to options and guarantees.

In Sections 4 and 5 we describe different ways of understanding and allowing for risk in liability cashflows, whilst in Section 6 we consider different approaches to general insurance provisioning dependent upon the nature of the claims.

1 Valuation methods

1.1 Introduction

There are two main groups of approaches to carrying out a valuation of assets and liabilities:

- 'traditional' discounted cashflow approaches based on long-term assumptions
- market-related or 'fair value' approaches.



Regardless of which approach to the valuation is chosen, it is important that the valuation of assets and liabilities is consistent. For example, if a discounted cashflow approach is being used to value the assets then a consistent discount rate should be used to value the liabilities.

There are a number of different approaches that can be taken to the fair valuation of liabilities.

In this section and the next we will look at each of the methods in turn, making use of example calculations in order to aid understanding. The example on which we will base the calculations is set out below.

This variety of possible approaches to valuing assets and liabilities primarily relates to valuations for benefit schemes.

Insurers might use the market-consistent approach based on matching assets (*ie* the replicating portfolio market value method) or they might use one of the methods described in Sections 5 and 6.

1.2 Example for illustrative purposes

As we discuss each of the methods, we will calculate the discount rate using the following information for the XYZ benefit scheme:

Asset holding:	Equity with a market value of:	\$950,000
	Cash of value:	\$50,000

Benefits:	Benefit payments of \$125,000 payable annually in advance over the next 12 years and increasing each year with price inflation.

Liability valuation bases

Traditional long-term basis

Discount rate	8.0% <i>pa</i>
Price inflation	5.5% <i>pa</i>
Dividend growth	6.0% <i>pa</i>

Market-related bases

Nominal gross redemption yield on 12-year index-linked government bonds	5.0% <i>pa</i>
Implied discount rate for actual asset holding	7.0% <i>pa</i>
Discount rate based on government bond yield plus equity risk premium	6.5% <i>pa</i>
Price inflation	3.5% <i>pa</i>
Prospective dividend yield of an appropriate equity index	3.0% <i>pa</i>

1.3 Traditional discounted cashflow method

For many years, actuaries valued future liabilities using discounted cashflow techniques where long-term assumptions are set.

These assumptions are chosen based on actuarial judgement.

A key long-term assumption is the future investment return expected. The future cashflows arising from the liabilities are discounted to a present value using this rate. For consistency with this approach, assets are also valued by discounting future cashflows using long-term assumptions.

A major criticism of this approach is that it places a different value on the assets from the market value, which introduces an additional element of risk.



Question

State the types of valuation for which it is particularly inappropriate to value assets at other than market value.

Solution

A short-term valuation, for example a break-up valuation for an insurance company or a discontinuance valuation for a benefit scheme.

Consequently, methods that value liabilities on a basis that matches that underlying the market value of the assets have been developed.

This leads on to the concept of fair valuation, which is covered after the worked example.

Example: XYZ benefit scheme – traditional discounted cashflow method

Using the information for the XYZ benefit scheme, the traditional discounted cashflow method gives:

Value of assets

We will value the equity holding as the present value of the expected future dividend stream, assuming the current holding is notionally reinvested in the equities underlying the index.

Dividends are assumed to be paid annually in perpetuity, with the next dividend due in a year's time and dividends increasing annually with dividend growth g .

So the equity holding is valued as: $MV \times D \times \left\{ \frac{1}{1+i} + \frac{(1+g)}{(1+i)^2} + \frac{(1+g)^2}{(1+i)^3} + \dots \right\}$

where D is the prospective dividend yield of the appropriate index.

In other words: $\frac{MV \times D}{i-g} = \frac{950,000 \times 0.03}{0.08 - 0.06} = 1,425,000$

So the total value of the asset holding (including the cash holding) is \$1,475,000.

Value of benefits

Benefits are valued using the same long-term discount rate and a long-term assessment of future price inflation p :

$125,000 \times \ddot{a}_{12|j}$, calculated at a rate of: $j = \frac{1+i}{1+p} - 1$, ie: $\frac{1.08}{1.055} - 1 = 2.37\%pa$

= \$1,323,000.

So the scheme's funding level = $\frac{\text{Value of assets}}{\text{Value of benefits}} = \frac{1,475,000}{1,323,000} = 111\%$.

1.4 The move to market-based or fair value approaches

In recent years there has been a move to market-based or fair value methods of valuation.

Both insurers and benefit providers have been making moves away from traditional discounted cashflow methods which use long-term assumptions towards market-related (fair value) approaches.

These methods seek to place a market value on the liabilities. Two definitions of fair value are:

- 1. the amount for which an asset could be exchanged or a liability settled between knowledgeable, willing parties in an arm's length transaction**
- 2. the amount that the enterprise would have to pay a third party to take over the liability.**

In some cases, a fair value of a liability is straightforward. If a contract provides that it can be terminated at various points in time for predetermined values, with no discretion on the part of the product provider, then those values are necessarily the fair values of the liability. This approach might particularly apply to unit-linked investment contracts.

As there is no liquid secondary market in many of the liabilities that actuaries are required to value, the identification of fair values from the market is not practical.

For example, there is no established secondary market in which a general insurance company can sell its domestic household insurance portfolio.

As a result, fair values of liabilities need to be estimated using market-based assumptions.

One approach to estimating fair values is to consider the liabilities as a series of financial options, and to use option pricing techniques to assess a value. Details of these techniques will not be examined in Subject CP1.

Another approach to obtaining a fair value of liabilities is to use a 'replicating portfolio'.

A further approach values liabilities using an asset-based discount rate.

The next section gives further detail on these different approaches to obtaining a fair value or market-related value of liabilities.

Market value based approaches are being increasingly adopted globally.

2 Fair valuation

2.1 Introduction

There are three fair value or market-related approaches that we will consider in this course.

In each case, assets are valued at market value.

It is then necessary to find a market-consistent valuation of the liabilities. In practice, it can be difficult to determine the market price or fair value of the liabilities, since usually there is no established market in the liabilities. This means that models and assumptions need to be used to determine the price. In particular, the discount rate chosen for the valuation of liabilities needs to reflect the market price of the liabilities, *ie* it needs to be consistent with the amount that an investor in the market would require to be paid in order to be willing to take over responsibility for meeting those liabilities.

The first two methods are replicating portfolio methods, which means that the discount rate for the liabilities is determined from the assets that best reflect the liabilities rather than being based on the actual asset holding. The third method, the asset-based discount rate, looks at the returns available from the assets actually held.

Example calculations under each of the three approaches are included in the practice questions at the end of this chapter.

2.2 Replicating portfolio methods

Using a 'replicating portfolio' approach involves taking the fair (*ie* market) value of the liabilities as the market value of the portfolio of assets that most closely replicates the duration and risk characteristics of the liabilities. The replicating portfolio can be established by using stochastic optimisation techniques, *ie* a form of asset / liability modelling. This approach is the basis of the following two methods:

2.3 Replicating portfolio method 1: Mark to market (or market value) method

This method is derived from financial economics.

We effectively try to identify the assets that are the best replicators of the future liability outgo, so that the price of these assets would be the *market price* of the liabilities in the market. We then use the underlying market discount rate of these assets to value the liabilities.

The inflation rate, discount rate and related assumptions are derived from market information as follows:

- **Assets are taken at market value.**
- **Liabilities are discounted at the yields on investments that match the liabilities – often bonds.**

For our example, we should be able to identify an index-linked bond of a 12-year term that would be a good match for the liabilities of the XYZ benefit scheme.

- **The bond yield may be based on government bonds or corporate bonds – the latter will allow for credit risk.**

Suppose a government bond gives a yield of 4.0% *pa* and a corporate bond of a similar nature and term gives a yield of 5.5% *pa*. The 1.5% *pa* additional yield on the corporate bond reflects an allowance for credit default risk (say 1% *pa*) and marketability risk (say 0.5% *pa*).

When setting the discount rate, the credit risk element should be stripped out of the corporate bond yield, reducing the discount rate to 4.5% *pa*. However, the allowance for marketability risk will often be included in the discount rate, if marketability is not an issue for the provider, *ie* the assets are intended to be held rather than sold, with the income from the assets being used to meet future liability cashflows. A discount rate of 4.5% *pa* might therefore be used.

- **A better, but more complicated, approach would be to use term-standard discount rates that vary over time to reflect the shape of the yield curve.**
- **The market rate of inflation is derived as the difference between the yields on suitable portfolios of fixed-interest and index-linked bonds.**

All the assumptions used should be market-related and hence consistent. For example, if a salary increase assumption is needed to value a pension scheme's benefits then this should be derived from the market.

Given that this method is commonly based on bond yields, and bond yields are often lower than the returns on other investments, it tends to be a *conservative* approach to valuation.

2.4 Replicating portfolio method 2: Bond yields plus risk premium

This method starts with using a discount rate based on bond yields as in the mark to market method, but then adjusts it to take account of the returns expected on other asset classes as follows:

- **Assets are taken at market value.**
- **Liabilities are valued using a discount rate that is found by adjusting (usually increasing) bond yields by the addition of either a constant or a variable equity risk premium.**

If other investments are held, the risk premium would reflect the additional return on those classes compared to bonds.

- **Where a constant equity risk premium is used, the result is the same as for the mark to market method (*ie* valuing an asset to reflect its current market levels) except that, all other things being equal, the value of the liabilities is (usually) lower.**

This is because liabilities are now discounted at a higher rate.

- **It is more common to use a variable risk premium, which is derived by a combination of market information and actuarial judgement.**

There is a school of thought that taking account of the extra return from equities is unsound unless account is also taken of the extra risk associated with equities. As a result, some actuaries argue that liabilities should only be valued using a risk-free rate of return (*ie* government bond yields).

Alternatively, as mentioned below, risk-free rates could be based on swap rates.

2.5 Asset-based discount rate

A further way of obtaining a fair value for liabilities is to value them using an asset-based discount rate, where:

- **Assets are taken at market value.**
- **An implied market discount rate is determined for each asset class, eg for fixed-interest securities it may be the gross redemption yield, for equities it involves estimating the discount rate implied by the current market price and the expected dividend and/or sale proceeds.**
- **The liabilities are valued using a discount rate calculated as the weighted average of the individual discount rates based on the proportions invested in each asset class.**

The discount rate could be determined using the distribution of the actual investment portfolio or the scheme's strategic benchmark (if the current asset allocation is not representative of the scheme's usual investment strategy).

For some asset classes, *eg* government bonds, determining the implied discount rate is objective and uses information readily available in the market. However, the discount rate for other asset classes, *eg* property, may be difficult to determine and subjective.

This method is market-related, since it uses the market value of assets and a liability valuation discount rate that is linked to current market yields. However, it can be argued that it does not truly represent a 'fair value' of the liabilities because it is dependent on the assets actually held. One of the general principles of fair value reporting is that the value of liabilities should be independent of the assets held to back those liabilities. This is because fair value is defined as being the amount that any knowledgeable and willing third party would be prepared to pay for the liabilities, and they would have their own investment strategy.

2.6 Estimating fair values

As we saw under the replicating portfolio approaches earlier in this section, we may use a discount rate that represents a risk-free rate.

Fair value can be determined by performing a 'risk-neutral' market-consistent valuation of the liability cashflows.

The risk-neutral market-consistent value is the present value based on discounting future liability cashflows at the pre-tax market yield on risk-free assets. In the UK, swaps are now often referred to when considering risk-free assets.

In other countries, government bond yields may instead be used.

If there is no availability of swaps or government bonds with a sufficiently long term to match all insurance liability cashflows, some estimation of future risk-free yields is needed.



Question

Give an example of the type of liabilities that a general insurer may have for which government bonds or swaps may not be available of a sufficiently long term to match the expected cashflows.

Solution

A general insurer's liability for claim payments may have a very long term for certain classes of business.

For example, claims on employers' liability policies due to asbestosis exposure might take longer than 20-30 years to be noticed by an employee and another five years or more to be settled.

However, government bonds typically have a maximum term of 25-30 years and swaps may only be available for terms of up to 10-15 years.

2.7 Allowance for risk

The allowance for risk within a fair value or market-consistent calculation is considered in Section 5.

3 Valuing options and guarantees

3.1 Introduction

In general when setting the terms for options or guarantees, a cautious approach is taken. However, a cautious valuation basis will not automatically produce cautious terms for an option or a guarantee.

In the previous chapter, we defined a *cautious* basis as one that puts a high value on the liabilities and/or a low value on the assets.

For example, consider the determination of terms for offering members the option to transfer the cash value of the benefits in a defined benefit pension scheme to another provider.

Using a cautious basis (light mortality and low investment return assumptions) to calculate the cash value would result in a high cash value being placed on the benefits. However, offering the member a high cash value does not represent cautious terms for the scheme, as it would result in the scheme transferring an amount which is generous compared with its best estimate of what the member would have received had the member remained in the scheme.

The scheme will have no way of *clawing back* any excess amount transferred, should investment return and mortality rate experience turn out to be higher than that assumed in the calculation.

Options and guarantees are not independent. Some guarantees may make options more valuable in certain scenarios.

For example, a life insurance company might have included in a with-profit product an option to convert the lump sum maturity benefit into an annuity at a guaranteed minimum rate. This option therefore combines with the guaranteed minimum maturity value (basic sum assured plus declared bonuses) offered by a with-profit contract.

It may therefore be important to consider options and guarantees simultaneously.

3.2 Valuing options

Introduction

In some circumstances, policyholders may choose to knowingly exercise an option when the alternative may have been financially better for them. An example of this is a life assurance policyholder who chooses to surrender early, rather than keeping the policy to maturity. In this case, the policyholder may receive materially less on surrender than they would have received had they kept the policy to maturity, even after adjusting for future premiums that won't be paid. Policyholders surrender for many reasons, the main one being that they have a better immediate use for the money, as far as they are concerned.

Insurance companies will consider persistency rates when product pricing and setting reserves. Risk-based capital calculations will need to check that an unexpectedly large number of surrenders and lapses doesn't have an adverse effect on unit costs and future management expenses because there will be fewer policies across which to spread overheads.

Other options will move in and out of the money over time depending on market conditions.

As explained in the earlier subjects, if an option is 'out of the money' that means that it is not financially advantageous to exercise. If it is 'in the money' then it is financially advantageous to exercise, and if it is 'at the money' then it is a neutral decision.

Option exercise rate influences

When valuing liabilities, it is necessary to make assumptions about the proportion who will exercise an option at each point in time at which exercise is possible.

In placing a value on options when setting provisions, it may be appropriate to assume that the highest cost option is always exercised.

In other words, it could be assumed that the holder of an option will always exercise an in the money option and will never exercise an out of the money option.

This may, however, build too much caution into the valuation. An option with a very high cost may be one that is unlikely to be the most valuable for the individual or chosen the most.

Many options are significantly dependent on the option holder's behaviour in the sense that some option holders may fail to exercise an in the money option and others may exercise an out of the money option.

The assumption that the holder of an option will *always* exercise an in the money option and will *never* exercise an out of the money option is most likely to be made when determining *supervisory provisions*, where a prudent approach is appropriate. However, as described above, even for supervisory provisions this may be *too* cautious.

Example 1 – the attraction of cash

The option holder's behaviour may be influenced by the option that is immediately financially advantageous, rather than an option that may be of greater value, but where the benefit is realised in the future.

A guaranteed annuity rate to convert the proceeds of a pension fund into an annuity may be significantly in the money. However, the experience is that policyholders who have the option to take their pension fund in cash at retirement are likely to select this option, rather than the more advantageous approach of taking the guaranteed annuity rate applied to the pension fund. The policyholder perceives immediate cash to be of more benefit than a higher value pension annuity.

Having 'cash in hand' may have a powerful influence on the individual's decision. Even if the option is in the money and so would enable them to obtain a guaranteed annuity rate which is better value than would be available on the open market, the member may choose not to exercise it.

Consequently, many pension scheme members do elect to take a lump sum at retirement, *eg* to pay off an outstanding mortgage, to finance home improvements, a holiday or a car, or simply to establish a source of readily realisable capital for the future.

Example 2 – tax benefit

This is another example of where the assumption of always exercising an option when it is in the money *from the provider's perspective* may not hold. It again relates to an option on a pension policy to take a guaranteed annuity rate at retirement and is similar to the first example.

However, it offers a slightly different reason for preferring to take cash: beneficial tax treatment in the hands of the individual.

A pension policy that provides a guaranteed rate for conversion of the policy proceeds into an annuity at retirement should normally be valued using the guaranteed rate if the option is or is close to being beneficial to the policyholder.

However, if there is also an option to take part of the value of the policy as a tax-free lump sum, this latter option may be more valuable to most policyholders, so that the majority choose it, even though they are forgoing a financial benefit by not taking all the proceeds in the form of an annuity at the guaranteed rate.

In this case it may be that the take-up rate of the option may be less than 100%.

Furthermore, the take-up rate may be different depending on the purpose of the valuation and the level of prudence required.

Selection

With options there is a risk of selection against the provider.

Assumptions about future experience should take into consideration the potential for such selection. For example:

- Term assurance – an option to renew a contract without further evidence of continuing good health may result in only those policyholders in worse than average health exercising the option. Therefore we could use heavier than average mortality rates to value the option.
- Household insurance – an option to have 'new for old' cover rather than cover on an indemnity basis may result in a higher proportion of fraudulent claims by policyholders looking to replace worn out goods.

This selection risk can be guarded against in setting eligibility criteria for the option or by setting terms that favour one option over another.



Question

Give examples of eligibility criteria that might be applied at outset in respect of a 10-year term assurance contract that offers the option to renew after 10 years without the need to demonstrate continuing good health.

Solution

Eligibility criteria might include:

- imposing a limit on the sum assured
 - stricter medical underwriting at outset to prove health
 - restricting the age of the applicant.
-

Other factors affecting the value of options

Contract values are highly sensitive to option pricing methods and assumptions.

The detailed use of these methods is outside the scope of this course, but the aim is to value an option by finding a market option that will close out the option in the policy.

If a market-traded derivative (*eg* put or call option) can be found which replicates the option in the liability, then the value of the policy option can be taken as the market value of that derivative.

If such a derivative is not available, it may be possible to construct a theoretical derivative that would replicate the option in the liability and then value that derivative using a model or 'closed form' solution, such as the Black-Scholes formula.

The assumptions used when valuing an option will depend on, among other things:

- **the state of the economy, and hence must be scenario specific**
- **demographic factors such as age, health and employment status**
- **cultural bias**
- **consumer sophistication.**

An example of cultural bias might, for example, be the extent to which individuals prefer having cash to spend now rather than planning for the future.

These sensitivities may change over time, for example, as consumers become more aware of options and improve their ability to evaluate the relative merits of electing options.

When using deterministic and closed form (*eg* Black-Scholes) methods to value guaranteed options, the traditional approach has been to assume that the take-up rate reflects the financial value of the option only – in other words a high take-up rate is used. If solvency and capital requirements are assessed on a risk-based approach, a best estimate option take-up rate will be used and capital will be held against the risk of the actual rate departing from the estimate.

3.3 Guarantees

For example, a defined contribution pension scheme may have a defined benefit underpin (*ie* a minimum defined benefit amount). This could protect members against the risk of low investment returns and hence an inadequate benefit.

As another example: a unit-linked savings contract may have a guaranteed minimum maturity value.

With guarantees there is a risk that the guarantee will apply and so the costs will be greater than would otherwise have been the case.

Unless all the guarantees are in the money, providing for the worst-case scenario for every contract will mean that unnecessarily large provisions are made.

‘In the money’ means that the guarantee is currently biting. For example, where a unit-linked benefit has a guaranteed minimum value, this minimum benefit is greater than the current value of the units.

In order to assess the value of a guarantee, we would need to use a stochastic approach or a variety of deterministic scenarios. Guarantees are best valued using a stochastic approach because multiple simulations can be run to estimate the *likelihood* of the guarantee biting.

Guarantees are usually best valued by a stochastic approach, taking the class of business as a whole. The value of financial guarantees will normally be assessed using a stochastic model. The parameters input to the model should reflect the purpose for which the results are required. The level of prudence required, or alternatively the required risk that the provision established will be inadequate, will affect the results from the model.

A stochastic model is the most sophisticated way of investigating the potential costs of guarantees.

For example, the potential impact of a minimum maturity value guarantee could be estimated by running a large number of simulations using a stochastic investment model. Given a particular distribution of investment returns and a minimum maturity value, the model could be used to determine the likelihood of the guarantee biting and the expected cost.

Factors affecting the value of guarantees

Guarantees may become more or less onerous for the provider over time, depending on how experience develops.

The value of guarantees and their influences on consumer behaviour will vary widely according to the economic scenarios and the sophistication of the market.

4 Sensitivity analysis

The assumptions used for setting provisions are estimates of future experience, taking any requirements for solvency capital into account. They are the expected values plus risk margins for adverse future experience. Sensitivity analysis can be used to determine these margins.

Margins for adverse future experience are considered further in the next section.

Sensitivity analysis could also be used to assess the extent of any global provisions that may need to be set up to cover potential future adverse experience.

These global provisions were described in the previous chapter.

When carrying out sensitivity analyses, it is important to change the assumptions singly, in a logical manner. Normal practice is to start with a central set of assumptions, and then to vary each item in turn, to quantify the effect of assumption changes.

It is then also necessary to test the effect of multiple assumption change. In most cases the assumptions will be neither fully independent nor fully correlated, and the result of applying two tests simultaneously will be greater or less than the sum of the individual results.

5 Different methods of allowing for risk in cashflows

5.1 Allowance for risk in a traditional discounted cashflow valuation

Best estimate and margin

An approach to the uncertainty surrounding benefit costs and asset returns may be taken by using assumptions that do not reflect an actuary's 'best estimate' of future experience. A risk margin is built in to each assumption by using 'best estimate' assumptions together with an explicit margin for caution.

For some assumptions the prudential margin may be an addition to the best estimate, *eg* higher than best estimate mortality rates when valuing term assurance liabilities. For others the prudential margin may be deducted, *eg* lower than best estimate mortality rates when valuing annuity liabilities.

Assessment of the necessary margins depends on the risk involved, and its materiality to the final result. Where a risk factor has been stable over many years and is not exposed to economic events, it may be reasonable to add a simple percentage loading. An example might be mortality risk for lives aged between 30 and 55 in developed countries.

In other cases a more detailed analysis of experience for various sources, perhaps using a stochastic approach, may be needed to determine a margin consistent with the risk appetite.

Care should be taken in considering the overall effect when introducing margins, since the introduction of small margins in many assumptions might lead to a cumulative effect of the basis being stronger than desired.

Contingency loading

This approach is to increase the liability value by a certain percentage. The choice of this 'contingency loading' is effectively another assumption and should ideally reflect the degree of uncertainty that exists. It would, therefore, be expected to increase with the value of the liabilities but not in a proportionate manner.

Given the analysis tools now available, this approach is excessively arbitrary.

Discounting cashflows at a risk premium

This is the traditional discounted cashflow approach where the cashflows are assessed on a best estimate basis, and then discounted at a rate of return that reflects the overall risk of the project or liability.

Determination of the risk premium is often arbitrary and in some circumstances it is a requirement set out by the firm's governing body. Frequently the risk discount rate is not based on the risks associated with the cashflow, but is the opportunity cost of the firm not pursuing some other business opportunity.

If risk discount rates are high, they can affect the near and the remote cashflows disproportionately to the actual risk of the cashflows.

In order to allow for prudence in a liability valuation, the discount rate should be *reduced*. A high discount rate places lower relative weights on cashflows further into the future, when these may well have the highest risk and uncertainty.

5.2 Allowance for risk in a market-consistent or fair valuation

Financial risk

Financial risk associated with the liability cashflow is normally allowed for in a market-consistent manner either by a replicating portfolio or through stochastic modelling and the use of a suitably calibrated asset model.

If a replicating portfolio has been found, the financial risk within the liability cashflows is implicitly allowed for through taking the market value of the replicating assets, since market value will reflect the inherent risk associated with those equivalent assets.

If stochastic modelling is used, the financial risk is allowed for through the volatility assumption used to generate investment outputs. As indicated, this should be set according to market conditions.

The risks associated with the general mismatching of assets and liabilities are on the whole excluded from fair value calculations. This is because inclusion of this risk would be inconsistent with the general principle that the fair value of liabilities should be independent of the assets held to meet the liabilities.

Non-financial risk

The adjustment for non-financial risks can be achieved either by adjusting the expected future cashflows or by an adjustment to the rate used to discount cashflows. Alternatively, an extra provision or a capital requirement, such as the risk margin under Solvency II, can be held for non-financial risks.

These adjustments will depend on:

- the amount of the risk
- the cost of the risk implied by market risk preferences.

6 Different methods of calculating provisions

In this section we consider different approaches an insurer may take to provisioning, dependent upon the nature of the expected claims from the class of business. The methods described in this section primarily apply to general insurers.

6.1 Statistical analysis

If the population exposed to a risk is large enough, and the consequence of a risk event is approximately normally distributed, then a mathematical approach to establishing a provision for the risk will give a valid answer.

A company establishing a provision for notified theft claims under a household contents policy might simply provide for the number of notified claims multiplied by the average cost of a claim in the last year. This would give a best estimate provision.

To establish a prudent provision that would be sufficient at a ruin probability of any given percentage, a simple analysis of the normal distribution will generate the required result.

6.2 Case-by-case estimates

If the insured risks are rare events and also have a large variability in outcome, then statistical analysis may break down.

For example, in establishing a provision for notified motor accident personal injury liability claims, there is little alternative but to carry out a case by case examination of the claim files to assess the extent of injury, the prognosis, and hence the likely claim amount. Even this approach still leaves risk of injury award inflation that a court might grant.

The case by case examination involves the claims assessor examining each individual claim file for the reported claims and assessing the likely cost of settling each claim.

6.3 Proportionate approach

An alternative approach, especially in making provisions for risks which a provider has accepted but where the risk event has not yet occurred, is to set a provision on the basis that the premium charged is a fair assessment of the cost of the risk, expenses, and profit.

If a premium basis allows for 25% of the premium to cover expenses, commissions and profit, then one approach to establishing a provision for the unexpired part of a year's cover is to assume that 75% of the premium covers risks equally through the period of the policy. A provision for the unexpired duration can be set by a simple proportion of this 75%.

If a portfolio is such that there is no method of assessing a required provision with any degree of confidence, this suggests that the risks ought to be transferred elsewhere.

6.4 Equalisation reserves

An example of the issues discussed above occurs where a product provider might wish to exhibit stable results from year to year, but where the portfolio contains low probability risks with a large and highly volatile financial outcome. In years where such an event occurs the company may show a significant reduction in profits; where no event occurs, profits will be greater than the long-term average.

To smooth results, a company may establish a claims equalisation reserve in years when no claim arises, with a view to using the reserve to smooth results when a claim does occur.

These reserves do not fit with the definition of a provision, but nevertheless are used in some jurisdictions for general insurance. Note that not all regulatory regimes recognise equalisation reserves; for example, these reserves do not exist under Solvency II.

Tax authorities are often not prepared to take such reserves into account in computing profits. Equalisation reserves are seen as a way of deferring profits and hence tax.

Chapter 32 Summary

Approaches to valuing assets and liabilities

Discounted cashflow approach: long-term discount rate used to value both assets and liabilities.

Market-related approaches: replicating portfolio approaches or actual asset-based approach can be used to value the liabilities. Assets are valued at market value. Aim to determine market price of liabilities and hence discount rate.

Fair value

In recent years there has been an increasing move towards fair value methods.

Two definitions of fair value are:

1. the amount for which an asset could be exchanged or a liability settled between knowledgeable, willing parties in an arm's length transaction
2. the amount that the enterprise would have to pay a third party to take over the liability.

These methods aim to find the market value of liabilities, but in practice there is no secondary market for most liabilities. Therefore the market value cannot be found directly. Instead we need to try to find market-based assumptions.

Setting the discount rate

<i>Method</i>	<i>Valuation of assets</i>	<i>Valuation of liabilities</i>
Traditional discounted cashflow	Discounted cashflows using long-term rate based on actual holding or notional portfolio	Discount rate is same long-term rate as used for assets
Replicating portfolio (mark to market)	Market value	Discount rate implied by market price of investments that match liabilities – often bonds
Replicating portfolio (bond yields plus risk premium)	Market value	Discount rate as in mark to market method, but then adjusted to take account of higher expected returns on other asset classes
Asset-based discount rate	Market value	Discount rate is the expected return on assets, weighted by proportions held of each asset class

Fair (or market) value of liabilities can be estimated by discounting using risk-free rates.

Valuing options

It is not always appropriate to assume that the highest cost option is always exercised. For example, the attraction of cash or a tax-free benefit might mean that individuals do not exercise an option that is in the money from the provider's perspective.

The risk of anti-selection must be allowed for when valuing options.

Options in liabilities can be valued by finding a market option that replicates it. A closed form approximation may be used, eg Black-Scholes.

Contract values are highly sensitive to option pricing methods and assumptions. The assumptions used will depend on, among other things:

- the state of the economy, and hence must be scenario specific
- demographic factors such as age, health and employment status
- cultural bias
- consumer sophistication.

Valuing guarantees

Guarantees are usually best valued by a stochastic approach, taking the class of business as a whole. A stochastic model allows for the likelihood of the guarantee biting and its expected cost.

Guarantees may become more or less onerous on the provider over time depending on how experience develops.

The value of guarantees and their influences on consumer behaviour will vary widely according to the economic scenarios and the sophistication of the market.

Sensitivity analysis

Sensitivity analysis can be used:

- to help determine the extent of the margins needed in assumptions, to allow for adverse future experience
- in determining the extent of any global provisions required.

Sensitivity analysis can be done on single or multiple assumptions.

Different methods of allowing for risk in cashflows

- Build a margin into each assumption.
- Apply an overall contingency loading by increasing the liability value by a certain percentage.
- Adjust the discount rate to reflect the risk in the project or liability.

Allowance for financial risk in market-consistent or fair valuation is implicit if a replicating portfolio or stochastic model (calibrated to the market) is used. Adjustment for mismatching risk is generally not made so as to achieve independence of the fair value liability valuation from the actual assets held.

Allowance for non-financial risk is achieved by adjusting the cashflows or the discount rate, or alternatively through an extra provision or capital requirement such as the Solvency II risk margin.

Different methods of calculating provisions

- Statistical analysis – if many claims following known pattern
- Case by case estimate – individual assessment of claim records where there are few claims
- Proportionate approach – base on amount of net premium yet to expire.

An equalisation reserve may be set up to smooth results from year to year where there are low probability risks with a high and volatile financial outcome.

The practice questions start on the next page so that you can keep the chapter summaries together for revision purposes.



Chapter 32 Practice Questions

- 32.1 Describe two replicating portfolio based approaches to valuing a benefit arrangement.
- 32.2 Calculate, using the replicating portfolio mark to market method, the following for the XYZ benefit scheme that was introduced in Section 1.2:
- (i) the value of assets
 - (ii) the value of benefits (the replicating asset is a 12-year index-linked government bond)
 - (iii) the funding level.
- 32.3 Comment on the likely stability of the XYZ benefit scheme's funding level over time when calculated using the mark to market method.
- 32.4 Calculate, using the replicating portfolio bond yields plus risk premium approach, the following for the XYZ benefit scheme:
- (i) the value of assets
 - (ii) the value of benefits
 - (iii) the funding level.
- 32.5 Calculate, using the asset-based discount rate approach, the following for the XYZ benefit scheme:
- (i) the value of assets
 - (ii) the value of benefits
 - (iii) the funding level.
- 32.6 Discuss the advantages and disadvantages of the traditional discounted cashflow approach to valuation (of both assets and liabilities) compared to a market-related approach.
- 32.7 A final salary pension scheme offers members the option at retirement to exchange part of their pension for a pension payable to a chosen dependant. The dependant's pension will be payable from the death after retirement of the member, for the remainder of the life of the dependant.
- Suggest restrictions that might apply to the exercise of the option.
- 32.8 A life insurance company sells a unit-linked five-year savings bond with a guaranteed minimum surrender value on withdrawals after the first 18 months equal to the premium paid.
- Exam style**
- An accountant who is auditing the supervisory provisions has suggested that an appropriate provision for this guarantee should be determined by stochastically modelling withdrawal rates.
- Discuss this suggestion, including alternative approaches that could be taken to the calculation.
- [6]

32.9 A final salary pension scheme offers members the option at retirement to commute pension for a lump sum payment.

Exam style

- (i) Set out a basic equation of value for this option, defining all terms used and stating any assumptions made. [3]
 - (ii) Discuss the factors to be considered in setting the terms for this option. [10]
 - (iii) Describe restrictions that might be imposed on the exercise of this option. [4]
- [Total 17]

32.10 Describe the advantages and disadvantages of using best estimate assumptions and a single explicit contingency loading for caution, compared with using more prudent individual assumptions.

32.11 Outline the disadvantages to a general insurance company of needing to carry out case by case estimates as opposed to a statistical analysis to calculate the provisions.

32.12 A premium basis allows 20% to cover expenses, commissions and profit. All policies provide cover for a two-year period and are written on 1 January. The total premium written is £200m.

Calculate the provision for the unexpired duration six months after the policies were issued.

32.13 An expert witness is advising on a suitable discount rate to use in order to calculate the amount of lump sum payment that should be made to a 50-year old individual in compensation for their claim for loss of earnings following an injury at work.

Exam style

The payment is determined as the present value of annual earnings lost, allowing for the number of years out of work as a result of the injury.

In previous cases, the discount rate used has been the real yield available on an index of long-dated index-linked government securities. It has been commented that this would be an inappropriate discount rate for this calculation.

- (i) Discuss the considerations that might have led to this comment. [7]

It has been suggested that a more reasonable discount rate would be based on the expected return above inflation on a portfolio of mixed assets.

- (ii) List the types of asset that a typical individual investor would hold in such a portfolio. [2]
- [Total 9]



Chapter 32 Solutions

32.1 Both of the methods value the assets at market value.

Both approaches value liabilities using the discount rate implied by the market price of a replicating portfolio.

This is the asset mix that is the best match for the duration and risk characteristics of the liabilities.

This portfolio may be determined using an asset / liability modelling study.

The market rate of inflation is derived as the difference between the yields on suitable portfolios of fixed-interest and index-linked bonds.

All other assumptions should be market-related, *eg* salary increase assumption should be derived from the market.

Market value method (mark to market)

Under this method, the replicating portfolio consists generally of bonds – government or corporate (where the credit risk has been stripped out).

A simple approach might aim to find a single discount rate that values asset cashflows at the observed market price.

A more sophisticated approach can be taken in which the discount rate varies by term to reflect the shape of the yield curve.

Bond yields plus risk premium

This approach builds on the previous method through the introduction of a risk premium that is added to the bond yields.

This reflects the extra return expected from the actual asset holdings (*eg* if equities are held then we may expect a higher return), although the discount rate should also be adjusted to reflect any extra risk.

A variable risk premium may be used, which is derived by a combination of market information and actuarial judgement.

32.2 (i) Assets are valued at market value = \$1,000,000.

(ii) Liabilities are valued using the yield on the replicating assets (*ie* index-linked government bonds) which is 5.0% *pa*, and also using a market-related price inflation rate *p* of 3.5% *pa*.

$$125,000 \times \ddot{a}_{12}^j, \text{ calculated at a rate of } j = \frac{1+i}{1+p} - 1, \text{ ie: } \frac{1.05}{1.035} - 1 = 1.45\% \text{ pa}$$

$$= \$1,387,500.$$

(iii) The scheme's funding level

$$= \frac{\text{Value of assets}}{\text{Value of benefits}} = \frac{1,000,000}{1,387,500} = 72.1\%.$$

- 32.3 The discount rate is based on bond yields, however the scheme is invested primarily in equities (and some cash). Bond yields and equity returns do not necessarily move in line; in particular equity returns are more volatile.

The funding level will therefore be volatile over time, reflecting the changing gap between the return on the actual assets held and the assets assumed to be held using a bond-based discount rate.

- 32.4 (i) Assets are valued at market value = \$1,000,000.
- (ii) Liabilities are valued using a discount rate equal to the government bond yield plus equity risk premium, 6.5% *pa*, and using a market-related price inflation rate *p* of 3.5% *pa*.

$$125,000 \times \ddot{a}_{12|}^j, \text{ calculated at a rate of } j = \frac{1+i}{1+p} - 1, \text{ ie: } \frac{1.065}{1.035} - 1 = 2.90\% \text{ } pa$$

$$= \$1,288,000.$$

(iii) The scheme's funding level

$$= \frac{\text{Value of assets}}{\text{Value of benefits}} = \frac{1,000,000}{1,288,000} = 77.6\%.$$

- 32.5 (i) Assets are valued at market value = \$1,000,000.
- (ii) Liabilities are valued using the expected return on assets, ie the implied discount rate allowing for the scheme's actual asset holding, ie 7.0% *pa*, and using a market-related price inflation rate *p* of 3.5% *pa*.

$$125,000 \times \ddot{a}_{12|}^j, \text{ calculated at a rate of } j = \frac{1+i}{1+p} - 1, \text{ ie: } \frac{1.07}{1.035} - 1 = 3.38\% \text{ } pa$$

$$= \$1,257,600.$$

(iii) The scheme's funding level

$$= \frac{\text{Value of assets}}{\text{Value of benefits}} = \frac{1,000,000}{1,257,600} = 79.5\%.$$

- 32.6 A traditional discounted cashflow approach uses a long-term valuation rate of interest to value both the assets and the liabilities.

The use of a consistent long-term rate gives:

- consistency in the valuation of assets and liabilities, and
- stability to the result over time.

Whether there is consistency between the valuation of assets and liabilities in a market-related approach depends upon how the valuation rate of interest for liabilities is set.

If the rate used is that implied by the market given the assets held, and the assets match the liabilities then there is consistency and the valuation result will be stable.

However, it can be difficult to determine the market-implied discount rate.

It will be easier to explain the valuation of assets to clients if a market-related approach is used.

The valuation of assets is usually easier under a market-related approach (although some assets are difficult to price and sometimes a market value does not exist).

To ensure fairness, market-related approaches are required for discontinuance valuations, for example on a transfer between pension schemes.

More generally, a discounted cashflow approach does not allow for the difference between the market value of assets and the discounted cashflow value of assets when buying or selling assets in the market.

The approach taken may be dictated by legislation, which may be more likely to require a market-related approach.

In recent years, international accounting standards have instigated a move towards a market-related or fair value method of valuation.

The discounted cashflow approach enables the actuary to bring in the benefit of judgement, whereas the market-related approach in its purest form does not.

On the other hand, this element of judgement can be viewed in a negative light as introducing subjectivity.

32.7 The restrictions might include:

- a limit on the proportion of pension that can be surrendered
- to require evidence of the member's good health
- restrict exercise of the option to specified times, *eg* just before retirement, at time of marriage
- once elected, the decision should be irrevocable
- restrict the eligibility to surrender pension according to the nature of the relationship between the member and the dependant
- the factors should be amended where there is a large difference between the ages of the member and the dependant.

32.8 In general, when determining the provisions for guarantees, a cautious approach should be taken. [½]

A very cautious approach would mean holding a provision that is at least as big as the guaranteed surrender value for all policies (*ie* a worst-case scenario). [1]

However, this may be considered too cautious and result in provisions being held which are deemed too high. [½]

We may want to factor the *likelihood* of the guarantee biting into the calculation. [½]

We may want to look at the provision required on a *global* rather than on an *individual* basis. [½]

Stochastic models are good for modelling guarantees. [½]

This is because the output can be used to work out the likelihood of the guarantee biting as well as key statistics such as the expected cost and the variability of the cost of the guarantee. [1]

However, stochastic models can be complicated and costly to build, time-consuming to run and difficult to interpret and explain to other parties. [1]

The suggestion is to model the *withdrawal* rates stochastically. However, withdrawal rates are difficult to model (to fit a distribution and parameters) as withdrawals are a consequence of human behaviour and are influenced by economic conditions and public opinion. [1]

Modelling withdrawal rates stochastically will give us information on the likelihood of withdrawals, but won't tell us the likelihood of the guarantee biting on withdrawal. [½]

A better variable to model stochastically would be the investment return assumption. [1]

A simpler alternative to a stochastic model would be to use a variety of deterministic scenarios or inspection to determine the likelihood of the guarantee biting. [½]

However, these simpler methods give us less information regarding the likelihood of the guarantee biting. [½]

[Maximum 6]

32.9 (i) **Equation of value**

$$L = P\ddot{a}_x^{(12)} \quad [1]$$

where:

- L is the lump sum payment [½]
- P is the annual pension *given up* [½]
- the pension is payable monthly in advance [½]
- x is the age of the member at retirement [½]
- it is assumed that any dependant's pension is 'ring-fenced', in other words the member can commute only their own pension entitlement [½]
- administration expenses and tax have been ignored [½]
- it is assumed that there is no annuity guarantee period. [½]

[Maximum 3]

(ii) **Factors to consider in setting the terms for the option**

The investment return assumption should reflect the assets backing this option. [½]

This is likely to be bonds of medium- to long-term. [1]

The investment return assumption should be based on *market values* as, in order to pay the lump sum, the assets will have to be realised. [1]

An allowance must be made for any guaranteed pension increases. [½]

In addition a decision needs to be made about the allowance to be made, if any, for discretionary increases. [½]

It may be that a conservative allowance is made if the scheme has an established practice of providing discretionary increases. [½]

The commutation factors should vary according to the age of the member. [½]

A mortality assumption will need to be set based on a mortality table appropriate to those likely to exercise the option. [1]

The mortality basis needs to reflect whether there is the risk of selection against the scheme. [½]

For example, if we set the terms based on the average member, it may be more likely that members in poor health (*ie* with a short life expectancy) exercise the option. [1]

Such selection risk can be controlled by amending the assumptions used, *ie* assuming heavier mortality, ... [½]

... and imposing restrictions on the exercise of the option. [½]

On the other hand, it may be felt that selection risk is minimal in that the option may be attractive to all members, *ie* people will prefer to receive the money now rather than later. [½]

This will particularly be the case if there are any tax incentives given on taking the pension as a lump sum. [½]

The aim may be for the exercise of the option to be financially neutral to the scheme. [½]

Using a best estimate basis will be fair to both the member exercising the option and the scheme. [1]

However, the views of the sponsor and trustees should be considered. [1]

For example, the sponsor might want harsher terms to be offered on the commutation option to reduce scheme costs or ease liquidity concerns. [1]

Or less harsh terms if the sponsor wants to encourage take up of the lump sum, *eg* to reduce its future longevity risk. [1]

Practical considerations need to be addressed. For example, it is likely that fixed factors will be used that are not changed too frequently. This makes it easier to communicate to members and easier to administer. [1]

However, using fixed factors is inconsistent with market-related investment returns (as these would vary from day to day). [½]

Furthermore, a decision needs to be made as to what triggers an updating of the factors. [½]

External factors also need to be considered, for example any relevant legislation, *eg* minimum conversion terms or whether the terms should be unisex. [1]

Consider the consistency of any new terms with those offered in the past by the scheme. [½]

Consider the approach taken by competitor schemes. [½]
[Maximum 10]

(iii) ***Restrictions on exercise of the option***

- A maximum amount that can be commuted – to ensure that members have sufficient pension to live on. There may be regulation of this area. [1]

However, it may be in the interests of the scheme to allow small pensions to be commuted in full to reduce the administration costs associated with paying small pensions. [1]

- A minimum amount that can be commuted – to ensure that the administration costs can be justified. [1]

- Ring-fencing of any dependants' pensions, so that members can only commute their own benefit. [1]

- Option is unavailable, or special terms apply, where the member has taken ill-health or early retirement. [1]

If the scheme is concerned about selection risk then some limited medical underwriting could be carried out on exercise. [½]

- Exercise of the option is at the discretion of the employer and/or trustees. [½]

- Option is irreversible once exercised. [½]

[Maximum 4]

32.10 ***Relative advantages of best estimate assumptions plus high level loading***

- The degree of caution introduced can clearly be identified.
- It avoids the need to take care when introducing individual margins within the basis to ensure that margins in different assumptions don't cancel out or alternatively that many small margins lead to a basis which is too strong.
- The approach may be easier to explain to clients. In contrast, using lots of individual prudent assumptions lacks transparency and can be harder to explain to clients compared with a single explicit contingency margin.

Relative disadvantages of best estimate assumptions plus high level loading

- It is difficult to assess the appropriate allowance to be made.
- Margins have not been targeted to the areas where they are required. For example, if future mortality experience is particularly difficult to predict then the margin can be introduced directly into that assumption under the prudent individual assumptions approach.

32.11 The main disadvantages are:

- it is time-consuming and therefore expensive
- there is a risk that the case assessors may not have sufficient expertise, leading to incorrect assessment
- the process is subjective and there is a risk of bias by the assessors
- this approach can only look at reported claims; a separate approach will be needed to evaluate incurred but not reported claims.

32.12 The provision for the unexpired duration is:

$$80\% \times 0.75 \times £200m = £120m$$

32.13 **Comments on answering this question:**

The question is asking what an appropriate rate to discount liabilities might be, so a good starting point is to think about the different methods of setting a discount rate that are described in this chapter.

In order to generate ideas, we need to think about the rationale behind setting the discount rate. The discount rate should be an estimate of the return the individual would achieve on investing the lump sum. We therefore need to consider how the lump sum would be invested.

One possibility would be to replicate the liability cashflows (ie use a replicating portfolio method). This will involve consideration of the nature, term and certainty of the liabilities.

Alternatively, a lower degree of matching could be used in choosing assets and an asset-based method used to set the discount rate.

(i) **Suitability of the discount rate**

One way of setting the discount rate is to use the return on assets that most closely replicate the nature, term, currency and certainty of the liabilities. [1]

The nature of both the assets and liabilities here is real. [½]

However, earnings growth (which affects the liability cashflows) may be greater than the price index on which the index-linked bond securities index is based. [1]

There may also be a term or duration mismatch. [½]

For example, the duration of the long-dated bonds may be longer than the expected period of lost earnings, since the claimant is 50 and may have retired normally at age 60 or 65. [1]

There is also uncertainty in the liability cashflows, for example uncertainty over the duration of future employment. [1]

It may therefore be appropriate to consider using a lower discount rate than the real yield on the bond index, in order to place a higher present value on the expected future cashflows, which could be used to reflect the uncertainties. [1]

This approach is approximate, and consideration could be given to stochastically modelling the future cashflows to more accurately reflect the uncertainty in the future liabilities. [½]

The nature of the discount rate (real or nominal) should be consistent with the nature of the cashflows being discounted. [1]

Therefore, using a *real* yield is appropriate only if the liability cashflows are stated in terms of *real* earnings growth (*ie* earnings growth in excess of price inflation). [1]

Another way of setting the discount rate is to use the weighted average of the returns on the assets in which the claimant would be expected to invest. [½]

However, investing in index-linked bonds may not be what a financially aware person would do – particularly given the size of the award. [1]

It is also possible that the real yield on the bond index will be distorted by market sentiment – *ie* supply and demand for the bonds. [1]

Adjustment may also need to be made to allow for tax. [½]
[Maximum 7]

(ii) **Mix of assets**

A typical individual investor would hold a mix of cash, bonds, property and equity in such a portfolio. [½ each asset type, total 2]

Individual assets may be held but holdings in collectives are more likely. [1]
[Maximum 2]

33

Reporting results

Syllabus objectives

- 12.3.1 Describe the reports and systems which may be set up to control the progress of the financial condition of the main providers of benefits on contingent events.

0 Introduction

This chapter looks at the principles underlying the financial statements of financial service providers. It starts with a reminder of the accounting concepts and principles that apply to all businesses, before going on to look at the financial reporting requirements of insurance companies. Finally, reporting and disclosure requirements for benefit schemes are considered.

Reporting of risk and risk management activities was covered in an earlier chapter.

1 Accounting concepts and principles

Accounting concepts and principles may vary from country to country, although efforts are being made to achieve greater harmonisation of international accounting practice. The principles used may also depend on the purposes for which the accounts are designed.

In recent years changes in Accounting Standards have placed greater emphasis on neutrality, rather than prudence. For trading companies there has also been a move away from historical cost towards 'fair values'.

Investment companies, including financial product providers, have prepared accounts using the market value of assets, or some proxy for it, for many years. This means revaluing assets and liabilities at the end of each accounting period. Gains and losses on revaluation are included in some form of income statement for the period. For a financial product provider, this can lead to volatile results if assets and liabilities do not move consistently.

Various accounting concepts were introduced in Subject CB1, and include the following:

- cost
- money measurement
- going concern
- business entity
- realisation
- accruals
- matching
- dual aspect
- materiality
- prudence
- consistency.

If you are unfamiliar with some of these terms, you may like to revisit the relevant material from the earlier subjects. There is a practice question at the end of the chapter which will help with this.

Candidates are not expected to be familiar with the accounting concepts and principles that apply in any particular country. They may be expected to discuss problems that arise in defining accounting concepts and principles and putting them into practice, and the implications for the interpretation of providers' accounts.



Question

'Although accounting concepts appear reasonable in isolation, conflicts between them can arise in putting them into practice.'

Give examples of possible conflicts.

Solution

Examples of conflicts between the concepts include:

- going concern and prudence – *eg* giving a non-zero value to a piece of machinery that would have zero resale value
 - prudence and realisation – *eg* taking credit for payment from a customer even though it has not yet been received.
-

2 Interpreting the accounts of financial product providers

2.1 Analysis of accounts

The examiners will expect candidates to be able to comment sensibly on the conclusions (if any) that can be drawn from analysing a simple set of accounts, referring where necessary to the effect of the strength of bases, business growth, etc.

Before attempting to interpret the accounts of a provider, it is necessary to be familiar with both the rules governing the preparation of the accounts and also the accounting rules and conventions that apply in the country concerned.

In developed economies, the published financial statements of financial product providers are usually prepared on a going concern basis and are intended to give a *true and fair* view of the provider's performance and financial position.

The prior year's figures will normally be shown alongside the current year. Changes in accounting practice will be identified and, if material, the prior year's figures will be restated on the current basis to enable fair comparisons to be drawn.

The figures published by the company should be comparable from one year to the next. Accounting policies should not, therefore, be changed from one year to the next unless there is a good reason for doing so. Any such changes should be highlighted and their impact explained.

Often when a provider does alter its accounting treatment of a particular item it will restate (and may be required by the accounting rules to restate) the previous year's accounts on the new basis for comparison purposes.

2.2 Reports accompanying accounts

The reports accompanying the accounts may reveal much more about the company than an analysis of the published numbers. Because these reports are written to be in the public domain, what is not said or disclosed in the reports can give greater insight to the company's position than what is publicly disclosed.

These additional reports might include:

- chairperson's and CEO's statements
- investment report
- strategic report
- risk report
- remuneration report
- corporate governance report.

The following sets out more detail on the possible content of each of these additional reports.

Chairperson's and CEO's statements

Depending on what is said elsewhere in the reports, these might give details of the successes of the year. Little will be said about the failures.

Performance against key objectives should be reported.

These reports normally refer to changes at Board and senior management level and give an idea of whether the company is flourishing or not.

The statements might also contain information on exceptional events that have happened during the period, including:

- merger and acquisition activity
- internal restructures
- unusual claims experience
- exceptional expenditure.

Investment report

This would be a summary of investment strategy and performance. It is often included within another report.

Strategic report

This should refer to the company's long-term and short-term strategic objectives, report how they have been met and the progress being made to achieve the long-term objectives. Performance against Key Performance Indicators may be given.

Risk report

If not included elsewhere, this might explain the company's attitude to risk, the key risks it faces, and how it manages and mitigates those risks.

Qualitative risk reporting might be included instead within the CEO's statement, for example.

Remuneration report

As well as recording the pay of executive and non-executive directors for comparison with other similar companies, this would also show attendance at Board meetings and the turnover of directors, both giving an idea of the state of the company.

Corporate governance report

This would normally describe how the company is organised in terms of Board and Board committees.

Statements on how the Board assures itself of independence would normally be included.

2.3 Insurance companies

Insurance business is subject to cyclical effects that may affect many providers at more or less the same time. This makes it necessary to compare the profitability of a provider's business with the results disclosed by the accounts of other providers, especially those transacting similar types of business.

General insurance in particular is subject to cyclical claims experience, *eg* seasonal weather variations. As well as cyclical claims experience, the *underwriting cycle* affects insurance providers.

Although many countries are adopting a risk-based approach to the assessment of solvency, such as the European Solvency II regime or similar, it is not necessarily the case that the published accounts of financial product providers have to follow the same risk-based approach.

The risk-based Solvency II regime is covered in more detail in the later chapter on Capital requirements.

Other methods of making provision for liabilities and margins may be used, for example by including a prudential margin in each element of a valuation basis. It may be that there is no information given in the accounts to assess the size of such margins.

In some countries, insurance companies may be required to put their methods for calculating a risk-based capital requirement into the public domain in a separate report that is filed alongside the accounts. It may be more appropriate to use this additional report for any comparative financial analysis, particularly when comparing companies that use a prescribed standard model for the risk assessment.

It may be possible to get a quick, but limited, indication of the financial position of an insurance company by examining individual accounting items and various ratios of one to another, and comparing them with the accounts of earlier years.

It may be useful to consider the figures and ratios both before and after reinsurance, if available and relevant.

Among the ratios to be considered could be:

- **incurred expenses to premium income**
Exceptional expenses may be excluded, if there is sufficient data available to identify these.
- **commission to premium income**
- **operating ratio, ie the total of incurred claims and expenses to premium income**
This ratio is used more when looking at short-term classes of business, typically in general insurance, rather than long-term classes.



Question

Explain why the operating ratio is used more in looking at short-term classes of business.

Solution

For short-term classes of business, most of the cashflows occur in a single year and the major items of interest are premiums, claims and expenses. Therefore, the operating ratio can give a meaningful measure of the profitability of a company.

For long-term insurance, the cashflows are spread over a greater time period and include the maintenance of appropriate provisions over this time period. Therefore an analysis of amounts over a single accounting period is not particularly enlightening.

- **outward reinsurance premium income to gross premium income.**

Outward reinsurance premium income is actually an *outgo* of the insurance company, *ie* the premiums it pays to reinsurers.

Care is needed when drawing conclusions from such high-level analyses. For example, a sharp rise in premium income may be a sign of competitively low, and perhaps unprofitable, premium rates, or it may represent the market success of a new popular product unique to the company concerned.

Aggregate premium may increase because of an increase in volumes sold, which may indicate that the premium rates are too low. Alternatively, it may indicate that the company has been able to exploit a niche market in order to gain market share and still make a profit.

2.4 Benefit schemes

Why benefit scheme reporting is different

Reporting on the progress of benefit schemes is different from the reporting of results by corporate entities. Benefit schemes do not generate profits or losses. Indeed if actuarial valuations of the scheme are not made annually, there are no entries that can be made on the liability side of the balance sheet of a benefit scheme, other than 'accumulated fund'.

Profits are a measure of the success of a corporate entity. An appropriate measure of the success of a benefit scheme is more difficult to establish. For example, it could be defined in terms of stability of contributions required or by reference to some measure of assets compared with liabilities, *ie* the funding level.

Without a valuation of the benefit liabilities, benefit scheme reporting is restricted to a statement of the net assets (*ie* net of current liabilities) at a point in time and a reconciliation of how the net assets have changed since the past reporting date, for example showing contributions and investment returns received and benefit payments and expenses paid out.

The two main purposes of the actuarial valuation of a benefit scheme are to:

- demonstrate the solvency (*ie* funding level) of the scheme
- determine the future contribution rate required.

The results of the actuarial valuation of the scheme generate a figure for accumulated surplus or deficit. This amount may be used to adjust the contribution rate for the succeeding period.

Disclosure – beneficiaries

In many countries, it is recognised that it is important that the beneficiaries are given sufficient information about their entitlements. This disclosure to beneficiaries is also commonly used as a legislative requirement as a means of attempting to improve the security of non-State provision.



Question

Give examples of how disclosure could help to improve the security of non-State provision.

Solution

Disclosure can improve the security of benefit schemes by:

- making the operation of the scheme more transparent and so subject to scrutiny
- alerting members and trustees to potential problems, possibly enabling them to put pressure on the scheme sponsor to address these potential problems
- providing members with the opportunity to leave the scheme if they are not happy with the level of security offered. If members did this in sufficient numbers, the sponsor may respond by addressing the security issue.

Disclosure could include details of the:

- **benefit entitlements**
- **contribution obligations**
- **expense charges**
- **investment strategy**
- **risks involved**
- **treatment of entitlements in the event of insolvency.**

Guidance or legislation on the precise form of the disclosure of such information is important in ensuring that the beneficiaries are not misled, either intentionally or unintentionally.

Disclosure – regulation

There may be legislation, regulation or less formal guidance on the form and content of disclosures. This aims to ensure that the beneficiaries are not misled.

Where disclosure is required by legislation, this may relate to information given to beneficiaries:

- on entry
- at regular intervals
- once payments commence
- on request
- a combination of these.

Disclosure – benefit providers

Disclosure may be important to providers as well as to regulators. Well-designed information can help to encourage individuals to make non-State benefit provision.

Although it is largely the form of the benefits that will dictate how well it is to be understood by members and potential members, it is usually possible to present the same set of benefits in different ways, some of which may be clearer to members than others.

Poor disclosure can lead to future problems for providers, as it may give rise to the beneficiaries gaining false expectations of their future benefits.

The effects of inflation are a good example of a potential source of misunderstanding. For example, a 30-year old with a current salary of £15,000 may be very happy with an estimate of their annual pension at age 65 of £20,000. However, assuming even a relatively modest level of 3% *pa* inflation over the rest of their working life, this is less than half their current income in real terms.

Disclosure – owners of benefit providers

Where benefits are sponsored by employers, it is important that the owners of the capital of the company (and potential owners) are aware of the financial significance of the benefit obligations that exist. Therefore, it is common practice in many countries for these financial obligations to be shown as part of the company's accounts.

In presenting benefit costs in the accounts, it is important that the readers of the accounts can form a realistic opinion of the company's current and future financial position.

A number of different accounting standards exist, with some common aims that most of the standards attempt to achieve:

- **recognising the realistic costs of accruing benefits**

For example, in a defined benefit scheme the benefits accruing over the working lifetime might be required to be recognised as steadily accruing over the members' working lifetimes.

- **avoiding distortions resulting from fluctuations in the flow of contributions from the employer to the pension scheme**

As we have seen in the earlier chapter on Pricing and financing strategies, the provider has a range of options with regards to the pace of contributions into the scheme (eg regular contributions, just-in-time funding). However, the *actual cost* of the scheme depends on the benefits provided and the actual experience of the scheme, and not on the pattern of contributions. The accounting standards might aim to ensure that the reported results for a year reflect the benefits accruing over that year regardless of the actual contributions.

- **consistency in the accounting treatment from year to year (although not necessarily from company to company)**
- **disclosure of appropriate information.**

Possible disclosure requirements that may be needed include the:

- **assumptions used**
- **actuarial method used**
- **value of liabilities accruing over the year**
- **increase in the past service liabilities over the year**
- **investment return achieved on the assets over the year**
- **surplus / deficit**
- **change in the surplus / deficit over the year**
- **benefit cost over the year in respect of any directors**
- **membership movements.**



Question

Explain briefly why the past service liabilities will increase over the year.

Solution

Past service liabilities will increase to reflect the fact that benefits are one year closer to being paid.

The chapter summary starts on the next page so that you can keep all the chapter summaries together for revision purposes.

Chapter 33 Summary

Accounting concepts

Although principles and practice may vary between countries, the main accounting concepts commonly used in drawing up financial statements are:

- cost
- money measurement
- going concern
- business entity
- realisation
- accruals
- matching
- dual aspect
- materiality
- prudence
- consistency.

Interpreting accounts

In analysing accounts, attention should be paid to:

- any accounting rules, guidance and practice in the country concerned
- whether the accounts should be prepared on a going concern basis and should give a true and fair view
- any changes in accounting practice.

Reports accompanying accounts

Reports accompanying accounts expand the information available about the company. What is *not* said or included can also be insightful.

Additional reports might include:

- chairperson's and CEO's statements – successes, progress against key objectives, senior management changes
- investment report – investment strategy and performance
- strategic report – progress against long- and short-term strategic objectives
- risk report – attitude to risk, key risks faced, risk management approaches taken
- remuneration report – directors' pay, Board attendance, turnover of directors
- corporate governance report – organisation of Board and committee, independence of directors.

Insurance companies

Insurance business is subject to cyclical effects, so the results of one insurance company should be compared to those of companies transacting similar types of business.

The strength of the provisioning basis will affect the reported results, which makes it difficult to achieve consistency from year to year. In some countries, insurance companies are required to disclose their capital requirements in a separate report.

Accounts can be analysed using ratios including the:

- expense ratio
- commission ratio
- operating ratio (particularly for short-term business)
- ratio of outward reinsurance premiums to gross premium income.

Benefit schemes

Reporting on the progress of benefit schemes is different as benefit schemes do not generate profits or losses. In many countries, information about the financial position of the scheme must be disclosed to beneficiaries in an attempt to improve security.

It is important that beneficiaries are given sufficient clear information about their entitlements. Disclosure could include details of the:

- benefit entitlements
- contribution obligations
- expense charges
- investment strategy
- risks involved
- treatment of entitlements in the event of insolvency.

Where disclosure is required by legislation, this may relate to information given to beneficiaries:

- on entry
- at regular intervals
- once payments commence
- on request
- a combination of these.

Also, where benefits are sponsored by a company, it is important that the company's shareholders are aware of the financial significance of the benefit obligations that exist. It is therefore common practice in many countries for these financial obligations to be shown as part of the company's accounts.

A number of different accounting standards exist but there are some common aims that most of these standards attempt to achieve:

- recognising the realistic costs of accruing benefits
- avoiding distortions resulting from fluctuations in the flow of contributions from the employer to the pension scheme
- consistency in the accounting treatment from year to year
- disclosure of appropriate information.

Possible disclosure requirements that may be needed include:

- assumptions
- actuarial method
- value of liabilities accruing over the year
- increase in the past service liabilities over the year
- investment return achieved on the assets over the year
- surplus or deficit and the change in this figure over the year
- benefit cost over the year in respect of any directors
- membership movements.

The practice questions start on the next page so that you can keep the chapter summaries together for revision purposes.



Chapter 33 Practice Questions

33.1 Explain what is meant by each of the following accounting concepts:

- cost
- money measurement
- going concern
- business entity
- realisation
- accruals
- matching
- dual aspect
- materiality
- prudence
- consistency.

33.2 Outline the possible contents of six additional reports that might accompany the accounts.

33.3 A financial service provider's accounts may be analysed by various parties including:

- shareholders
- loan creditors
- competitors
- regulator
- tax authorities.

Describe the degree of prudence that each of these users of the accounts is likely to find the most helpful.

33.4 The ratio of commission to premium income in an insurer's accounts is 20% lower than it was for this insurer in the previous year's accounts.

Give two possible reasons for this reduction in the ratio.

33.5 The ratio of outward reinsurance premium income to gross premium income in an insurer's accounts is 20% higher than it was for this insurer in the previous year's accounts.

Give two possible reasons for this increase in the ratio.

33.6 A government is thinking of introducing regulation of the benefit projections that are provided for individual defined contribution pension arrangements.

Exam style

Outline the principles that regulation of this area is likely to encompass.

[6]

- 33.7 The following summary information has been extracted from the annual accounts of a general insurance company. All figures are in Euro (millions).

Profit and loss account for the year

Gross premium earned	500	
Adjustment for reinsurance	(240)	
Net premium earned		260
Gross claims incurred	720	
Adjustment for reinsurance	(450)	
Net claims incurred		(270)
Investment income		210
Commission paid		(52)
Other expenses of management		(60)
Gross profit		88
Taxation on profit		(22)
Profits after tax		66

Balance sheet as at the end of the year

Assets

Ordinary shares	1,500	
Land and buildings	200	
Fixed-interest securities	800	
Cash	100	
Total assets		2,600

Liabilities (net of reinsurance)

Unearned premium	108	
Outstanding claims and claims incurred after one year	1,992	
Total liabilities		2,100
Assets – Liabilities		500

Share capital and reserves

Issued and paid-up shares		100
Retained profits		400
Total		500

Discuss the nature of the company's business and its financial condition, insofar as they can be determined from these accounts.



Chapter 33 Solutions

- 33.1 Under the 'cost' concept, non-current assets generally appear in the statement of financial position at their original cost less depreciation to date, subject to a possible impairment write-down.

Under the 'money measurement' concept, accounting statements restrict themselves to matters which can be measured objectively in money terms.

The 'going concern' concept assumes that the enterprise will continue in operational existence for the foreseeable future.

The 'business entity' concept states that the affairs of the business are kept separate from those of the owners.

The 'realisation' concept states that income is recognised as and when it is earned, not as money is received.

The 'accruals' concept states that costs should be recognised as they are incurred, not as money is paid.

The 'matching' concept states that income and expenses which relate to each other should be matched together and dealt with in the same income statement.

Under the 'dual aspect' concept, every transaction or adjustment will affect two figures.

The 'materiality' concept states that there is little point in providing information which is so detailed as to be unintelligible, or in making minute adjustments which have no real effect on the picture portrayed by the financial statements.

The 'prudence' concept states that financial statements should avoid presenting an unduly optimistic position. Thus the lowest reasonable figure should be stated for profit / assets, and the highest reasonable figure should be stated for any liabilities. However, it is not permitted to include deliberate margins in the financial statements by understating assets or revenues, or by overstating liabilities or expenses. Prudence should only be applied in situations where there is uncertainty.

The 'consistency' concept states that the figures published by the company should be comparable from one year to the next. Accounting policies should not, therefore, be changed from one year to the next unless there is a very good reason for doing so. Any changes should be highlighted and their impact explained.

33.2 Additional reports might include:

- chairperson's and CEO's statements – successes, progress against key objectives, senior management changes
- investment report – investment strategy and performance
- strategic report – progress against long- and short-term strategic objectives
- risk report – attitude to risk, key risks faced, risk management approaches taken
- remuneration report – directors' pay, Board attendance, turnover of directors
- corporate governance report – organisation of Board and committee, independence of directors.

For insurance companies, there may also be a separate report covering capital requirements.

33.3 Shareholders are likely to want a realistic view of the performance of the company to enable them to make correctly informed decisions.

Loan creditors are less concerned with the level of profitability of the company and more with the certainty with which the company can make their loan repayments. They would possibly prefer a slightly more prudent view than shareholders.

Competitors are likely to be interested in realistic information.

The regulator is likely to be primarily concerned with the solvency of the company, so would prefer more prudence than most other users.

Tax authorities will want as little unnecessary prudence as possible if it reduces or defers company profits and hence tax.

33.4 Possible reasons for the reduction in the ratio include:

- The insurer has lowered its commission levels with no change in premium rates or sales. For example, it might have changed to a greater element of non-commission remuneration for selling its business.
- The mix of business may have changed in some way. For example, the insurer might be selling more business from a sales channel which is paid lower commission or selling a greater proportion of products which have a lower commission rate than others.
- Commission payments and the commission loading in the premiums are lower by the same absolute amount, with no reduction in sales. The ratio will reduce because of the gearing effect. For example if the previous year saw commission of £20m and premium income of £100m and this year saw a £3m reduction in both commission and premium income, the ratio would fall from 20% to 17.5%. Given the size of the fall in the ratio this is unlikely to be the only explanation, especially as we might expect lower commissions to reduce sales volumes.

33.5 Possible reasons for the increase in the ratio include:

- The cost of reinsurance has increased.
- The insurer has increased its premium rates (either because of more expensive reinsurance or for some unrelated reason) and the number of policies sold has fallen as a result, leading to lower total premium income.
- The premium rates are unchanged but the number of policies sold has fallen and so total premium income has fallen anyway.
- The insurer is buying greater volumes of reinsurance relative to business written.

33.6 The principles underlying the projections are likely to be that they should:

- show the likely level of pension benefits that could be provided [½]
- show the likely level of the fund at retirement [½]
- show the return the individual is likely to obtain on contributions [½]
- show the effect of charges on the likely return [½]
- take account of individual circumstances, for example: [½]
 - age
 - gender
 - marital status
 - level of earnings and contributions
 - expected retirement age. [½ each, maximum 2]

The projections should give the individual a *realistic* assessment of benefit provision and contribution needs. [1]

They should also illustrate the risks of over- or under- provision. [½]

This can be achieved by:

- demonstrating the likely level of benefits under a range of events. For example, at retirement age assuming the current level of contributions continue and also assuming the member ceases to pay contributions. [1]
- providing projections on a realistic (best estimate) basis and also on a less optimistic and more optimistic basis to highlight the sensitivity of the results. [½]

The projections should aim to:

- be simple to understand [½]
- be transparent (*ie* all key assumptions are stated) [½]
- enable comparisons to be made by the member between providers [½]
- not be misleading. [½]

[Maximum 6]

33.7 ***Nature of the business***

The investment income (210) looks relatively high, being of the same order as the net premiums (260) and net claims (270). This suggests a class of business with significant assets invested, *eg* a class with long-term claims such as liability claims.

Investment mix

Real long-term assets: $(1,500 + 200) / 2,600 = 65\%$

Fixed interest and short-term assets: $(800 + 100) / 2,600 = 35\%$

This implies that a large proportion of the liabilities are long-term and real.

An alternative approach:

Even if we deem 500 of the real assets to be investment of the free assets (ie assets not required to back the liabilities), then our conclusion is not invalidated since the investment mix of the remaining assets is still weighted towards long-term real assets, ie:

Real long term assets: $(1,500 + 200 - 500) / 2,100 = 57\%$

Fixed interest and short-term assets: $(800 + 100) / 2,100 = 43\%$

Claim settlement pattern

Assuming that the claims experience of the business written is stable and that claim settlement patterns are stable, so that net claims paid = net claims incurred then:

Claims paid / outstanding and future claims reserve = $270 / 1,992 = 13.6\%$

This implies an average tail of about 7 years $(= 1 / 0.136)$ which backs up our above findings.

Reinsurance

Reinsurance ceded (based on premiums earned) = $240 / 500 = 48\%$

Reinsurance ceded (based on claims incurred) = $450 / 720 = 63\%$

The difference may imply that either the reinsurance is very cheap (*eg* because of position in the underwriting cycle) or that more recoveries have been made this year than average. This might be due to a number of large individual claims or a catastrophe or accumulation.

Financial condition

Financial strength

Ratio of assets to liabilities = $2,600 / 2,100 = 124\%$

Or ratio of liabilities to assets = $2,100 / 2,600 = 81\%$

The company therefore appears to be in a healthy financial condition.

However it would be important to compare the solvency margin with the regulatory minimum and that of competitors.

If the company writes business in the high-risk areas (liability classes) then it should probably have a higher than average solvency margin.

Previous years' accounts should also be examined to identify trends in the ratios.

The strength of the provisioning basis should also be considered.

Profitability and performance

Gross claim ratio = $720 / 500 = 144\%$

Net claims ratio = $270 / 260 = 104\%$

The ratios seem high, but since the company is writing long-tail business it can expect a significant amount of investment income.

The high claims ratios may be due to a one-off event or the market may be at the bottom of the underwriting cycle.

Expense and commission ratio = $(52 + 60) / 260 = 43\%$

Alternatively, expense and commission ratios could be calculated separately.

Operating ratio = $43\% + 104\% = 147\%$

The level of new business should be considered, because if this has been volatile the pattern of premiums, claims and expenses will be distorted.

Investment performance = investment income divided by value of assets = $210 / 2,600 = 8.1\%$

The asset value at the end of the year has been used since this is all the information available. Ideally the information at the start of the year would be used to calculate an average over the year.

An alternative approach:

Investment performance ratio, adjusted to remove the cash that is unlikely to earn any income
= $210 / 2,500 = 8.4\%$

This ratio appears very high, especially since the majority of the company's assets are long term and real. Perhaps realised or unrealised gains are being included as 'investment income' in the profit and loss account.

Return on capital = post-tax profit divided by free reserves at start of year

= $66 / (500 - 66) = 15.2\%$

Profit margin (gross) = gross profit divided by net earned premium = $88 / 260 = 33.8\%$

The company appears to be making a healthy profit, but again we need to consider trends, unusual events and the strength of basis used.

34

Insolvency and closure

Syllabus objective

- 12.4 Discuss the issues which need to be taken into account on the insolvency or closure of a provider of benefits on contingent events.

0 Introduction

This chapter looks at the following situations:

- an insurance company becoming insolvent
- a benefit scheme closing or 'winding-up'.

0.1 Insurance companies

An insurance company is insolvent if it is unable to meet its liabilities as they fall due or if it does not have assets in excess of the value of the liabilities.

In most territories, regulations impose on insurance companies a more stringent test of solvency than just having to demonstrate the holding of assets in excess of the value of the liabilities. That is, insurance companies are required to maintain a significant *excess* of assets over liabilities in order to demonstrate solvency. This required excess amount is referred to as the *required solvency capital*.

The amount of required solvency capital is related to the level of prudence associated with the valuation of the liabilities, with very prudent liability valuations being associated with relatively low solvency capital requirements.

0.2 Benefit schemes

A benefit scheme sponsor may become insolvent or decide to stop financing benefit provision for some other reason.

This may lead to closure of the scheme to new members, with or without continued contributions and benefit accrual in respect of existing members. In the latter case, the scheme may remain in force to meet accrued benefits or be *wound-up*.

***Winding-up* is the process of terminating a benefits scheme, usually by applying the assets to the purchase of individual insurance contracts for the beneficiaries, or by transferring the assets and liabilities to another scheme.**

1 Insolvency of an insurance company

1.1 Regulation

Insurance companies are normally subject to some form of State regulation and they are usually required to maintain a certain level of solvency capital. There are also regular reporting requirements that enable the regulator to monitor the financial position of companies. These are designed to enable the regulator to intervene in the running of a company before it reaches the position of being unable to meet its liabilities.

The required solvency capital therefore provides extra security to an insurance company's policyholders, enabling the regulator to take action where appropriate to protect policyholders' benefits, before the company becomes unable to meet its liabilities.

1.2 Intervention

Consequently, in such environments, insurers rarely become insolvent. If the required level of solvency capital is breached, the regulator intervenes to protect the interests of existing or prospective policyholders. If the insurer's financial position is serious, then the regulator may require it to close to new business, so that new policyholders are not entering a fund whose solvency may be in doubt. In most cases, the company will be required to establish a recovery plan, and this will be monitored closely by the regulator.

The recovery plan may include some or all of the following actions:

- changing the investment strategy to invest in less volatile asset classes
- increasing the amount of reinsurance the company has in place
- limiting the levels of new business sold.

Limiting the levels of new business sold may not make a significant difference in practice, as the volumes of new business for a company nearing insolvency may be very low anyway.



Question

Explain why the volumes of new business may be very low for a company nearing insolvency.

Solution

If a company has got as far as the regulator intervening (including specially monitoring the company's solvency position) then this is likely to be widely reported. Customers may consider that a company perceived as *risky* is not a wise choice when taking out a new policy. In addition, financial advisers, the financial press and possibly the regulator may warn prospective customers of the risks associated with the company.

Also, the company may already have taken action to limit new business if it has identified capital shortfalls.

Closure to new business is normally a last resort, because it is unlikely that the insurance company will be able to re-open. The exception would be if there are large front-end expense charges in the business recently written, when capital can be rebuilt quickly as the new business strain is released.

If the insurer writes products where significant initial charges are taken from the policies, it may start to sell this business again in order to benefit from retaining these charges within its capital base. However, such products are often not popular with customers and it may be difficult to sell them in sufficient volumes.

In normal circumstances, a regulator is unlikely to permit re-opening to new business until the company has substantially more than the minimum capital requirements built up.

If a company maintains the infrastructure (staff, premises, systems) to enable it to re-open, these costs will be a further drain on capital while no business is being written.

All the above should be considered when producing the recovery plan.

If a provider closes to new business, it will still have outstanding liabilities from the business written that will need to be met. However, in these circumstances it should be possible to make significant cost savings. These, coupled with the release of capital previously tied up in financing the new business strain of the business on the books, should enable the company to meet these liabilities in the short term.

In the longer term, diseconomies of scale will bite and further actions will be needed.



Question

A mutual life insurance company has only ever sold with-profit business.

The company closed to new business following intervention by the regulator when it was unable to meet the solvency capital requirement. Consequently, it has suffered from diseconomies of scale as fixed expenses have been spread over an ever reducing number of policies.

Describe the other problems that the company is likely to face in the longer term.

Solution

In the longer term, the issues for the company will include:

- the costs of closing down – eg moving to smaller premises, redundancies as fewer staff are required to administer the business
 - restrictions on the investment policy – as the proportion of benefits that are guaranteed increases over time
 - changes to the bonus philosophy – as the proportion of guaranteed benefits and investment policy change
 - policyholders' reasonable expectations – eg if the investment policy or bonus philosophy change radically from what they were at the time at which a policyholder took out the contract. Communication with policyholders will be important.
-

The insurer may be sold to or merged with another provider who takes on the liabilities.

A sale or merger would avoid these potential problems by ensuring that there was always at least a *critical mass* of business in force which made the operation of the business practicable.

1.3 Projecting solvency

In any of these scenarios it will be important to project the insurer's solvency position into the future on a range of deterministic scenarios, or with the aid of a stochastic model. It will be important to estimate the actions that might be taken in various scenarios, and to include these in the model.

The issues that need to be addressed and modelled include:

- **estimation of future post-tax profits available to equity shareholders**
- **the current value of all surplus assets**
- **the amount, and timing, of any loan or debt redemption**
- **problems relating to industrial relations (and redundancies)**
This means the insurer's relationship with its employees and any trade union that represents them.
- **issues relating to any staff benefit schemes – particularly if these schemes are in deficit**
- **outstanding financial obligations, minority interests and tax.**

It is critical to the validity of the model that any actions that the insurer might take in response to future developments would actually be implemented in practice, as well as being included in the model. For example, a projection of the future solvency position should only reflect sharp cuts in discretionary benefits being made in response to falls in asset values *if* the company would truly make such sharp cuts *in practice*.

For example, the insurer may be reluctant to make benefit cuts for competitive reasons or for fear of disappointing policyholders' reasonable expectations. In addition, the insurer may decide to *defer* the benefit cuts in relation to the timing represented in the model, in the hope that the solvency problems are only temporary.

In building the model, every effort should be made to reflect the *actions* that would be taken and the *timing* of when they would be taken. Communication of the results of the model should make it clear that its validity depends on the fact that these, often difficult, decisions would be implemented.

If there is an acquiring company prepared to take over the business, it will be necessary to consider:

- **the location of the operation**
- **any integration of the systems platform**
- **relocation of staff or whether there is an adequate labour force available**
- **the effect on unit costs.**

1.4 Compensation schemes

Where an insurer cannot meet its liabilities (as opposed to not having adequate solvency capital), and a buyer cannot be found to take them on, there may be a statutory scheme set up from which some or all of the benefit payments are paid.

Such a scheme is usually funded by a levy on all other providers.

For example, in the UK there is a Financial Services Compensation Scheme (FSCS).

Policyholders are eligible for protection under this scheme if they are insured by an authorised insurance company and that company is unable to meet its liabilities. Under the scheme, compulsory insurance claims (*eg* third party motor insurance and employer's liability) are paid in full. For other insurance claims, 90% of the benefit amount is paid.

The FSCS is funded by a levy on all authorised providers.

2 Closure of a sponsored benefit scheme

2.1 Types of closure

There are two types of closure of a benefit scheme:

- the scheme is closed to new members but existing members' benefits continue to accrue
- the scheme is closed to new members and no further benefits accrue to existing members.

The type of closure will depend on the circumstances: whether the employer / sponsor is insolvent or needs to reduce costs, whether the employer wishes to follow market trends in benefit provision, or any other reason.

For a defined benefit scheme, the scheme rules will need to set out the benefits that will be provided on discontinuance.

Closed to new members only

The scheme is closed to new members.

Existing members' benefits are unchanged. In defined benefit schemes, benefits continue to accrue with additional service and salary increases.

There are no human resource issues as a scheme is not offered on joining employment and the new employee accepts the salary and benefits package offered.

The sponsor expects to continue to pay contributions for the declining number of active members. The contribution rate as a percentage of salary is likely to both increase and also become more volatile as the membership reduces.

Closed to new members and no accrual of any future benefits

The scheme is closed to new members, and also no further benefits accrue to existing members.

Existing members are given reduced benefits on the date of closure. There are human resource issues, as previously promised benefits are reduced.

If the scheme is sufficiently funded at the point of closure, it would not be necessary to reduce existing benefits. However, poor funding levels may well have been the reason for closure.

The sponsor expects to pay a one-off settlement (perhaps over a period if the scheme is in deficit), but essentially to make no further contributions.

2.2 Level of benefits

Where a benefit scheme is set up to provide benefits for a group of individuals, consideration needs to be given to the benefits that will be payable were the scheme to cease. This may arise due to the insolvency of the sponsor or a decision to stop financing the benefit provision.

The benefits that will be paid to the members of the discontinued scheme will be affected by the following factors:

- **the *rights* of the beneficiaries, which will depend on the terms under which the scheme operates and any overriding legislation**
- **the *expectations* of the beneficiaries, which are likely to be the benefits that would have been available had the scheme not discontinued.**

If there are insufficient assets to meet the rights and expectations of beneficiaries, a lower benefit may be paid.

Rights will rank ahead of expectations if there aren't enough assets to meet both for all beneficiaries. Defining the terms *rights* and *expectations* is a matter of judgement.

Rights

There are many interpretations of the *rights* of beneficiaries. At one end of the scale they only have a right to the benefits that have been, or should already have been, received. At the other end of the scale beneficiaries have a right to what they would receive if they remained in the scheme until retirement and continued to accrue benefits.

Expectations

The interpretation of *expectations* (the benefits that would have been paid had the scheme not discontinued) will involve deciding whether to include:

- future accrual of benefits
- future growth (*eg* earnings link) that would apply other than on leaving
- any discretionary benefits (*eg* discretionary pension increases or enhanced early retirement terms).

The determination of the rights and expectations of the beneficiaries is only relevant if there are sufficient assets available to ensure the provision of benefits at that level. If the scheme's assets do not cover the liabilities, some or all of the benefits will have to be reduced unless the shortfall can be met, *eg* through a third party guarantee.

Level of assets – schemes in deficit

If the scheme is in deficit, then either:

- some (or all) of the members will have to accept a reduced benefit
- the sponsor will (if possible) be required to make up the deficit.

Where the whole benefit scheme is being discontinued and there are insufficient assets in the scheme to provide all the promised benefits, and the scheme sponsor is unable to provide further funding, then the accrued benefits will also be reduced.

If the benefits are to be reduced, legislation or scheme rules may indicate which types of benefits are to be reduced or which types of beneficiaries are to have their benefits reduced.

The different categories of members might be listed in an order of priority that determines which benefit payments must be made first and which will have to be reduced if there is a shortfall of assets. Benefits already in payment are often deemed to have the highest priority.

The assets for these purposes may simply be those that have been funded.

Alternatively, there may be additional assets available to secure the discontinuance benefits.

- **Legislation or ethics may lead to extra funds being made available by a solvent sponsor.**
- **Legislation may require a debt to be placed on an insolvent sponsor, which may rank alongside, above, or below other creditors.**
- **Insurance may have been taken out that ensures the sufficiency of assets in the event of the insolvency of the sponsor.**
- **There may be a State-sponsored fund to support benefits where the employer is insolvent. Such a fund may be paid for by a levy on solvent schemes.**

The expenses involved in determining the benefit allocations, informing the beneficiaries and securing the appropriate form of provision will further reduce the assets.

These expenses (*eg* legal fees, actuarial fees) will have to come from the scheme assets if the sponsor is insolvent. Expenses will usually be a first call on the assets because the advisers would not be willing to perform the necessary calculations *etc* for free. Therefore they will be higher in priority than even the highest-ranking type of beneficiary.

For example, consider a scheme with assets of \$90,000.

The discontinuance liabilities, in order of priority, are as follows:

1.	Expenses	\$5,000
2.	Pensions in payment	\$30,000
3.	Members' voluntary savings	\$5,000
4.=	Early leavers' benefits	\$20,000
4.=	Benefits for active members	<u>\$40,000</u>
		\$100,000

In this scenario, the funding level is 90%. However, the expenses and the first two categories of benefits would be paid in full and the remainder would be reduced to 83.3% of their promised level.

Level of assets – schemes in surplus

If, on discontinuance of the scheme, the assets are more than sufficient to meet the benefit rights of the members under the chosen method of provision, the surplus may pass back to the sponsor.

Alternatively, legislation or scheme rules may require the surplus funds to be used to increase the benefits for members.

Either way, it would be usual for all members to be granted their basic rights in full, before any are granted additional benefits.

The allocation of any surplus to individual beneficiaries may be done taking account of the length of membership or other possible indicators of the extent to which the individuals can be viewed to have contributed to the surplus.

Ownership of a surplus can be a contentious issue. Other than length of membership, other possible indicators that could be used to allocate any surplus to members include the value of a member's benefits or the level at which a member paid contributions.

It can be difficult to decide the fairest way to allocate any surplus assets, due to perceived inequity across different generations or different categories of members.

For example, pensioners might feel aggrieved if only the benefits of those members not yet retired are enhanced.

Some members may lose out as a result of moving from one category of membership to another, *eg* retiring shortly before the benefit improvements for those not yet retired were granted.

In practice, such an extreme distribution of surplus would be unlikely.

2.3 Provision of benefits

If a benefit scheme is being discontinued, the following options may exist for the provision of the outstanding benefit payments:

- **gradual removal of the liabilities by continuation of the scheme without any further accrual of benefits**

The scheme operates as a closed fund and no more benefits accrue, but there is an existing fund that is used to meet benefit outgo as it falls due (subject to adequate funding levels).

This option is generally used as a temporary measure until one of the other methods of securing benefits becomes a more attractive or sensible option.

- **transfer of the liabilities to another scheme with the same sponsor**

Discontinuance is not always the result of financial failure of the sponsor. If the sponsor is still in existence, it may have set up a new scheme into which the benefits can be transferred.

- **transfer of the funds to the beneficiary to extinguish the liability**

Legislation may not allow an individual to receive the capital value of their benefits. However, an alternative may exist that allows the individual to place the funds with an appropriate insurance company or in the scheme of any new employer.

- **transfer of the funds to an insurance company to invest and provide a group policy or an individual policy in the beneficiary's name**
- **transfer of the liabilities to an insurance company to guarantee the benefits**
- **transfer of the liabilities to a central discontinuance fund, operated on a national or perhaps industry-wide basis.**

A scheme sponsor may favour one of the last four options over the first two options if it wants to crystallise any surplus or deficit in order to remove any uncertainty about its financial obligations to the scheme.

If benefits remain in the scheme and the employer remains solvent, the employer remains liable for any shortfall in the value of assets to meet the promised benefits. The employer may need to finance any initial deficit and any future deficits that may arise.

If benefits are transferred to a third party such as another scheme or an insurance company but guarantees are not offered by the third party, the ultimate benefit will then depend on future experience and the assumptions used to capitalise the benefits. The benefits may be greater or smaller than the discontinuance benefit.

In other words, the risks and potential rewards are transferred from the scheme to the individual. The individual is exposed to the risks of the actual experience (in terms of investment, mortality etc) differing from the assumptions used to calculate the value of the benefits to be transferred.

The type of insurance policy mentioned here is simply an investment vehicle, rather than one providing any guaranteed income.

If the liabilities are transferred to a third party who will guarantee to pay a specified level of benefit, such as an insurance company, the third party will be accepting the risks of adverse future experience.

They will charge a premium for taking on these risks. As a result, the balance of the funds may not be sufficient to provide the benefits that could have been targeted using one of the other forms of provision described above.

Nevertheless, this approach gives guaranteed security to the scheme member and complete severance for the employer / sponsor.

An alternative way of guaranteeing benefits, other than with an insurer, is via the operation of some form of central discontinuance fund – as mentioned above.

The chapter summary starts on the next page so that you can keep all the chapter summaries together for revision purposes.

Chapter 34 Summary

Insolvency of an insurance company

Insurance companies rarely become insolvent because:

- a regulator typically regularly monitors the financial position of insurance companies
- insurance company regulation typically requires companies to hold a minimum level of solvency capital.

If the insurer's financial position is serious (*eg* the solvency capital requirement is not met), then the regulator may require the company to:

- close to new business, or
- establish a recovery plan (with implementation monitored closely by the regulator).

It will also be important to project the insurer's solvency position into the future using either a stochastic model or a deterministic model with scenario testing. The issues that need to be addressed and modelled include:

- estimation of future post-tax profits available to equity shareholders
- the current value of all surplus assets
- the amount, and timing, of any loan or debt redemption
- problems relating to industrial relations (including redundancies)
- issues relating to any staff benefit schemes – particularly if in deficit
- outstanding financial obligations, minority interests and tax.

If there is an acquiring company prepared to take over the business, it will be necessary to consider:

- the location of the operation
- any integration of the systems platform
- relocation of staff or whether there is an adequate labour force available
- the effect on unit costs.

In the extreme event that an insurer cannot meet its liabilities, and a buyer cannot be found to take them on, there may be a statutory scheme from which some or all of the benefit payments are paid. Such a scheme is usually funded by a levy on all other providers.

Closure of a sponsored benefit scheme

There are two types of closure of a benefit scheme:

- no new members but benefits continue to accrue for existing members
- no new members and no further benefit accrual for existing members.

A benefit scheme may cease due to:

- the insolvency of the sponsor
- a decision by the sponsor to stop financing benefit provision, *eg* to reduce costs or to follow market trends in benefit provision.

If a scheme ceases, the level of benefits that will be paid will be affected by the:

- *rights* of the beneficiaries
- *expectations* of the beneficiaries
- the level of *assets*.

At the time of discontinuance, the scheme may be:

- under-funded, in which case consideration will need to be given to the priority of the different groups of members of the scheme in receiving benefits.

An allowance should be made for the expenses involved in determining the benefit allocations.

- over-funded, in which case the surplus may pass back to the employer, or may be used to improve the benefits of the scheme members.

Consideration must be given to ensuring that members' basic rights are met before seeking to improve the benefits.

The approach to be taken in either case may be dictated by legislation or scheme rules.

If a benefit scheme is being discontinued, the following options may exist for the provision of the outstanding benefit payments:

- continuation of the scheme without any further accrual of benefits
- transfer of the liabilities to another scheme with the same sponsor
- transfer of the funds to the beneficiary, in cash form if permitted by legislation or as a transfer to an insurance company or to the scheme of any new employer
- transfer of the funds to an insurance company to invest in a group or individual pension accrual policy (without guarantees)
- transfer of the liabilities to an insurance company to guarantee the benefits
- transfer of the liabilities to a central discontinuance fund (national or industry-wide).

For the first two options, the employer remains liable for any shortfall in assets relative to benefits. For the third and fourth options, the risk of adverse experience falls to the individual. For the fifth option, the insurer takes the risk and will charge an additional premium for this. For the sixth option, the discontinuance fund takes the risk and is typically funded through a levy on solvent sponsors.



Chapter 34 Practice Questions

34.1 A life insurance company is considering including some or all of the following actions in its recovery plan:

- investing in less volatile asset classes
- increasing the amount of reinsurance used
- limiting new business volume.

Explain how each of these actions could help the company to recover.

34.2 Give reasons why a sponsor might decide to stop financing its benefit scheme.

34.3 Explain the reasoning behind giving priority to those benefits already in payment, when determining which benefits should be paid in full on the closure of an under-funded scheme.

34.4 A general insurance company selling domestic and commercial property insurance is concerned about its solvency level.

Exam style

Suggest control measures that could be put in place to reduce the risk of insolvency. [10]

34.5 (i) Describe the role of the regulator in protecting policyholders from insurance company insolvency. [4]

Exam style

The regulator has intervened in the affairs of a life insurance company to require it to close to new business after it failed to be able to meet the required level of solvency capital.

(ii) Set out the short-term and longer-term effects of closing to new business on the insurance company's:

(a)	expenses	[7]
(b)	withdrawal rates	[4]
(c)	investment policy	[5]
(d)	with-profit bonus strategy.	[2]

[Total 22]

The solutions start on the next page so that you can
separate the questions and solutions.



Chapter 34 Solutions

- 34.1 Changing the investment strategy to invest in less volatile asset classes reduces the probability of the assets being insufficient to meet the liabilities in future (assuming the liabilities were not perfectly matched by the volatile asset classes). This would reduce the solvency capital requirements of the insurer, if these are risk-based.

Increasing the amount of reinsurance used should reduce the level of risk the company faces, *eg* by reducing claim volatility. This would reduce the required solvency capital, if risk-based. However, it does increase the insurer's exposure to reinsurer default.

Selling new business normally creates capital strain. Limiting the new business sold limits the amount of capital that is required to meet this new business strain and so increases the amount of capital available to demonstrate solvency. However, limiting the levels of new business sold may not make a significant difference in practice, as the volumes of new business for a company nearing insolvency may be very low anyway.

- 34.2 A sponsor might decide to stop financing its benefit scheme because:
- a new scheme has been set up, with existing members being transferred into the new scheme for future accrual instead of continuing to accrue benefits in the existing scheme
 - the sponsor wishes to follow market trends in benefit provision
 - the sponsor does not want to finance any future benefit provision, for example because:
 - the cost and benefit balance has changed (*eg* a change in legislation has significantly increased the cost of providing a scheme)
 - the costs and benefits are themselves unchanged, but the sponsor's views have changed
 - the sponsor needs to reduce costs in order to continue to operate
 - the sponsor has become insolvent.
- 34.3 The reasoning is that existing pensioners may be completely dependent on their pension, *ie* it is their only source of income.

Members not yet in receipt of their pension are likely to have other sources of income and so would not be so adversely affected by the removal of their expected future pensions (although this depends on how close the members are to retirement).

Those members who are further away from retirement have more time to take corrective action.

34.4 The risk of insolvency can be reduced by implementing systems that:

- maximise the value of assets [½]
- minimise the value of liabilities and solvency capital requirements [1]
- give stability to the relative value of assets to liabilities. [½]

Increase the value of assets

Choose an optimal investment strategy that maximises return, subject to an acceptable degree of risk. [½]

Hold assets that have maximum value in the solvency test, ... [½]

... for example hold only assets that are admissible for solvency purposes. [½]

Raise new capital, *eg* through a rights issue or a capital injection from a parent company. [1]

Reduce the value of liabilities / required solvency capital

Reduce exposure to unusual and significant claim events that could jeopardise solvency. [½]

For example, large individual claims (*eg* an explosion at a factory) or accumulations of risk (*eg* flooding over an area of the country). [1]

Write less of classes where experience is very uncertain (*eg* some commercial property cover) – and hence particularly conservative reserves (and high solvency capital) have to be held. [½]

Restrict exposure to certain perils, through exclusions or upper limit on payouts. [1]

Purchase appropriate types and levels of reinsurance cover, *eg* individual excess of loss to protect against large individual losses. [1]

Use a weaker basis for valuing liabilities ... [½]

... but the basis should not be weakened to the extent that it is imprudent. [½]

Apply more stringent underwriting and claims control. [1]

Impose tighter insurance operational risk management, ... [½]

... for example more stringent expense control ... [½]

... and fraud management. [½]

Reduce risk through increased diversification of business. [½]

Restrict new business volumes, if there is new business strain. [1]

Stability of assets against liabilities

The investment policy should aim to match assets and liabilities by nature, term, currency and predictability so as to give stability to the solvency level. [1]

The suitability of the pricing basis should also be monitored, to ensure that it is appropriate for the risks being written, *ie* appropriate risk classification being used, and the business is not loss-making.

[1]

[Maximum 10]

34.5 (i) **Role of the regulator**

Insurance companies are normally subject to a requirement by the regulator to maintain a specified level of solvency capital.

[1]

There are also regular reporting requirements (*eg* annual supervisory solvency valuations) that enable the regulator to monitor the financial position of companies.

[½]

These are designed to enable the regulator to be in a position to intervene in the running of a company before it reaches a position of technical insolvency, *ie* of being unable to meet its liabilities as they fall due.

[1]

If the insurance company's financial position is serious, then the regulator may require it to close to new business.

[½]

In less serious cases, the insurance company may be required to establish a recovery plan, and for this to be monitored closely by the regulator.

[1]

In the extreme, when these courses of action fail and an insurance company cannot meet its liabilities there may be a statutory scheme set up from which some or all of the benefit payments are paid.

[1]

Such a scheme is usually funded by a levy on all other providers.

[½]

[Maximum 4]

(ii) **Effects of closure to new business**

(a) **Expenses**

Closing to new business will have a major impact on the operations and expenses of a life insurance company.

[½]

Short-term

The most significant savings will be connected with areas of the company that are no longer required. Most operations relating to the acquisition of business can be dispensed with immediately.

[1]

These include:

- sales and marketing staff [½]
- branch offices [½]
- some head office functions (*eg* new business customer support) [½]
- new business systems (*eg* new business illustrations). [½]

It might also be possible to sell any direct salesforce (and so raise capital).

[½]

These expense reductions will be offset to some extent by additional costs associated with the closure including:

- redundancies [½]
- disposal of marketing literature [½]
- notifying policyholders [½]
- early termination of office buildings' leases. [½]

All product development and most systems development work can be stopped ... [½]

... although some systems development is likely to have to continue, *eg* to comply with changing legislation and replacing obsolete technology. [1]

The company might decide to cut back on its administration function, since quality service is no longer needed to attract new business. [1]

However, business retention may be important to keep per-policy fixed expenses at an acceptable level. [½]

Longer-term

In the longer term there will be further redundancies, as the number of staff required to administer a decreasing number of policies falls. [½]

As the number of policies in-force decreases, fixed expenses will be split between an ever decreasing number of policies. This effect will increase per-policy fixed expenses. [1]
[Maximum 7]

(b) ***Withdrawal rates***

Short-term

Withdrawal experience (surrenders and lapses) will vary by investment type. [½]

Withdrawal rates may increase as a result of the bad publicity and concerns of policyholders regarding the security of their benefits. [1]

Higher withdrawals will increase the rate at which the fund becomes too small to be practically managed as a separate entity. [1]

If the company sold business through salespeople who now recommend products from other companies, the salespeople may encourage customers to transfer their existing policies to those other providers. [1]

The effect on withdrawal rates is less certain if the policyholders see the prospect of any windfall payments, *eg* if there is a chance of a mutual life insurance company demutualising as a way of raising capital to improve its financial situation. [1]

Longer-term

Some of these withdrawals may be selective, leading to a worsening of the mortality and sickness experience of the company. [1]

If service standards decline over time, withdrawals may increase. [1]

[Maximum 4]

(c) Investment policy*Short-term*

The loss of new business strain will have a positive impact on the supervisory solvency position, which might suggest a less constrained investment policy. [1]

However, the policy is likely still to be very constrained given the poor solvency position. [1]

Longer-term

In the longer term, when the average term outstanding becomes much shorter, the asset portfolio should be moved more towards shorter-dated, fixed-interest type investments to reduce the volatility of payouts. [1]

This volatility will increase relative to the size of the fund as the size of the fund reduces. [½]

The need for liquidity may increase as the fund runs off and if withdrawals increase. The company may be forced to dispose of illiquid assets at an unfavourable time. To prevent this, it could undertake a gradual move into more liquid assets (*eg* less direct property, more cash). [1]

As the funds under management decrease, the dealing costs will increase relative to the size of the fund, reducing net returns. [½]

It will become harder to attract and retain good fund managers and investment return might be negatively affected. [1]

The tax position of the company may change as a result of contracting rather than expanding funds. [1]

[Maximum 5]

(d) With-profit bonus strategy*Short-term*

Bonuses may have to be reduced to maintain the solvency of the company. [1]

Longer-term

The company may wish to use more deferral of distribution of surplus to provide some working capital to demonstrate solvency and as a cushion against adverse future experience. [1]

The company should be conscious of policyholder expectations and the need to communicate with policyholders. [1]

[Maximum 2]

End of Part 9

What next?

1. Briefly **review** the key areas of Part 9 and/or re-read the **summaries** at the end of Chapters 31 to 34.
2. Ensure you have attempted some of the **Practice Questions** at the end of each chapter in Part 9. If you don't have time to do them all, you could save the remainder for use as part of your revision.

Time to consider ...

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Capital management

Syllabus objectives

- 8.1 Discuss the interrelationship between risk and capital management.
- 8.2 Explain the implication of risk for capital requirement, including economic and regulatory capital requirements.
- 8.3 Describe how the main providers of benefits on contingent events can meet, manage and match their capital requirements.
- 12.1.3 Describe the tools available for capital management.

0 Introduction



Capital management involves ensuring that a provider has sufficient solvency and liquidity to enable both its existing liabilities and future growth aspirations to be met in all reasonably foreseeable circumstances. It also often involves maximising the reported profits of the provider.

Capital is another term for wealth or financial resources.

This chapter looks at why providers of benefits (*eg* benefit schemes, insurance companies, the State) need capital and the tools available for managing a provider's capital position.

The next chapter goes on to consider how capital requirements might be defined or measured, and the impact that holding required capital has on profitability.

Although providers of benefits have some unique reasons for requiring capital, they also require capital for many of the same reasons as individuals or non-financial companies. Therefore, a good starting point in considering the issue of capital is to consider why we, as *individuals* need capital.

1 Capital needs

1.1 Individuals

All individuals and corporations need working capital.

For individuals this enables them to survive the financial consequences of an unexpected event, such as their car needing repair. Individuals might also wish to build up capital, to save for a large future expense, such as a holiday or a child's marriage.

For most individuals, income (*eg* from salary, benefits, income on investments and gifts) and expenditure (*eg* on housing, food and entertainment) are unlikely to exactly match up in terms of amount and timing. This is one reason that capital is required – it allows people to overcome timing differences between their income and outgo.

In particular, during periods when income exceeds expenditure, an individual may accumulate capital, either to meet a specific future need or for expenditure on large items beyond those affordable from regular income (*eg* holidays, new car). Capital may also be accumulated in anticipation of a future fall in income (*eg* on retirement or a move to less remunerative employment).

A further use of capital is that it acts as a cushion against unexpected events, in particular unexpected or volatile outgo (*eg* major repairs to the home) or unexpected or volatile income (*eg* a period of unemployment).

Without capital, money needs to be borrowed. In developed economies credit is readily available to individuals through credit cards, with high rates of interest charged for unsecured loans. Even individuals with poor credit history can obtain loans, although the interest rate reflects the risk to the lender.

1.2 Companies

Corporations need capital for very similar purposes to individuals – to deal with the financial consequences of adverse events, to provide a cushion against fluctuating trade volumes, or to build up funds within the company prior to a planned expansion.

Trading companies need capital for cashflow management to finance stock and work in progress, because they usually need to pay suppliers of goods and services before they are paid for the finished product.

In addition, all companies need 'start-up' capital – to obtain premises, hire staff, purchase equipment *etc*, before they can start in business.

Obtaining sufficient capital is often a major problem for small businesses, especially when they are first being established. Often the amounts required are underestimated, as is the time for which capital is required before the business reaches a point where it is generating sufficient income.

1.3 Providers of financial services products

A provider of financial services products has all the same needs for capital as other companies. However, the long-term nature of financial services products, and the associated risks, gives rise to additional capital requirements over those considered in the preceding paragraphs.

When assessing the solvency and profitability of long-term financial products, issues arise that don't occur for most other goods and services. Consider, for example, a manufacturing company. In this case, the assets (*eg* factory, machinery, stocks, cash) and the liabilities (*eg* to creditors and tax authorities) are relatively easy to identify and quantify.

The position is more complex when we look at a long-term financial product such as a pension, where there is likely to be a significant period of time (quite possibly several decades) during which pension contributions are being received before the commencement of the payment of the benefits to the customer. This long-term nature gives rise to the need for provisions, the value of which is not always easy to quantify and is subjective.

When a provider agrees to pay benefits on future financial events, there is a possibility that the event leading to payment will arise before the provider has had time to accumulate sufficient funds from premiums / contributions to pay the benefits. There is, therefore, a need for capital to support these risks.

There is also often a timing mismatch between the expenses that are paid and the charges that are taken to cover them.

For many contracts, many of the expenses are incurred when the policy is first sold (*eg* payments to salespeople, underwriting costs and the costs of issue of policy documents to the customer).

However, matching this high initial expense with a high initial charge may not be possible for marketing reasons as high up-front charges are unpopular with customers. Even if this wasn't a constraint, the initial expenses may actually exceed the initial payment made by the customer, *eg* when the customer pays in monthly instalments, forcing the provider to have mismatched charges to recoup the initial expenses.

Capital can be used to finance this cashflow strain.

Start-up capital and development expenses

When taking on risks for the first time or when taking on a new type of liability, there will be costs for the provider in:

- **setting up suitable management systems to administer the liabilities**
- **collecting premiums / contributions**
- **paying commission to third parties**
- **investment expenses**
- **administration expenses.**

Until sufficient premiums / contributions have been collected, the provider will need to meet these start-up costs from capital.

If business volumes remain level, this additional capital can be rolled forward to the next tranche of business. If volumes increase additional capital will be required, while if volumes reduce some of this capital can be released.



Question

Discuss the extent to which the costs listed above are related to business volumes.

Solution

Setting up suitable management systems is an overhead cost that will not be affected by business volumes.

Collecting premiums / contributions will depend on business volumes, collections only being required in respect of business that has been sold.

Similarly, commission will be directly related to the volumes of business sold – though perhaps measured by premium / contribution size rather than policy numbers.

Investment expenses are likely to be a combination of amounts that are independent of business volumes (*ie* fixed costs such as systems and salaries of investment staff) and amounts that depend on the size of funds under management (*ie* variable costs such as dealing expenses). The size of funds under management will depend on the volumes of business sold.

Administration expenses are likely to be a combination of overheads and expenses that are proportional to the volumes of business sold.

The amount of *start-up* capital required therefore depends on the volumes of business written.

To put this another way, the amount of capital a provider has available will provide an upper limit on the volumes of business that it is able to sell.

Statutory or solvency requirements

We have seen that the long-term nature of financial products gives rise to the need for provisions. To get a realistic view of the amount of capital needed, these provisions could be calculated using best-estimate assumptions for the future experience.

Because of the *uncertainties* generated by the long-term nature of financial products, most developed countries require financial product providers to hold a minimum level of capital *in excess of the best-estimate* value of the future outgo.

In other words, the regulator (or legislation) imposes a minimum capital requirement in excess of provisions, to reflect the *risk* that these provisions are insufficient to meet liabilities.

This minimum capital requirement is normally defined in legislation or regulation, and there may also be rules on the required backing assets.

Solvency requirements for corporations normally require sufficient capital to be held in advance, rather than assuming it could be borrowed later when required.

At the start of an enterprise, or during a time of expansion, additional funding may be needed to maintain the statutory requirements.

As previously described, writing new contracts may generate new business strain: the shortfall that arises in the first year of a contract's life owing to initial expenses, initial statutory reserves and initial solvency capital requirements exceeding the premiums received.

As time passes, if experience turns out to be in line with the best-estimate assumptions, then this additional solvency capital will be released.

However, if a company is expanding rapidly (*ie* selling high volumes of new business) the rate of release of capital may not be sufficient to meet the capital requirements arising from new business strain.

Because the main use of capital is to support risks taken on, a capital requirement regime should reflect the risks in the enterprise. The riskier the business, the greater should be the regulatory capital requirements. This basic principle is followed in most regimes that are applied to financial product providers, as covered in the next chapter.

Investment freedom

Risks can be taken on by product providers by means other than issuing contracts.

For example, if a provider makes a decision not to hold a portfolio of assets that replicates its liabilities, its capital requirements will increase. This is because there is a danger that movements in investment markets and particularly in interest rates may result in the liabilities increasing by more than the assets. Capital will provide a cushion to absorb any deficits arising in this way.

We have come across this idea before in earlier chapters that covered investment strategy and types of risk.

Products with guarantees

The extent of guarantees in a product impacts the level of capital needed to cover the risk of the guarantees being in the money at the exercise date.

The level of provisions required will be higher the greater the levels of guarantees and the regulatory regime is likely to be such that the capital requirements also increase with the levels of guarantees. This reflects the additional risks taken on when offering guarantees.

Turning this point around, the ability of a provider to offer products with guarantees is very dependent on the amount of capital the provider has available.

Financial strength

The financial strength of providers may be significant in determining new business levels. Financial strength may be rated as one of the key determinants used by potential clients and their advisers when deciding whether or not to place business with any particular provider.

Impact on the accounts

Companies can manage their capital to smooth income statements and improve the solvency and matching position of their balance sheet.

In years when profits are poor, the company can use capital in order to pay a dividend that is in line with dividends in previous years. Similarly, providers of with-profit business can use capital to smooth bonuses from year to year. The solvency position will be improved if the level of assets increases relative to the value of the liabilities.

Strategic aims

The capital available to a company will have a key role to play in helping the company to achieve its overall strategic direction.

As well as being a constraint on the amount of new risks a company can take on in its normal business operations, the level of capital held will impact acquisitions, mergers and new ventures.

A measure of available capital is thus a key tool in the management of any company, and particularly of a financial product provider.

1.4 The State

The capital requirements of the State are different from those of companies and individuals.

State- and government-sponsored organisations do not need to build up capital because, in a developed economy, they can raise taxes or borrow money so that sufficient funds are available to meet government outgo. The State can print money if other methods of raising funds are insufficient, although printing money is inflationary in the long-term.



Question

Explain why printing money is inflationary.

Solution

The quantity theory of money states that an increase in the money supply will tend to lead to a proportionate increase in prices (*ie* to inflation).

This is a result of combining the assumption that V and Y are reasonably stable with the identity:

$$M \times V \equiv P \times Y$$

where M = nominal money supply

V = velocity of circulation (how often money changes hands)

P = average price level

Y = number of transactions (*ie* real level of economic activity).

Therefore, a government is likely to prefer to tax or borrow (as these actions do not increase the money supply) rather than to print money (which does).

Private sector individuals and companies can also borrow money. However, the cost may be higher than the cost for the government and the amount that can be borrowed may be more limited.

Nevertheless, governments tend to build up and try to maintain reserves (often in gold or foreign currencies) to support fluctuations in the balance of payments and in the economic cycle.

Governments also need short-term funds because of timing differences between government income and outgo.

So, in respect of these needs for capital reserves, the government is just like individuals and many organisations in the private sector, requiring capital as a cushion against fluctuations and to overcome cashflow timing differences.

2 How providers meet, manage and match capital needs

2.1 Insurance companies

All companies can increase their working capital by retaining profits or surpluses within the business and not distributing them as dividends or bonuses.

Payment of dividends is the principal means of passing profits to shareholders and payment of bonuses is the principal means of passing profits to with-profit policyholders.

In addition to retained profits, the other main sources of capital available to most types of company are debt and equity capital. We consider the extent to which these two are available to insurance companies here. There are also other sources of capital, *ie* other than debt and equity, that are more specific to financial companies and Section 3 discusses some of these.



Question

Describe the nature of debt and equity capital.

Solution

Holders of debt capital are *creditors* of the company. They receive interest payments which are a liability to the company, not a distribution of profits. Debt capital is usually redeemable. The interest payments and redemption terms are fixed at the outset of the loan. Debt capital may be secured on the assets of the company, which may be sold in the event of default.

Holders of equity capital are *members* of the company, *ie* they own the company. They receive dividends which are variable, and which are paid out of the profits of the company. Shares are not usually redeemable. Share capital is not secured on the assets of the company, although the shareholders do have a right to the residual value of the company on wind-up – but only after all the creditors have been paid.

As covered earlier in the course:

- a *proprietary* insurance company is owned by shareholders
- a *mutual* insurance company is owned by policyholders to whom all profits (ultimately) belong.

Proprietary companies

A proprietary company may raise funds through the issue of shares or debt securities. Issues can be to existing shareholders (rights issues) or to new shareholders (tender offers, etc).

Mutual companies

A mutual company has less access to the capital markets.

To start up, mutuals require someone to lend the initial capital, but without any requirement for the loan to be repaid unless profits emerge. There is then no liability for repayment that needs to be taken into account in the mutual society's balance sheet.

Mutual insurance companies can raise capital through the issue of subordinated debt, where repayment is subordinate to the calls from all other creditors, including policyholders.

Since mutual companies do not have shareholders, they cannot raise equity capital.

2.2 Sponsors of benefit schemes

The sponsor of a benefit scheme may be prepared to put up the initial capital for the arrangements, particularly those required to cover the expenses of setting up the scheme.

Again, this is likely to be an altruistic gesture, for example by an employer (to benefit employees who will be members of the scheme) or perhaps by a trade union or professional body running a scheme for their members.

2.3 Microinsurance providers

As mentioned earlier in the course, microinsurance is the provision of low-cost insurance products and benefits to those on low incomes.

Microinsurance schemes may have capital support from the State, given their usual purpose of supporting individuals on low incomes.

2.4 Reinsurance

Reinsurance serves two distinct roles in the management of the capital of a product provider:

1. Reinsurance can reduce the amount of capital required.
2. Reinsurance can act as a source of capital.

A provider can limit the amount of capital it needs by passing its liabilities to another provider through reinsurance.

We saw in Section 1.3 that one need for capital arises because of the uncertainty associated with future events. Reinsurance reduces the level of uncertainty of a provider's future liabilities (*eg* by capping the amount of any claim) and so less capital is then required as a cushion against future adverse experience. Also, the strength of any regulatory solvency requirement may depend on the amount of reinsurance a provider has in place.

The need for reinsurance usually decreases as the amount of free assets held by the provider increases.

As the amount of free assets held by the provider increases, these free assets provide a larger cushion against adverse future experience. For example, all other things being equal, a provider with assets of \$200m has less need for reinsurance than a provider with the same liabilities and assets of \$180m.

Also, as the absolute size of assets increases, the relative size of any particular claim decreases. For example, a provider with assets of \$1,000m and liabilities of \$900m would be less affected by a \$1m claim than would a provider with assets of \$10m and liabilities of \$9m.

Reinsurance companies can also contribute towards the initial capital strain of selling a block of life insurance business by contributing to the initial expenses by means of reinsurance commissions.

This second use of reinsurance, as a source of capital, is known as financial reinsurance and we will cover it in more detail in Section 3.1.

2.5 Matching and managing capital needs

Matching and managing capital requirements is an area where actuaries are frequently called on to give advice.

The primary tool needed to do this is a model of both the existing business and also the projected new business. The model can generate the amount of capital needed for the provider's business plans to be achieved at a given ruin probability.

A sophisticated model will also consider any statutory or regulatory minimum capital requirements for the business throughout its lifetime.

3 Capital management tools

There is a range of financial tools available to providers to help them meet their responsibilities and achieve their goals. Many are in common usage, but some are rare or relatively new.

The effectiveness of, and hence likely use of, the tools outlined below will depend on the regulatory and tax environment that the insurer is operating in. It is also possible that the effectiveness of a given approach to managing an insurer's capital may change over time if the regulatory / tax environment changes.

For example, financial reinsurance arrangements were historically used within the European Union to improve the regulatory balance sheet of an insurer by crystallising the value of the insurer's future expected profits. However the effectiveness of these types of arrangement has been reduced (or eliminated) under Solvency II. It is possible that alternative arrangements may be developed in future which will be more effective in allowing the insurer to manage its capital under Solvency II.

3.1 Financial reinsurance (FinRe)

FinRe typically consists of less transfer of risk than other forms of reinsurance and is, as its name suggests, more motivated by financial aims.

Generally, the main aim of FinRe is to exploit some form of regulatory arbitrage in order to manage the capital, solvency or tax position of a provider more efficiently. It frequently relies on the regulatory, solvency or tax position of a reinsurer, which may be based in an overseas state, being different from that of the provider.

This is done in the form of a reinsurance contract between the reinsured and the reinsurer.

A typical example of exploiting a regulatory position is a contingent loan from the reinsurer to the insurance company. A normal loan would increase the insurance company's assets, but there would be no strengthening of the available capital position as the insurance company would also have to identify the amount owing as a liability.

With a *contingent* loan, the repayments are contingent on, for example, the insurance company making profits in future on a block of business. Because the insurance company has no liability to repay the loan *unless* these profits emerge, the regulatory regime may allow it to not make any provision for these future payments on a statutory basis. Therefore the insurance company improves its statutory solvency position. Bear in mind that, as the company will repay the loan over time, the improvement is only short term.



Question

Explain why this arrangement might rely on the regulatory position of the reinsurer being different from that of the provider.

Solution

The reinsurer in this arrangement would have just seen a deterioration in its reported solvency position, assuming it was subject to the same rules as the insurance company. (The reinsurer's assets would decrease by the amount of the loan. The reinsurer would not be able to show the future loan repayments as an asset as the repayments are contingent.)

So, the arrangement relies on the reinsurer either having a strong enough balance sheet to be able to support this, or being subject to different rules on solvency reporting.

Financial reinsurance arrangements have historically been used to improve the balance sheet of a company by crystallising the value of future expected profits. However, the viability of such arrangements is much reduced (or eliminated) under regulatory regimes, such as Solvency II, which take credit for future profits.

Whether FinRe improves the statutory solvency position depends upon the regulatory regime. For example, if the regulatory regime already allows future profits to be included as an admissible asset (as is the case under Solvency II, for example) then the regulatory solvency position will not be improved by using a contingent loan. Such a loan would though still have a role in changing an illiquid asset (future profits) into a liquid asset (the money received from the reinsurer) and so can help with liquidity management.

3.2 Securitisation

Securitisation involves converting an illiquid asset into tradable instruments. The primary motivations are often to achieve regulatory or accounting 'off balance sheet' treatment.

Typical transactions will be structured with an element of transfer of the risk associated with the value of the asset. This will result in any potential loss in value of the asset being capped.

Almost any assets that generate a reasonably predictable income stream can in theory be used as the basis of a securitisation. Examples of illiquid assets that could be securitised are:

- future profits, *eg* on a block of in-force insurance policies
- mortgages (and other loans).

Each of these could be securitised into tradable instruments (*eg* bonds), in order to raise capital. The owner of the assets issues bonds to investors (*eg* pension funds, insurance companies and banks) and the future cashflow stream generated by the secured assets is then used to meet the interest and capital payments on the bonds.

In practice, a separate legal vehicle is usually established to stand between the owner of the assets and the investors. The securitised assets are transferred into this vehicle. This is done because the existence of a separate vehicle with separate ownership of the securitised assets provides better security and greater transparency for investors in the securitisation.

There is typically risk transfer as the repayments on the bonds are made only if, for example, the future profits emerge or mortgage repayments are made.

For example, a portfolio of mortgage loans owned by a bank could be pooled together and the cashflows from these mortgages used to service the interest and capital payments on a bond. Securitisation of this type, that had been backed by sub-prime mortgages in the US, was the focus of much attention during the sub-prime crisis and credit crunch.

Securitisations are less effective in regulatory regimes which take credit for future profits in the regulatory balance sheet, for example under Solvency II.

Similarly to the comments made in the previous section on FinRe, the benefits of securitisation in improving the statutory solvency position depend upon the regulatory regime. Also, as with FinRe, securitisation has a role in cashflow management, *ie* turning an illiquid asset into a liquid asset.

3.3 Subordinated debt

A provider can raise capital through issuing subordinated debt in the capital markets. The main aim of subordinated debt is to generate additional capital that improves the free capital position of the provider, as the debt does not need to be included as a liability in the assessment of solvency.

The subordinated debt can only pay interest if regulatory solvency capital requirements will continue to be met after the interest is paid or, in some countries, if authorised by the regulator.

Repayment of capital can only be made if, after repayment, regulatory solvency capital requirements continue to be met and if they are authorised by the regulator.

In the event of wind-up, the subordinated debt in all cases ranks behind policyholder liabilities, including non-guaranteed bonuses.

So again, this method of raising capital has increased the assets of the provider (by the amount of the debt issued) but, because the repayments rank behind the policyholder liabilities (*ie* are contingent on those liabilities being met), it does not increase the liabilities. Therefore, once again the provider's available capital position may be improved.

3.4 Banking products

The banking sector provides some capital management solutions for the insurance industry directly (rather than as intermediaries as with securitisation). These include:

- **liquidity facilities**
- **contingent capital**
- **senior unsecured financing.**

Liquidity facilities

Liquidity facilities can be used to provide short-term financing for companies facing rapid business growth.

As mentioned earlier in this chapter, a period of rapid business growth would typically be associated with an increased need for financing due to new business strain.

Contingent capital

Contingent capital can be a cost-effective method of protecting the capital base of an insurance company. Under such an arrangement, capital would be provided as it was required following a deterioration of experience (ie it is provided when it is needed).

Contingent capital works on the same principle as post-loss funding (one of the types of alternative risk transfer).

Although these arrangements clearly improve the financial strength of an insurer and can be given credit for by a rating agency, they lack visibility.



Question

Explain why lacking visibility can be a disadvantage.

Solution

Somebody looking at the balance sheet, such as a broker or potential customer, would not necessarily see or be aware of a contingent capital arrangement. Also, such an arrangement may not be reflected in comparative tables showing the financial strength of different companies.

It would not therefore be allowed for in the decisions these people take – the company would be considered to be in the same position as a company without such an arrangement, even though the existence of a contingent capital arrangement means that this company is in a stronger position.

There may also be issues about the extent to which regulators may accept such arrangements for the demonstration of supervisory solvency.

Senior unsecured financing

Senior unsecured financing directly for an insurance company would not have capital benefits as the loan would be treated as a liability on the company's balance sheet.

Such a straightforward loan doesn't help the company as it increases both the assets and the liabilities by the same amount. This contrasts with subordinated debt, which increases just the assets.

However, financing at the group level can be used within a group structure to provide capital to insurance subsidiaries. It can be more cost effective than other forms of capital but clearly has financial strength implications at the group level.

Capital can be moved around within a group of companies. Although this may improve the capital position of the insurer, the total amount of capital within the group as a whole is unchanged and so there must be a worsening of the capital position elsewhere.

3.5 Derivatives

Although derivatives are typically issued by banks, and so could be classed as banking products, the derivatives market is sufficiently large that they are usually considered as an asset class in their own right.

Prudent management requires that any provider entering into derivative contracts must exercise caution. The provider needs to ensure that its derivative strategy assists in the efficient management of its business and serves to reduce risk.

Derivatives contracts can be used either:

- to reduce risk (*hedging*), or
- to increase risk (*speculation*) in order to improve returns.

Prudent financial management of a financial services provider may involve hedging but should not involve speculation. Reducing risk through hedging will reduce the need to hold capital to protect against future unexpected events.

An example of when a derivative contract might be used is when a provider is concerned about the impact of a fall in the value of its equity portfolio. It could enter into a contract to protect its equity portfolio falling below a certain level. Potentially, the cost of this 'downside protection' could be partially met by the sale of some 'upside' potential via a second derivative contract.



Question

- State the types of derivative contract that could be used to provide downside protection for a provider's equity portfolio.
- Explain how the cost of this downside protection could be met by selling the upside using a second derivative contract.

Solution

- Either selling a future or buying a put option would provide downside protection for an equity portfolio.
 - Sale of the upside could be achieved by writing call options on the equities held. By doing this, the provider sacrifices all gains arising due to the equity market rising above the exercise price of the call. However, if the markets fall, the provider will have gained the option premium received (and the option will not be exercised).
-

3.6 Equity capital

An obvious source of capital is simply to increase equity, which increases assets without increasing regulatory liabilities.

The equity may come:

- from a parent company
- from existing shareholders by a rights issue
- directly from the market by a new placement of shares.

3.7 Internal sources of capital

There may be ways to simply reorganise the existing financial structure of an organisation in a more efficient way. Some of these are as follows:

- funds could be merged
- assets could be changed
- the valuation basis could be weakened
- the distribution of surplus could be deferred
- capital could be retained in the organisation, possibly by not paying dividends to any shareholders.

Merging funds

Merging funds would help if, for example, some of the regulatory liabilities or the solvency capital was calculated as a monetary or fixed amount per fund or had a fixed minimum.

Changing assets



Question

Selling \$100,000 of one asset in order to buy \$100,000 of another asset leaves the total amount of assets unchanged.

Explain how changing the assets could nevertheless improve the regulatory available capital position.

Solution

The regulatory available capital position would be improved if the asset sold was not admissible for regulatory purposes but the asset purchased was. (An *admissible* asset is one whose value can be included in the valuation of assets for the purpose of demonstrating statutory solvency.)

Furthermore, a change in the assets held might result in closer matching and therefore reduce the extent of any mismatching reserve required (or any additional solvency capital requirement relating to matching-related market risks), hence freeing up capital.

More subtly, the rate of interest used to discount future liabilities may depend on expected future returns on the assets held. A switch in assets may change this rate of interest. Therefore, although the value of assets may be unchanged, changing the type of assets held could change the value of the liabilities.

Weakening the valuation basis

Weakening the valuation basis would reduce the value of the liabilities *relative* to the assets, improving the reported solvency position. This is only an acceptable course of action if it can be justified.

Deferring surplus distribution

Deferring the distribution of surplus to policyholders (*eg* by deferring bonus distributions) reduces the level of guaranteed policyholder benefits and hence the capital required. This is because guarantees increase the level of risk and uncertainty, and hence the amount of capital needed to protect against potential adverse outcomes.

Retaining surplus

Paying out lower (or no) dividends to shareholders will retain capital within the company. However, it may have an adverse impact on share price.

Chapter 35 Summary

Capital management of a financial benefit provider involves:

- ensuring sufficient solvency and cashflow to meet:
 - existing liabilities
 - future growth aspirations
- maximising the reported profits.

Capital needs – individuals

Capital is needed by individuals to:

- provide a cushion against unexpected events
- save for the future.

Capital needs – companies

Capital is needed by companies to:

- deal with the financial consequences of adverse events
- provide a cushion against fluctuating trading volumes
- finance expansion
- finance stock and work in progress
- obtain premises, hire staff, purchase equipment (start-up capital).

Capital needs – providers of financial services products

A *provider of financial services products* has all the same needs for capital as other companies. However, the long-term nature of financial services products, and the associated uncertainty, gives rise to additional capital requirements to:

- meet benefits before sufficient premiums / contributions are received
- meet development expenses
- hold a cushion against unexpected events
- meet statutory / solvency requirements (fund new business strain, reflect risk)
- invest more freely (mismatch)
- sell products with guarantees
- demonstrate financial strength to attract business
- smooth reported profits
- achieve strategic aims.

Capital needs – the State

The State does not have the same capital needs as other providers as it can usually raise funds to meet its liabilities through:

- taxation
- borrowing
- printing money.

Nevertheless, the State will hold gold and foreign currency reserves to support:

- fluctuations in the balance of payments and economic cycle
- timing differences in income and outgo.

Meeting capital needs

A *proprietary* insurer is an insurance company owned by shareholders. A propriety company may raise funds through the issue of shares or debt securities.

A *mutual* insurer is one that is owned by policyholders, to whom all profits (ultimately) belong. A mutual has less access to the capital markets than a proprietary, but can use subordinated debt.

The sponsor may be prepared to put up the initial capital for a benefit scheme. Microinsurance schemes may have capital support from the State.

Capital management tools

There is a range of financial tools available to providers to help them with capital management. The effectiveness of any particular tool depends upon the regulatory and tax environment within which the insurer operates. These tools include:

- reinsurance – to reduce the amount of capital required
- financial reinsurance (FinRe) – a reinsurance arrangement that provides capital, typically by exploiting some form of regulatory, solvency or tax arbitrage
- securitisation – which in its most general form involves converting an illiquid asset into tradable instruments
- subordinated debt
- banking products – including liquidity facilities, contingent capital and senior unsecured financing
- derivatives
- equity capital
- internal restructuring – including merging funds, changing assets, weakening the valuation basis, deferring surplus distribution and retaining profits.



Chapter 35 Practice Questions

- 35.1 Mrs P Magnate has decided to leave her current job and set up as a developer of residential properties. Her basic idea is simple: she will buy one property, develop it and then sell it at a profit. The capital generated by the sale will then be used to finance the next development.

Explain why Mrs Magnate will require capital.

- 35.2 A general insurer is to start selling domestic household contents insurance.

Outline the purposes for which initial capital might be needed in order to pursue this project.

- 35.3 'I don't understand why there's a need for capital on single premium contracts such as immediate annuities. Surely the single premium will be enough to cover the initial expenses and establish provisions?'

Comment on this statement.

- 35.4 Compare the capital needs of the State with those of financial institutions.

- 35.5 Many reinsurance companies are based (or have subsidiaries) offshore, *eg* in Bermuda.

Suggest possible reasons for basing a reinsurance company in an overseas country.

- 35.6 Describe methods of organising the internal financial structure of an organisation in a more efficient way in order to improve its regulatory capital position.

- 35.7 A proprietary life insurance company sells a variety of long-term with-profit and without-profit business. Since it was formed, seven years ago, it has been expanding rapidly.

Exam style

The company calculates its regulatory capital requirement on a prescribed, cautious basis. Over the last five years, the level of free assets of the company has fallen steadily. The finance director is concerned that, if no action is taken, then the regulator will intervene.

Discuss the possible courses of action available to the life insurance company and any considerations that may be relevant to the decision. [12]

- 35.8 Outline possible reasons why an international aerospace manufacturing company holds capital. [5]

Exam style

The solutions start on the next page so that you can
separate the questions and solutions.



Chapter 35 Solutions

35.1 Mrs Magnate will require capital for a variety of reasons, including:

- to buy the first property
- to pay the fees (*eg* to solicitors, surveyors, estate agents) and taxes associated with the purchase of the first property
- to pay the interest on any amount loaned to buy the first property
- to have money to live on during the time each property is being developed
- to pay for all the raw materials required, *eg* fixtures, fittings, paint
- to pay all tradesmen and contractors required, *eg* builders, plumbers, plasterers, electricians
- to pay for all professional advice required, *eg* building regulation inspectors
- to advertise and sell the completed property and research the next purchase
- to provide additional money for the next property if the price is in excess of the sale price of the current property
- as a contingency against:
 - any of these being more expensive than anticipated
 - any stage taking longer than expected to complete.

35.2 Initial capital is needed to:

- develop the product, for example to meet the costs of:
 - investigating the market
 - setting policy conditions
 - setting premium rates
 - developing marketing and policyholder literature
- provide suitable administration systems:
 - to store risk data
 - to underwrite the risks
- satisfy regulatory capital requirements
- deal with the mismatch by timing of charges and expenses
- indicate financial strength to intermediaries and customers so as to help attract new business
- meet early claims (*ie* those that occur before sufficient premiums have been received)
- smooth results, *eg* catastrophe equalisation reserve
- act as a cushion against adverse claims experience.

- 35.3 This statement is incorrect – there is a capital requirement on writing single premium business (although it is generally less onerous than that associated with regular premium business).

When an immediate annuity product is first sold, there is a need to meet any initial expenses including initial commission *and* establish provisions in respect of future benefit payments and future expenses.

As the provider must be able to demonstrate *supervisory* solvency, the provisions established may need to be determined on a *prudent* basis and there will probably be a requirement to hold additional solvency capital.

The pricing decision (*ie* the amount of annuity per £1,000 single premium) will also have been made on the basis of assumptions about future experience, *eg* longevity, investment returns on matching fixed-interest bonds and inflation.

However, this pricing basis will almost certainly be less prudent than the basis used to determine the total of supervisory provisions and solvency capital, because of the need for competitively priced annuity rates and the extra prudence associated with the supervisory solvency assessment.

In this case, although the single premium may be enough to meet expected future outgo on the pricing basis, it may not be enough to meet expected outgo on the more prudent supervisory solvency basis. Therefore, new business capital will be required.

- 35.4 The State's needs differ in that it doesn't *have* to build up capital in advance, since in a developed economy the State can raise additional capital through:

- taxation
- borrowing
- printing money (as a last resort).

The State is similar to financial institutions in that it does try to build up and maintain capital in order to have reserves to draw upon when it needs to deal with adverse fluctuations, when outgo may exceed income.

Another similarity is the desire to hold short-term funds to maintain liquidity.

In a similar way to financial institutions and employers, it may issue debt in order to raise finances.

The State may raise equity capital through privatisations; a financial institution may raise equity capital through rights issues or demutualisations.

35.5 Possible reasons for basing a reinsurance company in an overseas country might include:

- less conservative provisioning / reserving assumptions
- less conservative solvency capital requirements
- less onerous actuarial certification requirements
- reduced income / capital gains and premium taxes
- fewer investment restrictions
- lower start-up capital requirements.

35.6 *Funds could be merged* – this could help if some of the regulatory requirements were calculated as a monetary or fixed amount per fund or were less onerous for funds above a certain size.

It would also help if it would result in significant savings on expenses (any tasks that have to be done per fund now only being done once) which resulted in lower provisions being required in respect of future expense outgo.

Assets could be changed – eg exchanging an inadmissible asset (that can't be used to demonstrate regulatory solvency) for an admissible one (that can).

Assets could be more closely matched to the liabilities, reducing the need for a mismatching reserve (or any additional solvency capital requirement relating to matching-related market risks).

Also, the valuation rate of interest used to discount future liabilities may be dependent on expected future returns on the assets held. A switch in assets may change the valuation rate of interest.

The valuation basis used for the liabilities could be weakened – leaving the assets unchanged but reducing the provisions and so improving the reported solvency position.

However, the regulations might not allow such arbitrary valuation basis changes.

Profits could be retained in the business – instead of distributing to shareholders / policyholders.

However, this would need to be examined in light of the reasonable expectations of these parties.

If the organisation sells with-profit business, it may be possible to *defer the distribution of surplus*, eg by paying more terminal and less regular bonus in order to reduce the level of guarantees.

35.7 **Possible courses of action**

Reduce the level of / close to new business [1]

Reducing the level of new business will reduce new business strain, since there will be a reduction in: [½]

- initial expenses, *eg* sales commission [1]
- the need to establish cautious levels of regulatory capital when new business is written. [1]

However, in the long run, as the existing business runs off, there may be diseconomies of scale. [½]

In addition, by reducing the levels of new business written, the insurer is foregoing the potential for future profits. [½]

Seek assistance from a reinsurer [½]

Appropriate reinsurance may reduce the regulatory capital requirement ... [½]

... since it will reduce the volatility of claims, and hence the required solvency capital is likely to reduce to make allowance for this. [1]

Financial reinsurance could be used to improve the solvency position as assessed on a regulatory basis or to reduce new business strain. [1]

For example, the reinsurer could provide a loan to the insurer, with the repayments contingent on future profits on the reinsured block of business ... [1]

... as such repayments may not need to be shown as a liability on a regulatory basis ... [½]

... although whether such an approach is acceptable depends on the particular regulatory regime. [½]

Change the investment strategy [½]

By moving to less volatile asset classes, the company may be able to reduce the total level of assets needed to back the liabilities. [½]

By moving to asset classes that more closely match the liabilities, the company may reduce the need to hold a mismatching reserve (or additional solvency capital requirements). [1]

By changing asset classes, the company may be able to increase the discount rate used to value the liabilities, leading to a reduction in the value of the liabilities, and an improvement in the solvency position of the company. [1]

The company could use derivatives to reduce market risk and thus the solvency capital requirements. [½]

Change the types of business written to be more capital efficient [½]

The company may be able to do this by:

- reducing the level of guarantees under the business sold (the regulatory requirement is typically more onerous where there are guarantees) [½]
- selling unit-linked versions of the contracts ... [½]
- ... as such contracts can be structured with high initial charges, or with variable charges, reducing the capital requirements. [½]

Defer profit distribution [½]

The company may be able to do this by reducing the regular bonuses payable on its with-profit business, and aiming to pay more in terminal bonuses. [½]

However, it should consider the need to treat customers fairly. [½]

The company may decide to hold back the payment of dividends. [½]

However, shareholders may not be happy with this approach. [½]

One-off measures to boost the level of capital [½]

The company could raise capital via:

- a rights issue [½]
- a securitisation of a block of existing business (if effective under regulatory regime) [½]
- an issue of subordinated debt. [½]

It could also make use of banking products such as contingent capital. [½]

[Maximum 12]

35.8 An international aerospace manufacturing company needs capital:

- to cover the research and development costs of developing new aircraft – these may be significant and long-term, occurring before any revenue is generated [1]
- to cope with mismatches in costs and revenues – in particular, before revenues are received, there will often be massive capital outlays, including: [1]
 - the purchase of raw materials [½]
 - marketing costs [½]
 - manufacture of new aircraft [½]
- as a cushion against fluctuating trade volumes [½]

- to meet the costs arising on unexpected events, *eg*: [½]
 - a cancellation of a major order, *eg* an airline cancels an order for a new fleet due to a reduction in air travel [½]
 - any court awards for liability in the event of accidents [½]
 - adverse currency movements leading to higher than expected research and development costs [½]
- to take advantage of opportunities, *eg*:
 - expanding into new markets [½]
 - mergers and acquisitions [½]
 - projects to create a more efficient and profitable business. [½]

In addition, the company will need 'start-up' capital at the outset (or when setting up subsidiaries in different countries) to obtain premises, hire staff, purchase equipment *etc* before it can start in business. [1]

[Maximum 5]

36

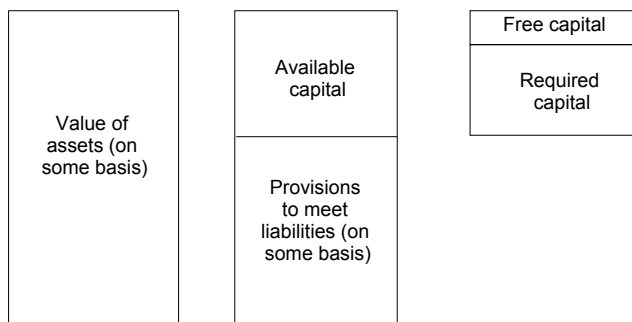
Capital requirements

Syllabus objectives

- 8.4 Discuss the implications of the regulatory environment in which the business is written for provisioning and capital requirements.
- 8.5 Discuss risk-based capital and compare with other measures of capital needs.
- 8.6 Discuss the merits of looking at an economic balance sheet in order to determine the risk-based capital requirements of a provider of benefits on contingent events.
- 8.7 Discuss the use of internal models for assessment of economic and regulatory capital requirements.
- 12.1.2 Discuss how regulatory capital requirements impact on a provider's profitability.

0 Introduction

This chapter completes the topic of capital management by looking at modelling capital needs. In particular, it considers different measures of the capital *required* and the capital *available* to meet that requirement.



Capital acts as a buffer against unexpected events and so the required capital should reflect the risks that a financial benefit provider faces. There are many different bases on which the available and required capital might be assessed. Two assessments of particular interest are *regulatory capital* and *economic capital*.

This chapter also considers the relationship between capital requirements and profitability.

1 The regulatory environment

This section starts by setting the scene for a discussion of regulatory capital requirements, including different approaches that can be taken. Some of the ideas it contains should be familiar from the material earlier in the course on determining provisions.

There is then an outline of two particular examples of regulatory capital regimes:

1. Solvency II – which governs capital requirements for insurance companies in the European Union
2. the Basel Accords – which are global banking capital requirements.

1.1 Solvency capital

One of the regulator's roles is to ensure that financial promises made to members of the public are kept.

A provider of financial benefits will need to hold provisions for:

- liabilities that have accrued but which have not yet been paid
- future periods of insurance against which premiums have already been received
- claims already incurred but which have yet to be settled.

Given that the future is impossible to predict with certainty, capital may be required in addition to the provisions to ensure that adequate security is provided.

A regulator will then monitor the adequacy of the provisions and capital that a provider sets aside against future liabilities. The security given by a regulatory regime is measured by the total of these two elements. A regulator will require that the total is sufficiently prudent and it may prescribe the assumptions and methodology to be used for the calculations.

In other words, the level of security will be assessed by considering the total of any margins in the provisions in excess of best estimate and any additional capital requirement.

The approach used may involve:

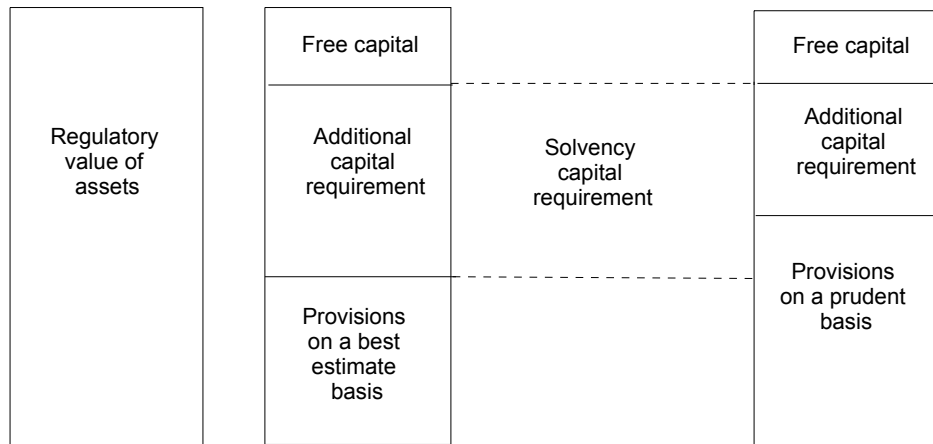
1. the regulator requiring a best estimate approach for the calculation of provisions. In addition, the provider will be required to hold significant further capital as a buffer for general adverse experience

OR

2. the regulator requiring provisions to be calculated on a basis significantly more prudent than best estimate. Only a much smaller (or zero) amount of capital would then be required compared with the situation if provisions were best estimate.

The total assets required to be held in excess of provisions calculated on a best estimate basis is the solvency capital requirement. In both of the approaches described above, the solvency capital requirement is effectively the same.

Two possible regulatory regimes which result in the same total solvency capital requirement are illustrated below:



Solvency II (described further in the next section) follows the first of the approaches above, with companies required to hold provisions established on a best estimate basis (plus an additional risk margin) together with a risk-based solvency capital requirement calculated using a method that gives direct recognition of the risks accepted by the business.

The additional risk margin is intended to represent an estimate of the 'fair value' of the non-market risk within the best estimate liabilities, and so could be considered to be part of the 'best estimate' (or, in the case of Solvency II, 'market-consistent') provisions rather than as an additional capital requirement or prudential margin.

Some countries use a different approach, under which provisions are determined on a prudent basis and/or additional solvency capital requirements are based on simple formulae. This has the disadvantages that:

- **levels of prudence within provisions vary between providers, making it difficult to make comparisons**
- **solvency capital requirements are not risk-based, making it difficult to ensure that sufficient security is provided to policyholders.**

1.2 Solvency II for insurers

Solvency II is a regulatory regime for all European Union states.

Solvency II succeeded Solvency I, which prescribed minimum additional solvency capital amounts that applied to EU insurance companies. However, these additional solvency capital amounts were not very sensitive to the actual risks faced by insurance companies and they 'sat on top of' provisions that varied considerably in their levels of prudence between the different EU member states, with the result that the overall solvency capital requirement also varied considerably.

Solvency II is much wider ranging than Solvency I and considers more than just additional solvency capital amounts, *eg* it includes the determination of the value of the assets, the valuation of provisions and assessment of companies' risk management systems.

As noted above, Solvency II is based on an assessment of provisions on a best estimate basis with a risk margin (the 'technical provisions') and an additional risk-based capital requirement.

The framework is based on three pillars:

- **quantification of risk exposures and capital requirements**
- **a supervisory regime**
- **disclosure requirements.**

Pillar 1 of Solvency II includes rules for valuing both the assets and provisions for liabilities and also the determination of *two levels of capital requirement*, ie a minimum capital requirement (MCR) and a solvency capital requirement (SCR). These two levels are described further below.

Whereas Pillar 1 is *quantitative* and relatively prescribed, Pillar 2 deals with *qualitative* aspects, eg a company's internal controls and risk management processes, and the company's own view of its strategic capital needs. The Pillar 2 supervisory regime includes monitoring visits to companies by the regulator.

The Pillar 3 disclosure requirements include both public disclosure and private disclosure by the company to the regulator.

Solvency II establishes two levels of capital requirements:

- **the Minimum Capital Requirement (MCR) — the threshold at which companies will no longer be permitted to trade**
- **the Solvency Capital Requirement (SCR) — the target level of capital below which companies may need to discuss remedies with their regulators.**

The SCR will be greater than the MCR.

If the amount of an insurance company's available capital is less than the MCR, the company is technically insolvent. If the amount of available capital is greater than the MCR but less than the SCR, this provides an indicator that action should be taken to prevent technical insolvency.



Question

Suggest examples of remedies that may be required in the event of a company breaching the SCR.

Solution

In the event of a company breaching the SCR, proposed remedies would need to increase the amount of available capital, including by reducing the company's levels of risk.

Examples of such actions were covered in the earlier chapters on risk management tools and capital management, and might include:

- closing to new business
 - moving to a more matched investment position.
-

The SCR and MCR both represent capital requirements that must be held in addition to the technical provisions.

Restrictions are placed on the quality of capital that can be used to cover these requirements.

The SCR may be calculated using a prescribed standard formula or a company's internal model, where the latter may be benchmarked against the output of the standard formula.

Considerable work is needed to justify using an internal model, and all but the largest companies are likely to find that any reduction in capital requirements is more than offset by the work needed to support the internal model.

The supervisor can compel an insurance company to develop an internal model, if it feels that the standard formula is not appropriate to the risk profile of the company.

The SCR is calculated by assessing the capital required for each risk against a 0.5% ruin probability in one year.

Hence the SCR is a 'risk-based' capital requirement: the amount of capital that has to be held is directly related to the level of risk within the business.

The various risks are aggregated using a correlation matrix to make allowance for any diversification benefits. In the standard formula the risks tested and the correlation matrix are prescribed. For the market risks, firms may need to use an economic scenario generator to assess the capital required for each risk. The details of the Solvency II calculation are covered in the relevant Specialist subjects.

Although the standard formula uses a correlation matrix, companies using the internal model approach can use different aggregation methods, such as copulas. The calculation of the SCR is considered further in Section 3.

Currently the Solvency II Directive applies to all insurance and reinsurance companies with gross premium income exceeding €5 million or gross technical provisions in excess of €25 million.

1.3 The Basel Accords for banks and credit institutions

Solvency II provides solvency requirements for insurance companies' risks. Comparable measures of capital adequacy for banks are the Basel Accords issued by the Committee on Banking Regulations and Supervisory Practices of the Bank for International Settlements (BIS).

These accords set requirements for the levels of capital that banks need to hold to reflect the level of risk in the business that they write and manage.



Question

Suggest factors that the regulator would take into account in assessing a bank's risk profile and risk management systems.

Solution

Factors the regulator could take into account in assessing a bank include:

- reviews of the work of internal and external auditors
 - the bank's risk appetite and its track record in managing risk
 - the nature of the markets in which the bank operates
 - the quality, reliability and volatility of its earnings
 - the bank's adherence to sound valuation and accounting standards
 - the bank's diversification of activities.
-

The Basel Accords apply to all internationally active banks.

2 Economic capital

2.1 Economic capital requirements

The approaches discussed in the previous section can be used to determine regulatory capital needs. However, a provider should not run a business solely on the basis of a regulatory requirement, and thus other approaches should be considered.

As explained in the previous section:

The SCR under Solvency II is a risk-based capital measure.

In practice, financial product providers will have a risk appetite that limits the amount of risk they are prepared to take on. The risk appetite is commonly expressed as a requirement for the company to hold an amount of capital that is based on the regulatory capital requirements.

For example, it might be expressed in terms of the SCR. However, part of the Solvency II regime (Pillar 2) requires each insurance company to consider its *own* view of capital needs, including the ability to meet business and strategic objectives over an appropriate time horizon.

Under Solvency II Pillar 2, all firms are also required to consider their internal economic capital requirements under the ORSA.

The ORSA is the company's Own Risk and Solvency Assessment. It links regulatory capital to economic capital, which is defined as follows:



Economic capital is the amount of capital that a provider determines is appropriate to hold given its assets, its liabilities, and its business objectives.

Typically it will be determined based upon:

- **the risk profile of the individual assets and liabilities in its portfolio**
- **the correlation of the risks**
- **the desired level of overall credit deterioration that the provider wishes to be able to withstand.**

This approach is also sometimes known as *risk-based* capital assessment. The amount of economic capital required would be determined using an internal model, as described in Section 1.2.

The internal-ratings based approach of Basel II and the use of internal models for the SCR in Solvency II has enabled companies to move their regulatory capital requirement calculations to be more in line with their economic capital requirement calculations (provided the regulator is satisfied with the quality of the internal model).

Depending on the provider and its regulatory regime, either economic or regulatory requirements may drive the need for capital. To meet the need for either economic or regulatory capital, various types of capital can be used. The cost to a provider of the various types of capital will depend on the level of relative risk exposure to the investor and on the availability of capital at any time in the market.

The impact of capital requirements on cost and profits is considered further at the end of this chapter.

2.2 Economic balance sheet

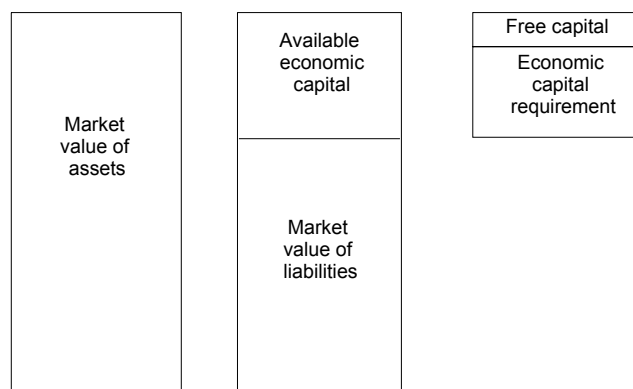
The basic economic balance sheet

The first stage in a risk-based capital assessment for a provider is to produce an economic balance sheet.

This balance sheet shows:

- the market values of a provider's assets (MVA)
- the market values of a provider's liabilities (MVL)
- the provider's available capital, which is defined as $MVA - MVL$.

The *available capital* is then compared with the economic *capital requirement* to assess the provider's solvency status.



Market values of assets are usually easily and instantly available from the financial markets.

There may be some assets held that do not have instantly available market prices (such as properties) and so an alternative valuation approach that aims to reproduce market values must be used for such assets.

The 'market value' of liabilities may alternatively be referred to as the 'market-consistent value' or 'fair value' of liabilities.

The determination of a market value for a provider's liabilities is not so easy and a high level of judgment is required to determine market-consistent liability values. One approach is to determine the expected value of the unpaid liabilities stated on a present value best estimate basis and to add a risk margin.

The value of using an economic balance sheet as a starting point for capital requirement assessment is that it starts with assets and liabilities both being assessed on the same, market-consistent, basis.

It is worth noting that Solvency II is an example of the economic balance sheet assessment being the first stage.

As mentioned earlier in the chapter, under Solvency II Pillar 1 the technical provisions comprise best estimate liabilities and a risk margin; these represent the market value of liabilities. Assets are also valued at market value or fair value.

Other methods that involve a deterministic valuation of liabilities necessarily use a basis that does not set out to be market-consistent. Some liability valuation bases used for supervisory purposes have an inbuilt prudential margin, to a greater or lesser extent, depending on the regulatory regime.

3 Models for assessing capital requirements

3.1 Standard formula

Under the Solvency II standard formula, the capital requirement is determined through a combination of stress tests, scenarios and factor-based capital charges.

We discuss factor-based charges further below.

The standard formula allows for:

- **underwriting risk**
eg premium (general insurance), mortality, morbidity, catastrophe, expense and lapse risks
- **market risk**
eg equity, property, interest rate, credit spread and currency risks
- **credit / default risk**
including reinsurance default risk
- **operational risk.**

The standard formula under Solvency II is very complicated.

Examples

Underwriting risk

The capital requirement for underwriting risk should allow for the level of risk arising from obligations in relation to the perils covered and the processes used in the conduct of business.

Hence for a life insurer, for example, it should allow for mortality risk, longevity risk, disability (or morbidity) risk, catastrophe (*eg pandemic*) risk *etc.*

The SCR should allow for underwriting risk by analysing the impact of prescribed stress tests, *eg* a specified increase in mortality rates.

The capital charge for underwriting risk should not only cover risks relating to the insured perils. For example, the insurer should hold sufficient capital to be able to withstand a specified change in withdrawal rates.

Market risk

The SCR should similarly allow for market risk by analysing the impact of prescribed stress tests, *eg* a specified adverse movement in the market value of properties.

Solvency II aims to assess the company's net risk and determine its capital requirement after recognising all the risk mitigation arrangements the provider has in place.

Solvency II aims to set solvency standards that reflect a firm's risk profile and that encourage proper risk control. In other words, an insurer with an efficient risk management process should be rewarded by having a lower capital requirement. Conversely, those companies with a higher risk profile should have a higher capital requirement.

Factor-based charges

Factor-based capital charges are a simple mechanism for determining capital requirements.

For example, possible factor-based capital charges could be of the form:

- factor $\times$ sum at risk – to determine a capital requirement in relation to mortality risk
- factor $\times$ reserves – to determine a capital requirement in relation to inadequate reserves.

The Solvency II standard formula for the SCR combines the factor-based capital charges and the stress tests to produce capital requirements in respect of each specified risk (underwriting, market, credit default and operational risks).

The final SCR is less than the sum of these individual parts because of the impact of diversification, *ie* it is assumed that not all risks will occur at the same time. The standard formula specifies how the component parts should be aggregated allowing for these diversification benefits.

Using the standard formula has the advantage that the Solvency Capital Requirement calculation is less complex and less time-consuming.

However, using the standard formula has the disadvantage that it aims to capture the risk profile of an average company, and approximations are made in modelling risks which mean that it is not necessarily appropriate to the actual companies that need to use it.

3.2 Internal model

As an alternative to using the standard formula for deriving Solvency II capital adequacy requirements, a company can use an internal model of its risks.

The company would need to gain regulatory approval in order to use an internal model for its SCR calculation.

Internal models aim to create a stochastic model that reflects the company's own business structure.

Internal stochastic models can also be used for determining economic capital requirements.

Internal stochastic models are more sophisticated than using factor-based capital requirements, stress tests and correlation matrices. A stochastic model can be used to project a company's balance sheet for each of a large number of future scenarios, which are intended to represent all the risks the company faces. To do this a suitable stochastic model needs to produce internally-consistent possible future scenarios. An advantage of such a model is that it can automatically allow for correlations between different risk scenarios.

A risk measure, *eg* a Value at Risk (or VaR), is then used to determine the capital requirement. For example, the model could identify the worst 0.5% of future scenarios and the capital requirement may be to hold sufficient capital that the company is solvent in one year's time with a 99.5% confidence level, *ie* a 99.5% one-year VaR.

The standard formula for the SCR in Solvency II is intended by the regulator to be calibrated to reflect such a VaR risk measure for a typical company.

Companies can also use internal models:

- **to calculate economic capital using different risk measures, such as Value at Risk (VaR) and Tail Value at Risk (Tail VaR)**
- **to calculate levels of confidence in the level of economic capital calculated**
- **to apply different time horizons to the assessment of solvency and risk**
- **to include other risk classes not covered in the standard formula.**

The 99.5% Tail VaR measures the expected shortfall (in assets relative to liabilities) in the lower 0.5% tail of the distribution. With this risk measure, companies would be required to hold sufficient capital to meet this expected shortfall.



Question

A particular company has an internal capital model that uses one-year 99.5% VaR as the risk measure.

The company is considering changing to a conditional Tail VaR risk measure to be targeted at the same stringency of required capital as for the one-year 99.5% VaR measure.

Explain whether the Tail VaR confidence level would be expected to be greater or less than 99.5%.

Solution

As the Tail VaR risk measure looks at the size of the expected shortfall in a specified tail, rather than the expected shortfall *at* the confidence limit itself, the equivalent Tail VaR confidence level would need to be less than 99.5% (*eg* the equivalent Tail VaR confidence level may be 99.0%).

4 Capital requirements and profitability

4.1 Components of profit

The profit made by a financial product provider can be expressed as two components:

- trading profit
- investment profit.

In outline, trading profit is the total of premiums and investment income on the provisions for future liabilities, less claims, expenses, tax and the net increase in any provisions for future liabilities.

It would also include investment income earned on net cashflows received during the period.

Investment profit is the investment return, less tax and investment expenses, earned on that part of the assets not required for the provisions for future liabilities.

Investment profit is therefore the investment return earned on 'available capital'.

4.2 The cost of capital

An earlier chapter covered how the price for a financial product is calculated, allowing both for the need to establish provisions for future liabilities and also for the need to earmark part of the capital to support the business written.

As already described in this chapter, there are different possible approaches to the determination of this support capital.

The amount of capital required to support the business written may be determined on a regulatory basis, which may be formulaic or risk-based, or on the provider's own economic assumptions, which will normally be risk-based.

The premium charged should include an allowance for the loss of return on the capital tied up in the contract.

As explained in the chapter on Pricing and financing strategies, the cost of holding required capital should be included within the pricing calculation cashflows.

This cost of capital reflects the likelihood of investment restrictions on capital supporting business in force, meaning that the investment return is not as great as if the capital tied up in the business could be used for some other purpose.

In other words, needing to put capital aside to support capital requirements is likely to mean that it will earn a lower return than if it could be invested more freely and used for other purposes. As previously mentioned, the resultant reduction in return is known as opportunity cost.

The investment profit is that earned on the free assets, whether or not they are earmarked to support the business written.

The aim of the product provider is that the shareholders should earn the same return on the free assets whether they are used to support business issued or whether they can be invested freely.

Consider first the assets that are being held as required capital.

In the first case the investment profit is restricted because there are limits on how the assets can be invested. However, the difference is made up from the additional trading profit that is earned from the allowance for the cost of capital built into the premiums or contributions.

Consider secondly the assets that are not being held as required capital, *ie* the 'free capital' shown in the diagram at the start of this chapter.

In the second case the whole return comes from investment profit.

If all the assumptions made in the product pricing are borne out in practice, then the expected profit will emerge each year throughout the life of the policy.

The chapter summary starts on the next page so that you can keep all the chapter summaries together for revision purposes.

Chapter 36 Summary

Regulatory capital

A regulatory solvency capital requirement is the total of:

- the prudential margins in the regulatory liability valuation basis
- an amount of additional solvency capital in excess of the regulatory provisions.

There are different approaches to the balance between these two components.

An approach that uses prudent provisions and simple formula-based additional capital requirements makes it more difficult to compare providers (different levels of prudence) and to ensure that there is sufficient security provided to policyholders (not risk-based).

Solvency II

Solvency II is based on three pillars:

1. quantification of risk exposures and capital requirements
2. a supervisory regime
3. disclosure.

Solvency II has two levels of capital requirements:

- Minimum Capital Requirement (MCR) – the threshold at which companies will no longer be permitted to trade
- Solvency Capital Requirement (SCR) – the target level of capital below which companies may need to discuss remedies with their regulators.

The SCR may be calculated using a prescribed standard formula or a company's internal model.

Using the standard formula has the advantage that the SCR calculation is less complex and less time-consuming. However, the standard formula has the disadvantage that it aims to capture the risk profile of an average company, and approximations are made in modelling risks which mean that it is not necessarily appropriate to the actual companies that need to use it.

The Basel Accords

The Basel Accords set requirements for the amount of capital that banks need to hold to reflect the level of risk in the business that they write and manage.

Economic capital

Economic capital is the amount of capital that a provider determines is appropriate to hold given its assets, its liabilities, and its business objectives.

It is an internal, rather than a regulatory, capital assessment.

Typically it will be determined based upon:

- the risk profile of the individual assets and liabilities in its portfolio
- the correlation of the risks
- the desired level of overall credit deterioration that the provider wishes to be able to withstand.

In an economic balance sheet:

- Assets and liabilities should be valued at market values, and the excess of the assets over liabilities (*ie* the available capital) should be compared to the economic capital requirement.
- One way to calculate the market value of liabilities is to use the present value on a best estimate basis and add on a risk margin.

Internal models

Internal models are used to calculate economic capital requirements and may be used to determine the Solvency II SCR (provided the internal model gains regulatory approval).

Internal models aim to create a stochastic model that reflects a company's own business structure.

Companies can use internal models:

- to calculate economic capital using different risk measures, *eg* VaR and Tail VaR
- to calculate levels of confidence in the level of economic capital calculated
- to apply different time horizons to the assessment of solvency and risk
- to include other risk classes not covered in the standard formula.

Capital requirements and profitability

Profit can be split into trading profit and investment profit, where investment profit is the investment return earned on available capital.

Pricing of financial products should allow for the cost of holding required capital (lower return due to restrictions on investments, opportunity cost). The lower investment profit is then offset by the additional trading profit earned from the allowance for the cost of capital built into the premiums.



Chapter 36 Practice Questions

- 36.1 Describe how an insurance company could assess its economic capital position, including consideration of the type of model that could be used. [10]
Exam style
- 36.2 Describe the disadvantages of factor-based capital requirements.
- 36.3 Discuss the use of the standard formula to calculate the solvency capital requirement (SCR) under Solvency II. [6]
Exam style
- 36.4 Discuss whether the standard formula or an internal model would be expected to produce a higher capital requirement on average.
- 36.5 Explain why a provider will not wish to hold too large an amount of capital in excess of its economic capital requirement.
- 36.6 Compare regulatory and economic capital requirements. [6]
Exam style

The solutions start on the next page so that you can
separate the questions and solutions.



Chapter 36 Solutions

- 36.1 An assessment of an insurance company's economic capital position requires the company to look at its economic capital *requirement* and also the economic capital it has *available*. [1]

Economic capital requirement

The economic capital requirement is the amount of capital that the company determines is appropriate to hold given its assets, its liabilities, and its business objectives. [1]

Typically it will be determined based upon:

- the risk profile of the individual assets and liabilities in its portfolio [½]
- the correlation of the risk [½]
- the desired level of overall credit deterioration that the company wishes to be able to withstand. [½]

For each major risk type (*eg* credit, market, operational), a stochastic model or a deterministic model with scenario or stress testing will generally be used to determine the capital requirement. [1]

A suitable stochastic model needs to produce internally-consistent possible future scenarios, *eg* for market risk reflecting downturns in investment performance and inflation and their impacts on levels of withdrawals and new business. [1]

An advantage of such a stochastic model is that it can automatically allow for correlations between different risk scenarios. [½]

The company would project its balance sheet for each of a large number of future scenarios, which are intended to represent all the risks the company faces. [½]

A risk measure, *eg* Value at Risk or Tail Value at Risk, would be used to determine the economic capital requirement, *eg* sufficient capital to maintain solvency in ten years' time in 99.5% of scenarios. [1]

Economic capital available

The starting point for assessing the economic capital available is for the company to draw up an *economic balance sheet*, which shows the market value of the company's assets and the market value of its liabilities. [1]

The market value of liabilities can be determined using a discounted cashflow approach. [1]

From this, the economic capital available would be determined as the excess of the market value of the assets over the market value of the liabilities. [½]

For tradable assets, the market value of assets should be easily available. [½]

It is possible that the portfolio may include some assets which are not tradable or for which a market value is not instantly available, and so an alternative valuation approach is needed. [½]

In the unlikely event that any of its liabilities are tradable, the insurance company could look up the market value of these liabilities. [½]

However, for the majority of its liabilities it is likely to have to use an alternative approach, *eg* use the market value of a portfolio of assets whose cashflows replicate the liability cashflows in all circumstances, if such a replicating portfolio is available. [1]

Alternatively, the company could determine the expected value of the unpaid liabilities stated on a present value best estimate basis and add a risk margin. [1]

In addition to its current available economic capital, the company may also look at the availability in the market and the likely cost of various sources of further capital. [1]

[Maximum 10]

36.2 The disadvantages of factor-based required capital calculations include:

- the large number of factors required to capture all the risks that insurance companies may face
- the factors may be chosen to be appropriate for a *typical* insurance company with typical risks – they are unlikely to be suitable for all companies
- the simple calculation may not be appropriate to deal with some types of risk, *eg* catastrophes
- to retain an appropriately stringent capital requirement in different conditions, the factors would need to be updated in the light of changing conditions, *eg* changing asset values.

36.3 Under the Solvency II standard formula, the SCR is determined through a combination of stress tests, scenarios and factor-based capital charges. [½]

These allow for underwriting, market, credit default and operational risks. [½]

For example:

- a factor-based capital charge for the risk associated with a worsening of mortality experience for an assurance provider might be of the form: factor $\times$ sum at risk
- a withdrawal risk stress test may be to hold sufficient capital to be able to withstand either a 50% increase or 50% decrease in withdrawal rates.

[½ for any suitable example, maximum 1]

The final SCR is determined from these individual component parts, using a correlation matrix to make allowance for any diversification benefits. [1]

Advantages of using the standard formula

Use of the standard formula has the advantage that the SCR calculation is less complex, time-consuming and resource-intensive to perform. [1]

This may make the standard formula particularly attractive for smaller insurance companies. [½]

Using the standard formula avoids the considerable work that is likely to be required in developing an internal model that meets the regulators' requirements to be used in the SCR calculation. [½]

The cost of doing this work may be greater than any benefit that would be achieved via a lower SCR. [½]

Even if the company is developing an internal model for other purposes, *eg* to assess its economic capital position, there would be additional costs and uncertainty in seeking regulatory approval for its use in Solvency II. [½]

Disadvantages of using the standard formula

As the calibration of the standard formula is based on an 'average' company the approximations it makes are not necessarily appropriate to all companies. [½]

A company with a risk profile very different from the 'average' underlying the model may have a lower SCR if it calculated it using an internal model that reflected its own business. [1]

Companies with sophisticated risk management systems and controls may also benefit from a lower SCR calculated by an internal model that reflects these items more fully. [½]

The company may be developing an internal model in any event, *eg* to assess its economic capital position. Using the internal model for Solvency II would not therefore require the cost of developing a model 'from scratch' and would reduce inconsistencies between the regulatory capital and economic capital positions of the company. [1]
[Maximum 6]

- 36.4 The standard formula is intended to be appropriate for the risk profile of an 'average company'. Therefore, *on average across all insurance companies*, it might be expected that the standard formula and internal model should produce a similar level of capital requirement.

However, the standard formula is known to be an approximation, which introduces extra model error. Therefore, as the regulators would probably prefer the approximations to result in companies holding too much rather than too little capital, it is likely to lead to a higher capital requirement than an internal model for most companies.

- 36.5 Capital has a cost, *ie* the providers of the capital will require a return on their capital. All else being equal, holding a larger amount of capital means that a given level of profits is spread more widely amongst the providers of capital.

Another way to consider this is in relation to the *opportunity cost* of the extra capital, and whether it is being used to generate the optimal level of return.

36.6 **Similarities**

Both relate to the amount of capital that needs to be held in order that future obligations are met. [1]

An internal model may be used for either calculation. [1]

Differences

The regulator may prescribe the assumptions and methodology to be used for the regulatory capital requirement calculations. The company will make its own decisions on these aspects for its economic capital requirement calculations. [1]

Regulatory capital requirements may be determined using factor-based capital charges or a simple formula, whereas economic capital is more likely to be modelled. [1]

Regulatory capital requirements may be defined as the additional solvency capital amounts that need to be held in excess of the provisions as determined on the regulatory valuation basis, or as the sum of these additional capital amounts and any prudential margins in the liability valuation basis. Economic capital requirements are held in excess of the market-consistent value of liabilities. [1]

Regulatory capital requirements may be higher than economic capital requirements, as the regulator's aim is to protect policyholders and so may require a company to hold more capital than would otherwise be considered to be necessary. [1]

Economic required capital may be lower than regulatory required capital due to a more sophisticated allowance for diversification benefits. [½]

However, in some situations economic required capital may be higher, for example because the company:

- may take into consideration the need to hold capital for future strategic objectives that are not included in the regulator's time horizon, including writing future new business [1]
- is very risk averse [½]
- uses a more stringent risk measure when determining economic capital (*eg* TVaR) than is used for the regulatory capital requirement [1]
- uses a standard formula / model to determine regulatory capital, but is riskier than the 'average' risk reflected in this formula / model [½]
- may be targeting a high credit rating. [½]

[Maximum 6]

37

Surplus and surplus management

Syllabus objectives

- 12.1.1 Describe how the main providers of benefits on contingent events can control and manage the cost of:
- payments arising on contingent events
 - expenses associated with the payment of benefits on contingent events.
- 12.2.1 Describe how a provider can analyse actual performance against expected performance.
- 12.2.3 Discuss the possible sources of surplus / profit and the levers that can control the amount of surplus / profit.
- 12.2.4 Describe why a provider will carry out an analysis of the changes in its surplus / profit.
- 12.2.5 Describe how any surplus / profit arising may be distributed.
- 12.2.6 Discuss the issues surrounding the amount of surplus / profit that may be distributed at any time and the rationale for retention of surplus / profit.

0 Introduction

Usually, the main aim of providers of financial products is to make money. As actuaries, it is of course therefore important that we understand the ways in which they can achieve this.

This chapter is called *surplus* and *surplus management*, however we could also refer to *profits* and *maintaining profitability*.

In order to *understand* surplus / profit, we need to be able to answer the following questions:

- *What* is surplus / profit?
- *Why* is it worth analysing?
- *How* can we analyse it?

It will then be necessary to *manage* the surplus / profit, which leads to the additional questions:

- *Why* might surplus / profit arise?
- *What* can we do to control it?
- *How* can we use surplus / profit once it has arisen?



If we can discover what influences surplus / profit then we will be able to manage it more effectively. Factors that management can affect through management control systems to influence the amount of surplus / profit are known as *levers*.

1 Introduction to surplus / profit

1.1 Definitions

Profit

$$\text{Profit} = \text{revenue} - \text{expenditure}$$

where the revenue and expenditure figures include all amounts that relate to the time period being considered.

If actual experience turns out to be different to what was anticipated then unexpected profits (or losses) may arise.

Because of the long-term nature of financial services contracts, the final profit from a scheme or tranche of policies cannot be determined until all have gone off the books.

Waiting until this happens before the terms under which the next tranche of policies are written can be determined is clearly impractical.

In particular, if a company is selling long-term contracts on terms that are not profitable, it needs to realise this as early as possible, not at the end of the life of the contract.



Question

In a particular country, many firms that carry out building work on people's homes provide a 30-year, insurance-backed guarantee. In the normal course of events, if customers have claims for defective building work under the terms of the guarantee, they claim from the building firm. However, there is a risk that the building firm goes out of business, in which case the guarantee would be worthless without the insurance backing.

The insurance backing involves the building firm paying a single premium to the insurer at the start of the 30-year period. In return the insurer is liable to pay any claims under the terms of the guarantee if the building firm is no longer in business at the time of the claim.

The insurance company providing this contract realises two years after its launch that this product is not profitable.

Describe possible actions the insurance company could take.

Solution

Possible actions the insurance company could take are:

- Improve the profitability of the business by improving the experience. For example, by expense cuts or by improved underwriting when selling the product, such as by imposing more rigorous criteria in assessing the quality of building firms to whom it will sell this product.
 - Reprice the product so that new business is profitable. The extent to which this is possible will depend on the level of competition in the market for this product. Repricing existing contracts may only be possible if terms are reviewable.
 - If competition results in it not being able to reprice at a profitable level of premiums, the insurance company should stop selling the business or change its profit criterion.
-

To monitor the progress of the business it is necessary to value the outstanding liabilities from time to time, often annually.

Therefore, during the life of a contract or scheme, despite the uncertainty about the future, the amount of *surplus* can be estimated by valuing the assets and liabilities on a chosen set of assumptions.

Surplus

Surplus = value of assets – value of liabilities

Surpluses (or deficits) may appear and disappear as the contract's experience unfolds. The size of the surpluses also depend on the basis and methodology used to value the assets and liabilities.

Surplus arising

The *surplus arising* over any time period is the change in the surplus over the time period.

So, using the notation A_t for the value of assets at time t and L_t for the value of liabilities at time t , the surplus arising from time t to time $t+1$ will be:

$$(A_{t+1} - L_{t+1}) - (A_t - L_t)$$

or equivalently:

$$(A_{t+1} - A_t) - (L_{t+1} - L_t).$$

It should be noted that:

- It is common to refer to *surplus* when strictly what is being referred to is *surplus arising*. (The context is usually sufficient to tell whether a particular reference to the surplus means surplus or is referring to surplus arising.)
- *Surplus arising* is equivalent to *profit*.

So, there are two alternative (but equivalent) ways of looking at *profit* or *surplus arising*:

- look at *balance sheet* entries (*ie* assets and liabilities)
- look at *profit and loss* entries (*ie* revenue and expenditure).

These two viewpoints are equivalent because the component parts of $(A_{t+1} - A_t)$ or $(L_{t+1} - L_t)$ are exactly the same as the revenue and expenditure items of the year, *eg* investment return, claim payments, expenses. There are a couple of subtleties to watch out for:

- Allowance must be made for the need to establish provisions – therefore, the expenditure figure will include money required to establish (or increase) provisions and/or the revenue figure will include any release in provisions.
- Allowance may be made for the change in value of assets – for example the revenue figure may include any capital gain over the year, even if this gain has not been realised.

Impact of basis on surplus arising

The choice of valuation basis will not affect the *total amount* of surplus arising over the life of a contract, which will depend solely on the differences between the actual experience and that assumed in pricing the contract. However, it will affect the *timing* of the emergence of the surpluses during the life of the contract.



Question

A life insurance company has a portfolio of ten-year endowment assurance contracts. It is monitoring a tranche of these policies that were sold exactly nine years ago.

Explain the effect on the surplus arising of strengthening the valuation basis at the end of the ninth year, assuming that everything else is unchanged.

Hint: Consider the effect on the surplus arising in both Years 9 and 10.

Solution

In Year 9:

Making the valuation basis more prudent will result in the value of the liabilities after nine years being higher than it would otherwise have been.

This will reduce the surplus arising for Year 9, as the transfer to provisions at the end of Year 9 will be higher than it would otherwise have been.

In Year 10:

At the end of Year 10 no provision is required. Therefore there is a release of any remaining provision at the end of Year 10. Increasing the provision held at the end of Year 9 will result in a greater amount of provision to be released at the ten year point. Therefore the surplus arising in Year 10 is increased.

1.2 Reasons for performing an analysis of surplus / profit

An *analysis of surplus* (or *profit*) is a breakdown of the surplus (or profit) arising over a year into its constituent parts.

A provider will want to analyse the change in any surplus arising over a year or a longer period of time in order to:

- **show the financial effect of divergences between the valuation assumptions and the actual experience**
- **determine the assumptions that are the most financially significant**

For example, the actual investment return over the year on a term assurance contract may have been very different from expected, but the impact of this on the surplus over the year may be only marginal. This is because investment return is not a financially significant assumption for term assurance contracts due to the low level of provisions that have to be held.

- **show the financial effect of writing new business**

If a *prudent* basis is being used (eg the supervisory provisioning basis), new business will normally contribute negatively to the surplus in the year of inception. This is because the premiums will not be sufficient to cover the initial expenses (including commission and a contribution to overheads) as well as establish the prudent supervisory provisions.



Question

Explain the likely impact of new business on surplus if a *realistic* basis is being used.

Solution

If a realistic basis is being used, the initial provisions should be much lower than with a supervisory basis, perhaps even negative.

The provisions should reflect the future profits expected from the business, which should offset the initial costs involved.

So, the effect on surplus is positive provided the business is written on profitable terms.

-
- **validate the calculations and assumptions used**
 - **provide a check on the valuation data and process, if carried out independently**
 - **identify non-recurring components of surplus, thus enabling appropriate decisions to be made about the distribution of surplus**

This is discussed at greater length later in the chapter. Different decisions may be made in relation to *recurring* components of the surplus, which the provider may be happy to treat as a regular occurrence with associated expectations that these will continue, and *non-recurring* components of the surplus.

- **reconcile the values for successive years**
- **provide management information**
- **provide data for use in executive remuneration schemes**

A desirable feature of an executive remuneration scheme is that the rewards it offers depend on the *success* of the entity being managed.

- **provide detailed information for publication in the provider's accounts**
- **demonstrate that the variance in the financial effect of the individual sources is a complete description of the variance in the total financial effect**
- **give information on trends in the experience of the provider to feed back into the actuarial control cycle.**

The reasons listed above can be divided into three groups as follows:

- assisting the management in decision making
 - financial effect of divergences
 - financially significant assumptions
 - effect of writing new business
 - distribution of surplus
 - management information
 - information on trends
- providing information for other purposes
 - executive remuneration schemes
 - accounts
- data and calculation checks
 - validation of calculations / assumptions
 - independent data check, reconciliation over periods
 - completeness of description.

2 Carrying out an analysis of surplus

In determining premiums, contributions and provisions for future liabilities, assumptions will need to be made. Where actual experience differs from the assumptions made, a surplus / profit (or deficit / loss) will arise.

It is therefore possible to analyse surpluses / deficits (or profits / losses) by comparing actual results with those that we expected.

2.1 Projecting expected results

To analyse the actual performance of any financial structure, ranging from a single product type to a complex product provider, it is necessary to determine the expected values against which the actual values can be compared.

This is just the same as for any form of review that we might wish to undertake – a comparison is made between what was originally expected and what actually happened. This is the main element of *monitoring the experience* within the actuarial control cycle.

When analysing the results of a product provider, it is usually necessary to project items such as the revenue account and balance sheet as if the actual experience had been the same as that expected when its business was written. This involves building a model of the expected future experience of the provider.

The result will thus be a set of hypothetical accounts based on the future values of economic, market and other relevant variables that were expected at the time the business was written.

2.2 Modelling considerations

The bases for such an exercise are likely to be models used when the products were developed.

The results of the initial product pricing models can be combined to build a complete model of the provider's future revenue accounts.

It is important in building such a model to ensure that the elements of the revenue account are self-consistent in their own right. It is not sufficient to project premiums, investment income, death claims, lapses etc independently.

In other words, any such projection must be based upon a set of mutually consistent variables. Both the resulting relationships between the elements of the accounts and the absolute values of those elements should be realistic.

The model is developed by multiplying the profit test results by the expected number of contracts to be sold in each future year.

'Profit test results' in the above context means the cashflows for a single policy. This 'scaling up' will need to take into consideration the expected numbers of contracts of each *type*, including by *rating factor*.

Then for each future year the number of contracts still in force from previous years needs to be added in. This will then give a model that can be used to build up the expected future progress of the business as shown by the revenue accounts.

As time goes on, a second model can be built up from the original profit test, but using the actual volumes of business sold, rather than expected volumes. Comparisons of actual results with this model will identify whether differences between actual and expected outcomes are due to:

- **differences between actual and expected experience, or**
- **sales volumes being different from what was expected.**

2.3 Comparison of different models

So we end up comparing three models:

1. expected experience with expected volumes of new business
2. expected experience with actual volumes of new business
3. actual experience with actual volumes of new business.

The actual revenue accounts for the business showing the actual experience of the provider can then be compared with the projections. This analysis will show how the actual experience compares with that anticipated when products were designed and will answer questions such as:

- **Has the provider earned more by the way of investment than it expected to earn when it designed the product?**
- **Has the provider spent more than it allowed to be spent in the design of the product?**
- Have termination rates (*eg* death, lapse, surrender, claim *etc*) followed expectations?
- Has inflation (and hence expenses and index-linked claim costs) been higher than expected?

The answers to such questions will give an initial indication of whether the profitability criterion used in designing the product in the first place is being met in practice. This can be used as feedback information in the actuarial control cycle.

2.4 Comparison of expenses

When comparing actual with expected expenses, the volumes of business sold or the average volumes of business in force during the period must be taken into account. Additional business above that expected brings in additional margins, and justifies additional expenditure to process that business. Therefore, in analysing expenses it is unit costs rather than the monetary expenditure that are the key metric.

In other words, comparison of actual vs expected expenses is best performed by considering expense per policy (or per another volume measure) rather than by total expense amount.

3 Sources of and levers on surplus / profit

There are many reasons why results turn out to be different to expected. Some of these will be beyond the control of the management of the company, however others will be controllable, at least to some extent. Factors that management can affect through management control systems to influence the amount of surplus / profit are known as *levers*.

In this section, we look at the:

- possible sources of surplus
- levers that may be used to control the amount of surplus.

3.1 Sources of surplus

Possible sources of such surplus / profit (deficit / loss) include:

- **mortality**
- **morbidity**
- **claim frequency**
- **claim amounts**
- **withdrawal / lapses**
- **investment income and gains**
- **expenses**
- **commission**
- **salary growth**
- **inflation**
- **taxation**
- **premiums / contributions paid**
- **new business levels.**

Claim frequency and claim amounts apply to general insurance.



Question

State the three key sources of surplus that are likely to be included in the analysis of the surplus arising on a portfolio of level, without-profit annuities in payment.

Solution

The key sources of surplus are likely to be:

- investment return
- expenses
- mortality.

Other sources of surplus (or deficit) can arise as a result of more strategic events, such as:

- **failure of reinsurer or of derivative counterparty**
- **restructuring of the business / fund, such as bulk sales or acquisitions.**

A change to valuation methods or assumptions may also lead to surplus (or deficit). The impact of assumption changes depends on the extent to which assets and liabilities are matched.

If assets and liabilities are well matched in terms of a particular variable (*eg* interest rates), then there should be limited impact on surplus as a result of changes in relation to that variable since the assets and liabilities should move in a similar way.

3.2 Levers on surplus

The levers that can control the amount of surplus / profit are the factors that the provider can affect by using management controls to increase value.

In particular:

There are various ways in which providers can control and manage the cost of the payments they make and their expenses.

For example, management can try to:

- **reduce the likelihood of claims through:**
 - **good underwriting of new business**
 - good underwriting at the claim stage
 - providing customer incentives *not* to claim
- **reduce the cost of claims through:**
 - **cost-effective claims management procedures**
 - *eg* by periodically reviewing ongoing claims
 - **using reinsurance to limit the volatility of claims or to protect from the risk of large claims**
 - reducing *future* benefit payments
 - keeping guaranteed benefits to a minimum
 - introducing / increasing excesses

- **control expenses:**
 - periodically reviewing expenses
 - keeping charges / premiums flexible
 - ensuring that claims expenses are commensurate with the claim size
- **reduce the number of contracts that lapse or that do not renew at the renewal date**
- **follow an investment policy that increases investment returns (subject to an acceptable level of risk)**
- **adopt an effective tax management policy.**

In the rest of this section, we look at each of the above in more detail.

3.3 Reducing the likelihood of claims

Good underwriting of new business

Underwriting of new business is important in order to minimise anti-selection, and hence poor claims experience.



Question

Suggest ways in which an insurance company might ensure that new business is adequately underwritten.

Solution

It could ensure that:

- the level of risk is taken into account at the new business stage by requesting pertinent data such as previous claim history, convictions *etc*
 - unacceptably high risks are defined and excluded
 - policy documentation is watertight, *eg* exclusions are given and worded carefully
 - data is shared with other insurers regarding individuals who have made fraudulent claims in the past.
-

Good claims underwriting

Underwriting at the claim stage (or *loss-adjusting*) can help both to reduce excessive claims and to identify fraudulent claims.

A provider can put measures in place to prevent fraudulent claims. The requirement to see

- **medical certificates**
- **death certificates**
- **pictures of damage**
- **reports by loss assessors**
- **pictures of stolen goods**
- **evidence of business continuity incidents**

can all be implemented.

The extent to which these are used depends on the size of the loss / claim and the perceived risk of fraud.

For example, a life insurance company in a developed country may require more evidence than just a death certificate in the case of a death on holiday in an undeveloped country for a young life with a high sum assured, where the policy was recently taken out.

For a general insurer, loss by theft is particularly susceptible to fraud, because by its nature the items stolen are not available to view after the theft. Policyholders should be advised to have photographs of any small, high value items, such as jewellery.

Customer incentives

It may be possible to incentivise policyholders *not* to claim. For example:

A general insurer can control claims and expense costs by offering discounted premiums in future years to policyholders who do not make claims.

In other words, it can offer a 'no claims discount'.

3.4 Reducing claim costs or benefit amounts

Reviewing ongoing claims

For some contracts, benefits are paid in instalments. It is important to review the continued eligibility for these benefits regularly.

For example, where payments are made under an income protection arrangement that provides benefits on incapacity, then costs can be controlled by requiring the beneficiary to provide ongoing proof of eligibility for the benefit. The provider may provide rehabilitation services to assist and support the beneficiary to recovery.

Use of reinsurance

There are many different types of reinsurance that could be used in order to reduce an insurer's exposure to large claims and claims volatility, and hence reduce the risk-based capital requirements.

Reducing future benefit payments

It may be possible for the provider to reduce the benefit payments that it must make in the future. For example:

A government could reduce costs by taking a unilateral decision to raise the age at which the State pension becomes payable.

Minimising guarantees

Guaranteed benefits are far more onerous on a provider than benefits which are not guaranteed. It may therefore be in the interests of the provider to reduce the level of guarantees that it offers. For example:

A benefit scheme can control costs by not guaranteeing regular benefit increases but only giving discretionary increases as and when they can be afforded.

Similarly, a life insurer could reduce guarantees by selling with-profit or unit-linked business, rather than without-profit business.

Use of excesses

A general insurer can reduce the number and amount of claims by introducing an excess into the product design. This will mean that the policyholder will pay the first part of any claim.

The *number* of claims will be reduced because fewer claims will exceed the excess level. The *amount* of claims will be reduced because policyholders will be paying a larger part of each claim.

3.5 Controlling expenses

Reviewing expenses

Regular reviews of expenses can help to ensure that the costs arising from each product line are monitored and controlled and that appropriate allowances are made when pricing and provisioning.

Expense analyses can also help to ensure that procedures are standardised for efficiency.

Flexible charges / premiums

Charges and/or premiums may be guaranteed (fixed) or flexible. If they are flexible, it means that the provider has the option to increase them if experience turns out to be poor. For example:

If a provider can change any expense charge it makes to the customer within the product design then costs can be passed on in this way.

Ensuring claims expenses are commensurate with claim size

A provider will wish to ensure that costs are kept to a minimum and, in order to do so, it will consider the different methods it can use in order to reduce them. However, it must also consider that the cost of implementing these methods might outweigh the benefits that will ultimately be derived from them. For example:

A provider can manage the expenses associated with benefit payments, by ensuring that the costs of claims management are commensurate with the cost of the claim.

Two examples of this are given below:

Example 1

- **A motor insurer is likely to accept without question a single estimate from a garage for damage repairs of up to, say, £500.**
- **For larger sums, up to perhaps £1,000, the insurer might require more than one estimate to be submitted, or alternatively the work to be carried out by the insurer's own approved repairer.**
- **Insurers are likely to appoint professional loss adjusters to investigate large, complex or contentious claims. In some arrangements, loss adjusters can prepare and negotiate claim settlements on behalf of insurers. For motor insurance, loss adjusters are most likely to be appointed for personal injury claims and the largest claims such as where the vehicle is a write-off.**

Example 2

- **With a permanent health insurance claim, the amount of medical evidence that an insurer will require before accepting a claim will depend on both the amount of weekly or monthly benefit, and the expected duration of the illness or condition.**
- **A potentially chronic condition can justify considerably more time and costs in claims assessment than an acute illness of limited duration.**

Increasing renewals / reducing lapses



Question

Suggest actions that a general insurance company could take in order to increase the number of policies that renew at the renewal date.

Solution

Some possible actions are:

- the issue of renewal notices
 - automatic renewals, *eg* policy renews *unless* the policyholder specifies not to
 - loyalty discounts
 - good customer service and claims handling
 - marketing activities to promote the brand
 - the maintenance of competitive premiums.
-

3.6 Increasing investment returns

This relates to the principles of investment that were discussed in an earlier chapter, *ie*:

- a provider should select investments that are appropriate to the nature, term and currency of the liabilities, and the provider's appetite for risk
- subject to this, the investments should also be selected so as to maximise the overall return on the assets, where overall return includes both income and capital.

3.7 Effective tax management



Question

Suggest ways in which an insurance company might ensure that an effective tax management policy is in place.

Solution

This may be achieved through:

- tax allowances being fully utilised
 - tax being paid out on time (to avoid penalties)
 - tax-efficient vehicles being used.
-

4 Distribution of any surplus / profit arising

4.1 Insurance companies with with-profit policyholders

For with-profit life assurance business some or all of the distributable surplus is allocated to policyholders in the form of bonuses.



Question

Explain why the with-profit policyholders might get only some of the with-profit distributable surplus.

Solution

Not all of the distributable surplus will necessarily be distributed to this generation, *ie* the company may retain some as working capital.

Also, in a proprietary company, some of the surplus will go to the shareholders.

The structure of the bonus and the manner in which it is paid is determined by the terms of the policies and the constitution of the company. The constitution of the company may also determine the maximum proportion of the distributed surplus that can be paid to shareholders. In some jurisdictions this is determined by legislation.

For example, a very common approach for proprietary companies in the UK is for 90% of all with-profit surpluses (from whatever source) to go to policyholders and 10% to shareholders.

A mutual insurance company has no shareholders and thus all the distributable surplus belongs to the policyholders.

4.2 Other companies or corporate institutions

The types of provider included in this section are:

- life insurers with only non-participating (*ie* unit-linked or without-profit) policyholders
- general insurers
- banks.

For all other corporate institutions the surplus belongs entirely to the shareholders, and the only decision the directors of the company have to make is the extent to which it is retained in the business or distributed as dividends to shareholders.



Question

The *directors* of a company want to retain surplus in the business to increase the available capital of the company.

Explain why the *shareholders* might be happy to see surplus retained in the business rather than distributed to them as dividends.

Solution

If the shareholders believe that the company will use the capital to generate more returns for them in future, commensurate with the amount of risk being taken on, they may be happy for surpluses to be re-invested in the business.

There may also be tax advantages if the result is that the shareholders' return is received more as capital gain and less as income.

4.3 Benefit schemes

For benefit schemes any surplus is usually retained within the scheme, and may be used to:

- **enhance the benefits of members, or**
- **reduce future contributions of members and/or the employer.**

Because it is usually difficult to remove benefit enhancements once awarded, changes in contribution rate are normally the first choice.

In some jurisdictions it is possible for surplus to be repaid to the scheme sponsor, and in others it is not.

5 Issues surrounding the amount of surplus to distribute

5.1 Life insurance companies

For a life insurance company the key factors that will affect the amount of surplus distributed are:

- **provision of capital**
- **margins for future adverse experience**
- **business objectives of the company**
- **policyholder expectations**
- **shareholder expectations**
- **other stakeholder (including staff) expectations.**

Provision of capital and margins for future adverse experience

Not all surplus arising will be distributed. If the distribution is deferred, the surplus augments the company's available capital during this deferment period.

There are several reasons why life insurance companies need capital. These are discussed elsewhere in the course. One of the main sources of working capital is simply to defer profit distribution and retain the capital within the business.

Where conventional with-profit policies are involved, there are various additional considerations. The premium rates for with-profit policies are greater than those for without-profit policies because the former contain margins designed to generate profit that will then be distributed to policyholders. The pace at which the profit arises and the pace at which it is distributed may or may not be the same. If part of the profit is deferred to some future date before being distributed then it will augment the company's free assets in the meantime.

The last sentence assumes that the regulatory regime does not require provisions to be established for future expected bonus distributions. If this is not the case (*eg* under Solvency II), then free assets will not be augmented to the full extent of the bonus distribution that is being deferred, because a liability has to be set up in relation to this expected future distribution. However, deferring the bonus distribution may still result in an increase in available capital due to there being lower guarantees building up as a result of the lower regular bonus declarations.



Question

'If future experience is worse than expected, a life insurance company can simply reduce its bonus rates. The margins in the with-profit premium rates mean that the company is not at risk from future adverse experience.'

Comment on this assessment.

Solution

The assessment is not completely true. The company does still face the risk of adverse experience because, despite the premium rate margins, there may be a limit to the extent to which it can reduce bonuses. In particular:

- The basic guaranteed benefit under all with-profit contracts means that there is some level of adverse experience beyond which any further losses cannot be recouped by reducing bonus declarations (*ie* the company cannot declare negative bonuses).
 - Regulation or company constitution may specify that certain sources of surplus (or loss) are shared between the policyholder and the company, while others are entirely attributable to the company. For example, investment surpluses may be shared but all other sources of surplus or loss (*eg* an expense overrun) attributed to the company.
 - Competitive pressure and policyholders' expectations may limit the extent to which bonuses can be reduced in practice.
-

Where profit is not being distributed as and when it arises, there will be years when the amount distributed exceeds the amount generated and vice versa. However, over time it would be expected that there should be a balance between the two. Sustained over-distribution could lead to an excessive drain on the free assets. Sustained under-distribution is likely to be contrary to policyholders' expectations.

There are two concepts to consider here – timing and amounts:

1. If the combination of product design and bonus distribution system is such that profit is not distributed as it arises, the company needs to manage this mismatch over time.
2. On average, bonuses paid to policyholders need to be in line with what they have a right to. If bonuses are too great, perhaps because bonus declaration levels have been massaged upwards for commercial reasons, then the capital situation of the company might be badly affected. If bonuses are too small, then policyholders are getting a bad outcome.

The extent to which it is possible to defer the distribution of profit depends on the form of the distribution.

For example, in some countries (including the UK) bonuses are given as a combination of:

- *Regular* – these bonuses (also sometimes referred to as reversionary bonuses) are added to the sum assured during the life of a policy. Once a regular bonus is attached it is a legal liability of the company, *ie* the guaranteed benefit of the policy has increased.
- *Terminal* – as the name suggests, these final bonuses are added only at the time a claim is made. Terminal bonuses are not guaranteed.

The use of terminal bonus enables a company to defer the distribution of profits.

Business objectives of the company and retention of margins

A with-profit life insurance company is likely to have as one of its business objectives the maximisation of the profit distribution to policyholders so as to improve its competitive position by demonstrating good returns for the premiums invested. However, an aggressive distribution policy will result in the company having very limited free assets, and thus limited ability to survive risk events.

The converse position is equally important. A company that retains more surpluses than necessary to protect against risk events, ensure solvency, finance business growth and allow appropriate investment freedom may find securing new business more difficult because of the lower bonuses it is awarding.

The financial press may publish comparisons of bonus rates and/or payouts under with-profit contracts. Therefore, a reduction in bonus rates may adversely affect the company's competitive position and so lead to a reduction in new business.



Question

Explain why a reduction in new business might be detrimental to existing policyholders.

Solution

Lower new business volumes would result in fewer in-force policies over which to spread the company's overheads and so per policy expenses for existing policyholders would increase.

However, there may be times when the company *should* reduce bonus rates to reflect the current financial reality, and there may be times when the company *must* reduce bonus rates to ensure that it remains solvent.

Stakeholder expectations

Policyholders and shareholders may have expectations regarding the form of the profit distribution and the level of the bonuses or dividends given.



Question

List three factors that may give rise to such expectations.

Solution

Such expectations would arise from:

- documentation issued by the insurer
 - past practice
 - general practice of the insurance market.
-

Failure to meet these expectations will lead to policyholder dissatisfaction and the risk of losing existing and/or new business. It may also in some countries, for example the UK, be grounds for intervention by the insurance supervisory authority in the affairs of the company.

Staff may have expectations relating to the ongoing security of their job and the level of bonuses and/or salary increases.

5.2 Benefit schemes

There are several ways for a benefit scheme to reduce or remove a surplus, including:

- increase the value of the benefits and hence the value of the liabilities
- reduce future contributions for a period of time, so that the surplus decreases gradually as additional liabilities accrue
- transfer all or part of the excess assets from the scheme – eg to the sponsor as a refund of contributions paid or to the beneficiaries as a one-off benefit payment.

Factors influencing the decision about the application of a surplus or deficit are:

- legislation
- tax treatment
- scheme rules
- discretion of the sponsor or fund managers.

In the latter case, the following may also be taken into account:

- risk exposure of the various parties
- the source of the surplus
- industrial relations.

A decision also has to be made about the:

- speed of corrective action.

Each of these factors will now be considered in more detail.

Legislation

For a benefit scheme, legislation is likely to be the major factor in determining the application of surplus or deficit.

If a benefit promise has been made, legislation may insist that the benefit is provided whether or not any funds set aside prove to be sufficient. There may be a legal obligation on a sponsor to make good any deficit, even if doing so results in the insolvency of that sponsor, and affects other interests of employees, such as their continued employment.

Benefit scheme deficits may also have a prior ranking in the event of the sponsor's insolvency.

Legislation may also require surplus to be used to increase the benefits being provided, and may even dictate which categories of members should have priority for such increases.

A potential problem with legislation constraining options for using surplus is that it can deter sponsors from funding prudently (or even from providing benefits at all). The undesired consequence may be that the security of members' benefits may be worsened in the long term.

Tax treatment

Where the funds set aside are subject to a beneficial tax treatment, it is possible that surplus funds may be excluded from this beneficial treatment.

It is also likely that the sponsor would be required to pay tax if receiving a return of surplus funds.



Question

Explain why it is likely that the sponsor would be required to pay tax if receiving a return of surplus funds.

Solution

If there was no tax payable by the sponsor on return of surplus funds, the system would be open to manipulation for tax-avoidance by the sponsor who could deliberately set aside excess funds to take advantage of the beneficial tax treatment (eg compared with corporation tax on profits) and then receive a return of surplus funds tax-free.

Scheme rules

Where legislation does not restrict the application of surplus or deficit, the sponsor can choose to place restrictions on the use of surplus, deficit, or both when setting up the scheme through which the benefits are provided.

This may have been done as a reassurance to the potential beneficiaries that the benefits will be provided even if the fund suffers from adverse experience, or it may have been done as an attempt to prevent disputes were deficits or surpluses to arise.

Discretion of the sponsor / managers

If there are no detailed restrictions from the State or in the rules of the scheme, the sponsor or the managers of the fund may be able to choose how to apply any surplus or deficit.



Question

Outline the factors that the sponsor or managers of the fund should take into account in cases where they are making this decision.

Solution

The factors they should take into account are:

- who would make good any deficit – some would argue that this party should also benefit from any surplus
 - the source(s) of the surplus
 - employee relations
 - the volatility of the surplus.
-

Risk exposures

In making these decisions the risk exposure of the various parties may be considered.

For example, if the sponsor is exposed to the risk of making good any deficit, it may be felt that the sponsor should take the benefit of any surplus.

There may be situations where it is necessary to take legal advice before dealing with any surplus or deficit.

A difficult decision for scheme managers is whether a surplus should be used to the advantage of the members or the sponsor. Whilst the scheme managers' primary responsibility is to the members, they will often allow the sponsor some flexibility in the financing of the benefits.

For example, if a surplus arose because of generous contributions from the sponsor, the managers may agree for the sponsor to reduce future contributions or take a refund of surplus.

It is easier for a sponsor to claim that it has a right to benefit from a surplus arising in a scheme in which it meets the entire cost of the benefits, *ie* a non-contributory scheme. The position is less clear for a scheme in which members also contribute towards the cost of the benefits and a surplus has arisen through exceptional investment performance on the assets.

Source of surplus

The source of the surplus or deficit may also be taken into consideration, particularly when applying the surplus or deficit to a certain category of beneficiary.

For example, in a final salary pension scheme a surplus may arise as a result of pension increases being lower, in real terms, than was expected. In these circumstances it may be decided to use the surplus to increase pensions for pensioners, perhaps restoring their value in real terms.

If the surplus or deficit is from a source that is liable to particularly volatile experience, the most appropriate application of the surplus or deficit may be to retain it as a balance for future volatility. This approach is perhaps more likely to be adopted in the event of surplus, rather than deficit where such an approach may not be prudent. It is also more likely when the surplus or deficit is small relative to the total value of the assets or liabilities.

In an ongoing scheme, small surpluses and deficits can come and go as actual experience is more or less favourable than the assumptions. The scheme managers may decide to retain an unallocated surplus to act as a contingency reserve against future experience being less favourable.

Industrial relations

Another factor that may affect a decision on the application of surplus or deficit may be the expected effect of that decision on industrial relations. A sponsor may therefore make a decision that is more generous to beneficiaries than may otherwise seem necessary.

Speed of corrective action

Where surplus is to be applied to the advantage of the sponsor, or deficit is to be made good by the sponsor, a further decision would be required relating to the pace at which this will happen. It is likely that the speed of removal of deficit would be required or expected to be faster than for the removal of surplus. A common approach adopted for pension benefits may be for a deficit to be removed over a period of say five years and a surplus to be removed over a longer period, perhaps the remaining working lifetime of current employees with a benefit entitlement.

The appropriate speed of corrective action may depend on the magnitude of a deficit. For example, if the deficit is large the sponsor might be required to reduce it significantly over a short period of time and then be permitted to remove the remaining deficit over a longer period.

The chapter summary starts on the next page so that you can keep all the chapter summaries together for revision purposes.

Chapter 36 Summary

Definition of surplus / profit

Profit is the difference between revenue and expenditure. Because of the long-term nature of financial services contracts, the final profit from a scheme or tranche of policies cannot be determined until all risks have gone off the books.

Surplus is the difference between the value of the assets and the value of the liabilities. Surpluses (or deficits) may appear and disappear as the contract's experience unfolds.

The *surplus arising* over any time period is the change in the surplus over the time period. Surplus arising is equivalent to profit.

Reasons for performing an analysis of surplus / profit

An *analysis of surplus* (or *profit*) is a breakdown of the surplus arising over a year into its constituent parts.

A provider will want to analyse the surplus arising in order to:

- show the financial effect of divergences between the valuation assumptions and the actual experience
- determine the assumptions that are the most financially significant
- show the financial effect of writing new business
- validate the calculations and assumptions
- provide a check on the valuation data and process, if carried out independently
- identify non-recurring components of surplus, to help make decisions about distributing surplus
- reconcile the values for successive years
- provide management information
- provide data for use in executive remuneration schemes
- provide information for the provider's accounts
- demonstrate that the variance of the parts is a complete description of the variance of the whole
- give information on trends in the experience of the provider to feed back into the actuarial control cycle.

Carrying out an analysis of surplus

To analyse the performance of a product, set of products or an entire financial service product provider over a period, the actual results obtained should be compared with those that were expected.

The expected results can be modelled by using the models produced at the product development stage. The assumptions within the models should be mutually consistent.

By applying the expected new business and renewal levels to such models and aggregating the results, sets of revenue accounts can be developed. The relationships between the elements of the modelled revenue accounts should be mutually consistent. These modelled accounts can be compared with the actual accounts to derive the deviation from expected.

The deviation can be analysed to help answer the questions arising, particularly concerning the investment returns obtained and the product development and other costs incurred. Expenses should ideally be analysed in the form of unit costs rather than total amount.

Sources of surplus / profit

Actual vs expected experience in terms of:

- *claims* – mortality, morbidity, claim frequency, claim amounts
- *volume* – new business levels, withdrawal / lapses
- *other cashflows* – investment income and gains, expenses, commission, premiums / contributions paid
- *other factors* – salary growth, inflation, taxation.

Other sources:

- strategic events, *eg* failure of counterparty, business restructure
- change to valuation method or assumptions (depending on matching).

Levers on surplus / profit

These can be used to try to:

- reduce the likelihood of claims, *eg* through good underwriting
- reduce the cost of claims, *eg* through claims management procedures or by using reinsurance
- control expenses
- increase renewals and/or reduce lapses
- follow an investment policy that increases investment returns (subject to an acceptable level of risk)
- adopt an effective tax management policy.

Distribution of any surplus / profit arising

For life insurance companies, distributable surplus is allocated to with-profit policyholders and/or shareholders or retained as working capital.

For other corporate institutions, the surplus belongs to shareholders and is either:

- retained in the business
- distributed as dividends.

For benefit schemes any surplus is usually retained within the scheme, and may be used to enhance the benefits of members, or to reduce future contributions of members and/or the employer. It may or may not be possible to return surplus to the sponsor.

Issues surrounding the amount of surplus to distribute

For a life insurance company the factors that will affect the amount of surplus distributed are:

- provision of capital
- margins for future adverse experience
- business objectives of the company
- policyholder, shareholder and other stakeholder (including staff) expectations.

For a benefit scheme, the factors influencing the decision about the application of surplus or deficit are:

- legislation – likely to be the major factor
- scheme rules
- tax treatment
- discretion of the sponsor / managers.

If the sponsor or the managers of the fund are able to decide how to apply the surplus or deficit, this decision will depend on the:

- risk exposure of the various parties
- source of the surplus or deficit
- expected effect of that decision on industrial relations.

Where surplus is to be applied to the advantage of the sponsor, or deficit is to be made good by the sponsor, a further decision would be required relating to the *pace* at which this will happen.

The practice questions start on the next page so that you can keep the chapter summaries together for revision purposes.



Chapter 37 Practice Questions

37.1 Describe why a provider of long-term financial contracts will carry out an analysis of the variance in its surplus.

37.2 An insurance company has used a profit test model to develop and price its new critical illness product.

Describe how the company could build on the profit test model to project its expected results and to review the progress of the product six months after its launch.

37.3 Suggest reasons why a general insurance company may make a loss during a period when it has been writing profitable business.

37.4 List the sources of surplus / deficit in the valuation of a portfolio of motor insurance policies that arise from experience differing from that assumed.

37.5 (i) List the *key* sources of surplus / deficit that would likely be included in an analysis of a life insurance company's surplus. [4]

Exam style

(ii) Give examples of possible causes and effects of a detrimental change in each of these sources for a with-profit endowment assurance portfolio. [8]

[Total 12]

37.6 Following the introduction of recent legislation that outlaws discrimination in the provision of pension benefits, a company has amended the design of its defined benefit (final salary) scheme so that all options offered are priced on a unisex basis (*ie* the same terms are offered irrespective of gender). At the following scheme valuation, a large deficit is revealed.

Exam style

(i) Discuss the possible effects on the scheme's funding level of the change in option pricing to a unisex basis. [4]

(ii) List the other possible sources of surplus or deficit that may have arisen since the last valuation. [8]

[Total 12]

37.7 A life insurance company has an established portfolio of income protection business, which provides an income to policyholders during periods of incapacity due to sickness.

Exam style

It is considering implementing a claims management process, where health professionals are used soon after a claim is notified to the insurer to treat the claimants and help them back to work. The process will also be used on the claims currently in payment.

Describe the potential impact of this proposal on the claim inception and termination rates. [5]

- 37.8 As part of the process of managing its costs, an insurance company should ensure that the costs of claims management are commensurate with the cost of the claim.

Explain how this might affect the approach taken to claims management by a:

- (i) general insurance company in respect of its household buildings and contents insurance business
- (ii) life insurance company in respect of its waiver of premium business.

With a waiver of premium contract, a policyholder's premium is waived (ie not required to be paid) during a period of sickness or disability and/or sometimes unemployment.

- 37.9 A proprietary life insurance company specialises in with-profit business. The with-profit actuary has been asked to produce a report setting out the recommended discretionary benefits to be awarded on a particular product at the end of the year.

Exam style

- (i) List, with reasons, the parties that should be considered when making this recommendation. [6]
- (ii) Outline the factors that should be considered in setting the level of discretionary benefits and the factors to consider in communicating the results of this task. [10]

[Total 16]

- 37.10 The latest valuation of a well-established defined benefit pension scheme has revealed that there is currently a surplus and that continuation of the existing contribution rate would give rise to a substantial future surplus. The scheme actuary has therefore recommended a reduction in the sponsoring company's contribution rate.

Exam style

The finance director of the company has asked the actuary to consider an alternative course of action. As the company is experiencing cashflow difficulties at the moment, the director would like to take a refund of some of the surplus fund and a more drastic (and shorter-lived) cut in the contribution rate.

Discuss the factors that should be taken into account in replying to the finance director. [12]

- 37.11 A defined benefit pension scheme offers voluntary membership and many employees do not join at the same time at which they start employment.

One of the benefits provided by the scheme is a pension payable on ill-health retirement.

Discuss the advantages and disadvantages for the employer of the following options in connection with the benefits on ill-health retirement to be provided to employees who do not join the plan when they start employment:

- offer membership at any time with no regard to medical evidence
- only permit membership on receipt of satisfactory medical evidence
- offer membership but with some adjustment to ill-health benefits.



Chapter 37 Solutions

37.1 Because of the long-term nature of these contracts, the final profit from a scheme or tranche of policies cannot be determined until all have gone off the books.

Waiting until this happens before the terms for the next tranche of policies can be determined is clearly impractical.

To monitor the progress of the business it is necessary to value the outstanding liabilities from time to time, often annually.

A provider will want to analyse the surplus arising over a time period, *eg* a year, in order to:

- show the financial effect of divergences between the valuation assumptions and the actual experience
- determine the assumptions that are the most financially significant
- show the financial effect of writing new business
- validate the calculations and assumptions used
- provide a check on the valuation data and process, if carried out independently
- identify non-recurring components of surplus, thus enabling appropriate decisions to be made about the distribution of surplus
- reconcile the values for successive years
- provide management information
- provide data for use in executive remuneration schemes
- provide detailed information for publication in the provider's accounts
- demonstrate that the variance in the financial effect of the individual sources is a complete description of the variance in the total financial effect
- give information on trends in the experience of the provider to feed back into the actuarial control cycle.

37.2 ***Project expected results***

The initial launch profit test model can be combined with estimates of future sales volumes and mix of business to build a complete model of the company's projected future revenue accounts and balance sheets.

This model is developed by multiplying the profit test results by the expected number and type of contracts to be sold in each future year.

Then, for each future year, the contracts still in force from previous years are added in.

This will then give a model that can be used to build up the expected future progress of the business as shown by the revenue accounts and balance sheets.

This gives a model based on expected sales volumes and expected experience.

It is important in building such a model to ensure that the elements of the revenue account are self-consistent in their own right. It is not sufficient to project premiums, investment income, death claims, lapses *etc* independently.

Review progress after six months

A second model can be built up, similar to the one above, but using the *actual* volumes and mix of business sold, rather than *expected* volumes.

The actual revenue accounts and balance sheets for the business showing the actual experience of the company can then be used in conjunction with these two models:

- Comparison of the initial launch model of expected results and the second model identifies differences that are a result of sales volumes or mix of business being different from expected.
- Comparison of the second model with the actual experience identifies differences that are a result of differences between actual and expected experience.

These results will help the company in answering questions such as:

- How has the actual critical illness claim rate affected the profitability and solvency of the company?
- Has the company sold sufficient volumes of the product to recoup the money spent in the design and launch of the product?

The answers to such questions will give an initial indication of whether the profitability criterion used in the profit test model in the first place is being met in practice. This can be used as feedback information in the actuarial control cycle.

37.3 Reasons why a general insurance company may make a loss while writing profitable business:

- deterioration in claims experience of previous years' business (higher claim amounts and/or frequency)
- lower than expected investment return
- over-spending on expense budget / one-off expenses
- provisions too cautious / increase of prudence in provisioning basis
- reinsurer failure / default
- fraud
- change in legislation or tax
- regulatory fines.

37.4 Sources of surplus / deficit for motor insurance include divergence from valuation assumptions of:

- claim rates
- claim amounts
- volumes of business
- mix of business, *eg* by gender, age, type of car, level of excess *etc*
- proportion of policyholders who renew
- expenses
- expense inflation
- claim inflation
- commission
- mid-term cancellation rates
- endorsements (will affect expenses and mix of business)
- investment return.

37.5 (i) ***Key sources of surplus / deficit for life insurance***

The *key* sources include divergence from valuation assumptions of:

- mortality and other insured events, *eg* morbidity for critical illness / long-term care [1]
- expenses including commission [1]
- withdrawal rates [$\frac{1}{2}$]
- investment return [$\frac{1}{2}$]
- new business volumes and mix. [1]

Another possible key source is changes to the valuation basis.

[1]

[Maximum 4]

(ii) ***Causes and effects***

Mortality

Poor / ineffective underwriting might lead to higher mortality rates, leading to a greater number of claims. [1]

If these occur early in the policy term, death benefits may exceed provisions and initial costs may not be recovered, thus leading to mortality losses. [1]

Expenses, including commission

Poor estimates of the costs of new systems / processes, an inefficiently run business, unexpected one-off expenses or high expense (*eg* salary) inflation could lead to higher expenses than anticipated. [1]

Commission levels set at the outset may need to be raised to meet those of the competition thus increasing costs. [1]

If higher costs are passed on to the policyholder they may lead to loss of customers. [½]

Withdrawals

Customers might experience poor levels of service and/or perceive the product as being poor value for money, leading to higher surrenders. [1]

Higher early surrenders will result in non-recovery of initial costs. [½]

If the volume of policies in-force is consequently lower than expected, this will lead to higher fixed costs per policy, and potential loss of customer loyalty and brand image. [1]

Investment return

Poor investment management could lead to comparatively low returns. [½]

Customers would be disappointed and could surrender and/or take their new business elsewhere (eg when increasing their mortgages and thus looking for additional cover). [1]

New business

New business volumes could be low due to weak marketing or a very competitive market, or due to tax changes making such policies less attractive. [1]

The new business mix could be detrimental ... [½]

... eg more small policies than expected. [½]

Lower levels of new business and/or a smaller book of in-force business will increase fixed costs per policy. [1]

Valuation basis changes

The valuation assumptions would change if the company's view of future experience has changed, eg as a result of recent trends that are expected to continue, or because the company wishes to include more prudence. [1]

A strengthening of the basis would reduce the surplus arising now. [½]

[Maximum 8]

37.6 (i) **Possible effects on the scheme's funding level**

When faced with a situation in a question that doesn't look familiar, it's sometimes difficult to get a grasp of the issues or to know where to start. Start by addressing some of the key phrases in the question, for example:

- *funding level, ie assets over liabilities: what would cause the funding level to fall or rise?*
- *change in option pricing: how might the company set the unisex rates and what might happen to the take-up rate of the option?*

Following the change in option pricing to a unisex basis, it is possible that either a surplus or deficit will have arisen. [½]

The change will affect the scheme every time a member reaches a position of deciding whether to exercise an option. [½]

If the option terms have been set to be the more generous of the previous terms, this would have a negative impact on funding levels. The opposite is the case if set to be the less generous. [1]

If the option terms have been set to be equivalent to an average across males and females, then the impact on the scheme will depend on the extent to which the actual numbers of each exercising are in line with the assumed male / female split used to determine the average. [1]

However, the change will also affect the take up rate of the option. [½]

A more generous basis for either males or females may make it more likely that the option will be exercised by individuals of that gender. [½]

For example, if there is a reduction in the female factor (which might be the case if the unisex factor is set in relation to the proportions of male / female members) then the take up rate for females may possibly reduce. [½]

On balance, this selective effect would reduce the funding level as those who benefit from improved terms will be more likely to take the option. [1]

[Maximum 4]

(ii) ***Sources of surplus / deficit for a final salary pension scheme***

Divergence from valuation assumptions of:

- investment returns on scheme assets [½]
- general salary increases [½]
- promotional salary increases [½]
- inflation used for pension increases [½]
- discretionary pension increases [½]
- ill-health retirement rates [½]
- pre-retirement mortality rates [½]
- post-retirement mortality rates [½]
- mortality rates of dependants [½]
- withdrawal rates [½]
- early / late retirement rates [½]
- amounts commuted [½]
- expenses [½]
- expense inflation [½]

- marital statistics experience. [½]

Other factors that could cause a surplus / deficit to arise include:

- differences in contributions paid vs those expected [½]
- a change of valuation method [½]
- a change of valuation basis [½]
- benefit changes [½]
- changes in legislation, *eg* taxation changes [½]
- differences in the number of new entrants vs those expected [½]
- failure of any insurer or derivative counterparties used [½]
- restructuring of the scheme [½]
- surplus carried forward from a previous valuation. [½]

[Maximum 8]

37.7 ***Impact of claim management on income protection business***

The question asks for the impact on both claim inception and termination rates. In order to answer the question fully, consideration should be given to different groups of policyholders, namely:

- *policyholders currently claiming*
- *policyholders who have submitted a claim that has not yet been accepted*
- *policyholders not currently claiming.*

It is important to consider the effects in both the short and the long term.

Claim inception rates

There should be a reduction (improvement) in claim inception rates. [1]

This is because some of the claims notified to the insurer during the deferred period, which in the past would have been admitted, will no longer be made as a result of the early intervention by health professionals. [1]

In the longer term, the company may also find that once policyholders and intermediaries become aware of the claims management process, borderline claimants may be discouraged from claiming. [1]

Hence the number of claims *notified* to the insurance company may in due course decrease. [½]

Claim termination rates

The implementation of a claims management process should, in the short term, lead to an increase (improvement) in claim termination rates. [1]

This is because some of the claims currently in payment are likely to be terminated earlier than before, due to the intervention by health professionals. [½]

The treatments given should lead to some claimants returning to work sooner than they otherwise would have done. [½]

However, termination rates may reduce (worsen) in the longer term. [½]

This is because the types of claims that could be dealt with by early health professional intervention may have been resolved during the deferred period and therefore not come into payment. [1]

Therefore the claims in payment may, on average, have a higher level of disability or illness than before the process was introduced. [1]

[Maximum 5]

37.8 (i) ***General insurance company – household buildings and contents insurance business***

Claims up to a certain (specified) monetary amount may be accepted on production of a single receipt or estimate. This keeps the expenses of investigating small claims low.

For larger amounts, the insurance company may require the submission of more than one estimate for work or for the price of a new good.

Alternatively the insurer may require any work to be carried out by a tradesperson or company to be approved or nominated by the insurance company, or for any good to be purchased from a supplier that it has approved or nominated.

For claims beyond a certain amount, the company may insist on sending out a representative (claims handler) to visit to assess the extent of any damage.

For very large claims (or claims which appear to be contentious or complex), *eg* house destroyed after a gas explosion, the company may appoint a professional loss adjuster to assess the claim on its behalf.

(ii) ***Life insurance company – waiver of premium business***

The amount of medical evidence that the company will require before accepting a claim will depend on the:

- amount of premium that is being waived
- expected duration of the sickness / disability or period of unemployment.

A potentially long-term claim can justify considerably more time and costs in claims assessment than an acute illness of limited duration.

37.9 (i) ***Parties to consider***

Shareholders – The level of discretionary benefits awarded should fit in with the long-term strategic aims of the company and should be in line with the dividend philosophy of the company. [1]

There may be rules that state that the shareholders are entitled to a fixed proportion of the discretionary benefits awarded to policyholders. [½]

With-profit policyholders – The level of discretionary benefits awarded should be in line with policyholders' expectations to avoid policyholder dissatisfaction and the risk of losing existing and new business. [1]

Without-profit policyholders – The level of discretionary benefits awarded to with-profit policies should not threaten the security of without-profit policies. [½]

Potential policyholders and brokers – The level of discretionary benefits awarded should be attractive to potential policyholders so that the company can secure adequate volumes of business in the future. [1]

Board of directors – The board of directors should ensure that policyholders' expectations are met, but that policyholder security is not threatened, and that shareholder demands and regulation are also met. [1½]

Competitors – The level of discretionary benefits awarded should not be too far out of line with discretionary benefits awarded by competitors. [½]

Regulators – The level of discretionary benefits awarded should fulfil any regulatory requirements and any requirements specified in the policy literature. [1]

Reinsurers – If the contracts have been reinsured, the reinsurers should be consulted to ensure that existing reinsurance arrangements will still be valid. [½]

Creditors of the company – The level of discretionary benefits awarded should not threaten the security of any outstanding debt / balances to third parties. [½]

Marketing – The marketing department may be able to advise on an appropriate level of discretionary benefits, bearing in mind current and future potential policyholders' needs and competitors. [½]

Administrators / IT – The discretionary benefits must be able to be administered on the systems. [½]
[Maximum 6]

(ii) **Factors to consider**

Factors to consider in setting the level of discretionary benefits

The level of discretionary benefits awarded will depend on the performance of the product (*ie* surplus arising) over the year. [1]

In years where performance has been good, it may be possible to award a higher level of discretionary benefits. [½]

However, the company is likely to choose to smooth experience over time – holding back money in good years, so that it does not need to reduce discretionary benefits in bad years. [1]

Regular discretionary benefits may also be held back so that a terminal discretionary benefit can be paid, so the regular discretionary benefits might be reduced to allow for this. [½]

The company may wish to defer distribution in order to augment available capital. [½]

This helps to provide margins against future adverse experience. [½]

The business objectives of the company might affect how much of the surplus is distributed. For example, if the company is planning to expand, it might choose to award lower discretionary benefits, and instead retain the surplus within the business. [1]

Alternatively, it might have an objective to sell more business and therefore might wish to declare higher discretionary benefits in order to improve the competitive position. [½]

Policyholders, shareholders and other stakeholders (*eg* staff) may have expectations as to the level of surplus distributed as discretionary benefits. [1]

The level of surplus that can be retained by shareholders might be restricted by regulation. [½]

To meet policyholders' expectations, the distribution needs to take into account:

- any illustrations or promises made in the marketing literature for the product [½]
- discretionary benefits awarded on this product in recent years [½]
- discretionary benefits awarded on other (similar) with-profit products, since discretionary benefits for different products should be broadly consistent with each other [½]
- current industry practice, *ie* the discretionary benefits being awarded by competitors. [½]

Factors to consider in communicating the results

The recommendation should be based on a detailed investigation of appropriate discretionary benefits that might be offered. [½]

It might be appropriate to recommend an acceptable range of discretionary benefits or a set of alternatives. [½]

Since there may not be any one optional solution, the alternatives should be presented in an unbiased fashion avoiding pre-judgement as to which is the best solution. [½]

The implications of each alternative – on each of the relevant stakeholders – should also be given. [½]

Any assumptions made should be explained. [½]

In particular, implicit decisions may have been made in determining appropriate discretionary benefits, for example the grouping of policyholders for the purpose of discretionary benefit allocation. [½]

These implicit decisions should be disclosed as part of the process of making the recommendation. [½]

Background information should be clearly presented. However, care should be taken to avoid making the presentation of this background information so complicated that it becomes confusing and detracts from the solution. [1]

Areas of risk should also be highlighted, for example over-distribution of discretionary benefits might threaten the security of existing benefits. [1]

Any potential or perceived conflicts of interest should be disclosed, *eg* if the actuary advises any of the stakeholders on other matters. [1]

The recommendation should be communicated in a way and at a level that is appropriate to the audience. [1]

It may be necessary to issue a warning to the effect that the recommendation applies given the current situation and may not be appropriate if circumstances change. [½]

The actuary should consider and comply with any regulations or rules on setting and communicating discretionary benefits. [½]

Finally, the communication should highlight any data issues that may affect the advice being given, for example the use of incomplete data. [1]
[Maximum 10]

37.10 **Legislation**

Legislation may require that any surplus be used to increase the benefits being provided rather than to reduce future contributions or to be taken as a refund. It may even dictate which categories of members should have priority for such benefit increases. [1]

Presumably such legislation does not apply here (as the actuary's original suggested course of action was a contribution reduction). However, legislation may dictate the permissible form of a contribution reduction (*eg* may insist it is over some longer time horizon than the finance director is proposing). [1]

Taxation

Where the funds set aside are subject to beneficial tax treatment, it is possible that surplus funds may be excluded from this beneficial treatment. It is also likely that the sponsor would be required to pay tax if receiving a return of surplus funds. [1]

If no tax was payable by the sponsor on return of surplus funds, the system would be open to manipulation for tax-avoidance by the sponsor. [½]

Scheme rules

Where legislation does not restrict the application of surplus, it is possible that, in setting up the scheme, the sponsor chose to place restrictions in the scheme rules on the use of surplus. [½]

This may have been done as an attempt to prevent disputes if surpluses arose. [½]

Discretion of the sponsor

If there are no detailed restrictions from the legislation or the scheme rules, the sponsor or trustees or scheme managers may be given the right (*eg* under the trust deed) to choose how to apply the surplus. [½]

Risk exposures

In making these decisions the risk exposure of the various parties to the scheme should be considered. [½]

For example, if the sponsor is required to make good any deficit, then it may be reasonable to assume that they should be entitled to surplus. [½]

The security of members' benefit entitlements is of vital importance. [½]

Further investigation of the sponsor's current cashflow problem is required, in particular to determine whether this is a temporary issue or a more fundamental problem affecting the company's prospects. [1]

If it is believed that the company is in permanent trouble, then a better approach may be to persuade the company to reduce ongoing benefits (as ultimately it is the level of benefits that affects the cost of the scheme, not the rate at which those benefits are paid for). [½]

A poor outlook for the company may make it less likely that the finance director's proposal is acceptable, as this will worsen the security of members' benefits if the company runs into more severe trouble in the future. [½]

The sponsor may argue that if it is exposed to the risk of making good any deficit immediately, it should also be entitled to take the benefit of any surplus immediately. [½]

Source of the surplus

If the surplus arose because of extra contributions in excess of what was strictly required from the sponsor, it may be more acceptable to agree that the sponsor can reduce future contributions in the short term and/or take a refund of surplus. [1]

The appropriate response may be influenced by whether or not members contribute to the scheme. It is easier for a sponsor to claim that it has a right to benefit from a surplus arising in a scheme in which it meets the entire cost of the benefits, *ie* a non-contributory scheme. [1]

The position is less clear for a scheme in which members also contribute towards the cost of the benefits and in which a surplus has arisen. [½]

In an ongoing scheme, small surpluses and deficits can come and go as actual experience is more or less favourable than the assumptions. [½]

The assumptions may be selected to represent a prudent view of what may occur in the long term. In the short term (*eg* the period between valuations) there can be quite marked differences between the assumptions and the actual experience. [1]

Changing the assumptions would change the size of the surplus. [½]

It may be decided to retain an unallocated surplus within the scheme to act as a contingency reserve against the risk of future experience being less favourable than expected ... [½]

... or against the risk of the sponsor being unable to make contributions in future. [½]

Worries about benefit security may mean it is less appropriate to allow the sponsor to take a refund or to make more drastic contribution cuts. [½]

Speed of corrective action

A further decision would be required relating to the pace at which this will happen, *eg* over the remaining working lifetime of current active members. [1]

Other factors

Another factor to consider may be the expected impact on industrial relations. How the finance director's proposal would be received by employees should be considered. [1]

Taking the surplus earlier as suggested may cause liquidity issues. This is unlikely to be a major problem. If it is, the investment policy could be altered to produce a little more income. [1]
[Maximum 12]

37.11 *No regard to medical evidence*

This will be easy for the members to understand and they are likely to appreciate it.

It will be easy for the administrators and will have the lowest cost.

However, it will leave the scheme open to anti-selection. If members only join the scheme when they become aware of illness, this would lead to a significant strain on the fund.

Receipt of satisfactory medical evidence

A decision will be needed on who will provide medical evidence: a doctor appointed by the scheme or the employee's own doctor.

This might lead to conflicts and aggrieved employees.

It may be best to have a scheme doctor, but then there will be additional costs involved.

However, once a member has been accepted into the plan the administration will be relatively straightforward.

Anti-selection risk will be reduced through this option.

Adjustment to ill-health benefits

Anti-selection risk will also be reduced through this option.

A robust scale will need to be set for the adjustments and consistent rules must be applied to different members.

The administration of this arrangement will be more complicated than for the other two options.

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Monitoring

Syllabus objectives

- 13.1 Describe how the actual experience can be monitored and assessed, in terms of:
- the reasons for monitoring experience
 - the data required
 - the process of analysis of the various factors affecting the experience
 - the use of the results to revise models and assumptions.
- 13.2 Describe how the results of the monitoring process in the actuarial control cycle or the risk management control cycle are used to update the financial planning in a subsequent period.

0 Introduction

In this chapter we look at the completion of the actuarial control cycle loop: how to monitor experience in order to review the validity of models and assumptions.

Monitoring is also relevant to the risk management control cycle: reviewing the risks faced by a provider and the risk management strategy.

In reality, experience is never exactly as expected, models and assumptions are not borne out in practice and the decisions taken may not have been the *best* that could have been taken, with hindsight. Experience investigations allow us to revise assumptions so that decisions remain as 'best' as possible, within the practical limitations imposed by the operation of the business.

Monitoring of some aspects (investment performance, expenses, risks) has already been covered in earlier chapters.

We start this chapter by identifying why we monitor experience (Section 1) and consider the data that we need for this purpose (Section 2). In Section 3, we look at how we might go about performing the monitoring process and in Sections 4 and 5 consideration is given to how the results of the monitoring process are used. Section 6 provides a summary of the monitoring process.

1 Reasons for monitoring experience

Monitoring the experience is a fundamental part of the actuarial control cycle.

The actual experience of a provider should be monitored to check whether the method and assumptions adopted for financing the benefits continue to be appropriate and, if not, what changes should be made in order to achieve the desired level of profit.

The experience will be monitored so as to:

- **update the methods and assumptions adopted so they reflect expected future experience more closely**
- **monitor any trends in experience, particularly adverse trends, so as to take corrective actions**
- **provide information to management and other key stakeholders.**



Question

List at least ten tasks and/or investigations that a life insurance company performs that require assumptions about future experience.

Solution

Assumptions about future experience will be required for:

- pricing
 - provisioning – statutory assessment
 - provisioning – realistic assessment
 - profitability monitoring
 - modelling capital requirements
 - investigating the resilience of the company to adverse future experience
 - determining appropriate types and amounts of reinsurance
 - determining appropriate underwriting policy
 - investment strategy investigations, *eg* asset-liability modelling
 - analysis of surplus investigations
 - setting discontinuance terms.
-

2 Data required for monitoring

The basic requirement is that there is a reasonable volume of stable, consistent data, from which future experience and trends can be deduced.

Consistent here means that, when comparing the experience of one group with another, the data used as a basis for the calculations for each group should be:

- in a similar form
- preferably extracted from the same source
- grouped according to the same criteria
- equal in terms of reliability.

The data ideally needs to be divided into sufficiently homogeneous risk groups, according to the relevant risk factors.



Question

Explain why having heterogeneous data in a single group is a problem.

Solution

The problem with grouping together heterogeneous data into single cells for analysis is that we would not be able to tell whether a change in some observed variable was genuine or just the result of having a different mix of business within the cell.

However, this ideal must be balanced against the danger of creating data cells that have too little data in them to be credible.

For example, for benefit schemes with a small number of members, it may not be appropriate to carry out any analysis or at least the results should be recognised as being very crude.

This may also be true when events are infrequent and volatile. For example, a benefit scheme with only young members may have many members but few deaths in service and so an analysis of the mortality rate may lack credibility.

Example

Consider an insurer looking at the claims experience on its motor insurance business. As it writes lots of motor policies it considers performing a fairly comprehensive split into homogeneous risk groups. It therefore considers splitting the data by:

- type of cover – either comprehensive or not
- policy excess – into three bands
- use to which the vehicle is put – either domestic only or business
- typical annual mileage – into four bands
- make and model of vehicle – into twenty groups
- the age of the vehicle – into six bands
- gender of main driver
- age of policyholder / driver – into seven age bands.

Already this investigation would have over 80,000 different risk groups. However, it ignores factors such as past driving history, where the vehicle is stored overnight, postcode and other possible factors that could have been used to split data.

In practice, the level of detail in the classification of the data depends upon the volumes of data available. The volume of data will not only indicate whether or not an analysis will produce meaningful results, but it will also indicate the extent to which data can be subdivided without leading to similar problems. For example, it may be necessary to group data on deaths into five-year age bands rather than single-year bands.

In the motor insurance example above, not only do we need a reasonable number of policies in each group, we need a meaningful number of claims in each group.

As well as data on the feature being assessed, it is necessary to have data on the exposure to risk, divided into the same cell structure as the experience data. An analysis of experience is not valid unless experience and exposure to risk are matched.

This matching of experience and exposure to risk (sometimes referred to as 'exposed to risk') was mentioned in the earlier subjects, where it was called 'the principle of correspondence'.



Question

Describe how the central exposed to risk for a particular life would be determined.

Solution

The central exposed to risk E_x^C for a life with age label x is the time from Date A to Date B where:

- Date A is the latest of:
 - the date of reaching age label x
 - the start of the investigation
 - the date of entry.
 - Date B is the earliest of:
 - the date of reaching age label $x + 1$
 - the end of the investigation
 - the date of exit (for whatever reason).
-

3 Analysis process

Once the data have been grouped in an appropriate manner, the analysis can be performed.

An analysis of any experience item could be performed, *ie* any item about which assumptions are made. The experience can then be compared with the assumption.

3.1 Statistical factors

Statistical factors include:

- mortality rates
- morbidity rates (inception and transition)
- withdrawal rates.

For statistical factors, such as mortality and withdrawal, this will involve the calculation, for each age band, of the number of deaths (or withdrawals) divided by the number exposed to risk of death (or withdrawal).

The results can then be compared with the assumptions adopted to determine whether there is a significant difference and also with other relevant standard tables to determine if they appear to be more appropriate.

The details of this process, including the details of exposed-to-risk calculations, were covered in an earlier subject. The important result that we need here is simply:

$$\frac{\text{number of claims}}{\text{number exposed to risk of claim}}.$$

Example

Assuming the volume of available data was no constraint, an investigation of the mortality experience of an insurer might analyse the data by:

- product type
- age
- gender
- duration from entry
- smoker / non-smoker status
- accepted on normal terms or special (*eg* medically-rated) terms
- sales channel
- target market
- occupation.

3.2 Economic factors

Economic factors usually have the greatest impact on the result for a company or scheme, but are also generally outside the management's control.

Economic factors include:

- interest rates and investment returns
- expense inflation
- salary growth.

Interest rates and investment returns

The main economic factors for a benefits scheme or insurance company are:

- **interest rates**
- **investment returns of various sectors.**

For these the analysis is simply a comparison between the actual returns and those assumed.

Therefore, these items are usually both the *most significant* and the *easiest to compare*. The calculation of the actual return may present some practical calculation difficulties, for example allowing accurately for:

- the timing of cashflows in or out
- the investment income received or accrued over the period being analysed
- investment expenses
- tax.

The effect of the difference between actual and expected can be calculated by re-running the expected experience model using the actual economic experience items.

This is the same as the approach used in analysing surplus, which we covered in the previous chapter.

Expense inflation

The actual level of expense inflation would need to be determined by removing from the expense analysis any costs that were included only in the previous or current data, and by considering the change in unit costs rather than overall totals (in order to remove the impact on total expenses from volume changes).

The analysis of expenses was covered in detail in an earlier chapter so we will briefly recap via a question.



Question

Explain how the data might be subdivided when analysing expenses.

Solution

The main items of expense for a financial provider are:

- salaries and salary-related expenses
- property costs (rent, property taxes, heating, lighting and cleaning)
- computer costs
- investment costs (investment department, stamp duty, commission, custodian, *etc*).

In order to analyse these expenses, the provider will look to subdivide them into:

- fixed / variable
- direct / indirect
- initial, renewal, termination and investment expenses
- product with which they are associated
- whether they are proportional to the:
 - number of contracts
 - amount of the claim (or benefits)
 - amount of the premiums (or contributions)
 - amount of funds under management.

The reason for these subdivisions is that they correspond to how assumptions are made in most actuarial models.

Salary growth

Salaries increase in two ways:

1. general 'across the board' inflation-related (or 'cost of living') increases
2. individual promotional increases.

When considering salary-related benefits, it would be common to make separate assumptions for each element. When analysing experience, care must be taken to extract the elements separately.

In order to illustrate how this might be carried out, we have included in the next section an example based on a final salary pension scheme. The scheme wishes to analyse the salary growth of its members over a three-year period.

We have broken this example up into stages with some actual calculations. We recommend working through these calculations since an exam question could ask students to do this. Hints and assumptions needed to perform the calculations are given below.

3.3 Analysis of salary growth – example

Consider a benefit scheme which is performing a three-yearly valuation. For this purpose it is performing an analysis of the salary increases experienced since the previous valuation.

Assumptions

- Annual general inflation rises will be 6% *pa*.
- Promotional / age-related rises in addition to general inflation rises will be as follows:
 - between ages 21 and 25 5% *pa*
 - between ages 26 and 30 3% *pa*
 - between ages 31 and 35 2% *pa*.

Process – determining actual salary growth

The analysis of actual salary growth involves dividing the current levels of salary by those that applied for the same individuals at the previous recording date.

However, in many cases salary is not just time dependent but is also related to age or period of employment. It might therefore be appropriate to perform an analysis of total salaries for age groups. (Another option would be to group cells by date of joining service.)

A table could therefore be produced along the following lines:

- in column (1), age x nearest at the date at which the analysis is being performed
- in column (2), salaries at the previous recording date (*ie* three years ago) for members now age x (which represents members aged $(x - 3)$ at the previous recording date)
- in column (3), salaries at the current date for members age x
- in column (4), the calculation of $(3) / (2)$ – which is the increase in salary in the three-year period for an individual going from age $(x - 3)$ to x over the period.

For example, the table could be as follows:

<i>Current age nearest, x (1)</i>	<i>Previous total salaries (2)</i>	<i>Current total salaries (3)</i>	<i>Salary increase (4) <i>ie</i> (3) / (2)</i>
...			
25	225,000	305,000	1.36
30	312,000	384,000	1.23
35	295,000	360,000	1.22
...			

Any stable pattern of differences between the figures in this column at different ages may then indicate the existence of a correlation between salary growth and age.

In this example, salary growth has slowed with increasing age. As always, the credibility that we can attach to this result depends on the volume of data available.

Process – comparison with assumptions

In order to investigate whether this age-related salary growth is consistent with the assumptions adopted or with standard tables for such growth, the following extra columns could be added to the analysis table:

- in column (5), s_x / s_{x-3} (where s_x is an assumed salary inflation scale, including general inflation rises as well as promotional / age-related rises)
- in column (6), the calculation of (4) / (5) as the ratio of actual over expected.

If the experience had followed the assumptions, then the figures in column (6) would all be equal to 1.

Any differences would need to be explained by considering differences in both general salary increases and in promotional / age-related increases.

Now we can calculate the figures for column (5) as s_x / s_{x-3} , representing the expected growth of salaries from age $x-3$ to x from both general inflation rises and promotional / age-related increases:

$$s_{25} / s_{22} = 1.06^3 \times 1.05^3 = 1.38$$

$$s_{30} / s_{27} = 1.06^3 \times 1.03^3 = 1.30$$

$$s_{35} / s_{32} = 1.06^3 \times 1.02^3 = 1.26$$

Therefore the table is updated as follows:

Current age nearest, x (1)	Previous total salaries (2)	Current total salaries (3)	Salary increase (4) <i>ie (3) / (2)</i>	Expected increase (5) <i>ie s_x / s_{x-3}</i>	Actual / expected (6) <i>ie (4) / (5)</i>
...					
25	225,000	305,000	1.36	1.38	0.986
30	312,000	384,000	1.23	1.30	0.946
35	295,000	360,000	1.22	1.26	0.968
...					

So, the expanded table allows us to compare the actual salary increases against the combined assumptions for general inflation rises and promotional / age-related increases. In this example, the actual experience has been lower than expected.

Process – separation of general and promotional / age-related increases

In order to analyse the promotional and age-related increases separately, we need to identify the general inflation-related salary increases that have been awarded over the last three years, and use these figures in new column (5*) with the assumed promotional salary scale. That is, we need to rework s_x for all ages allowing for actual inflation-related increases and the assumed promotional scale.

On reworking column (6*), the differences from a value of 1 will represent deviations in the promotional scale alone for ages $(x - 3)$ to x over the three-year period. This analysis will also provide us with information on an assumed general salary increase against actual inflation-related increases awarded.

Information regarding the *actual* inflation-related increases awarded can usually be obtained from the company.

In the example, we will suppose that the employer advises that the general inflation-related increases over the three-year period totalled 15%.

Now we can rework the figures for column (5*) using the *actual* general inflation rises and the *assumed* promotional / age-related increases.



Question

Calculate the figures for column (5*) using the *actual* general inflation rises and the *assumed* promotional / age-related increases, and complete the table below:

Current age nearest, x (1)	Previous total salaries (2)	Current total salaries (3)	Salary increase (4) ie (3) / (2)	Expected increase (5*)	Actual / expected (6*) ie (4) / (5*)
...					
25	225,000	305,000	1.36		
30	312,000	384,000	1.23		
35	295,000	360,000	1.22		
...					

Solution

$$s_{25} / s_{22} = 1.15 \times 1.05^3 = 1.33$$

$$s_{30} / s_{27} = 1.15 \times 1.03^3 = 1.26$$

$$s_{35} / s_{32} = 1.15 \times 1.02^3 = 1.22$$

So the table becomes:

<i>Current age nearest, x (1)</i>	<i>Previous total salaries (2)</i>	<i>Current total salaries (3)</i>	<i>Salary increase (4) ie (3) / (2)</i>	<i>Expected increase (5*)</i>	<i>Actual / Expected (6*) ie (4) / (5*)</i>
...					
25	225,000	305,000	1.36	1.33	1.023
30	312,000	384,000	1.23	1.26	0.976
35	295,000	360,000	1.22	1.22	1.000
...					

The figures in column (6*) show whether the actual promotional increases were higher (figures over 1) or lower (figures less than 1) than expected and the extent of the differences.

However, it is possible that the inflation-related increase quoted by the employer did not in fact apply to all members uniformly. For example, it could have contained an element of promotional award that is closely correlated to age or service. This would obviously distort the analysis just performed.



Question

In this analysis, we used salary information from members who were present at both the previous and the current valuation dates.

List the groups of members who are therefore excluded from the analysis.

Solution

The following groups are excluded:

- those members who joined the scheme since the last valuation
- those members who left active membership of the scheme before this valuation
- those members who joined and left active membership of the scheme during the inter-valuation period.

4 Use of the results

The results of an analysis will show how the economic and statistical experience of the scheme has differed from the assumptions made. The next stage of the process is to decide whether the assumptions should be amended in light of the experience.

The results of an analysis of experience should not be used blindly. Consideration should be given to whether the period under investigation was typical and whether the experience is likely to be representative of future experience.

For example, the period under investigation may have been affected by abnormal events or by significant random fluctuations – many elements of experience are affected by economic cycles.

Economic variables such as investment returns, salary levels and dividend yields are not the only items of experience that are affected by economic cycles. For example, withdrawal rates on various savings and insurance products and claim rates on unemployment protection products are likely to be affected by economic activity.

When considering whether the past experience is likely to be representative of future experience, the actuary should attempt to separate the effects of:

- trends – a trend is a long-term underlying increase or decrease over time
- cycles – a cycle causes higher or lower values with a frequency of several years
- random variation.

It is also possible that there is a gradual change in the experience from period to period, as has been the case in the past with mortality rates. Before adopting the results of the investigation, it is therefore necessary to consider the changes over time and whether it is likely that any past trends will continue into the future.

If it had not been possible to split the analysis into sufficiently homogeneous groups, it is important to consider whether the individuals to whom the investigation related are relatively homogeneous with the individuals whose benefits will be affected by future experience.



Question

An actuary is performing an analysis of the experience in an occupational pension scheme.

Suggest ways in which the structure of the membership to whom the investigation relates might not be homogeneous with the individuals whose benefits will be affected by future experience.

Solution

The ways in which the structure of the membership may differ include:

- the occupations of the membership may change, *eg* if the employer changes the focus of its business
- the age and gender profile of the membership may change
- the family circumstances of the members may change
- there may be a trend from full-time to part-time employment
- the individuals may be subject to different tax treatment and therefore have different preferences for certain benefits.

Subject to these considerations, the results of the analysis may be adopted as assumptions when calculating values. However, depending upon the purpose of the assumptions, it may first be appropriate to make an adjustment in these assumptions to allow for data and modelling risk. This will allow for any uncertainty as to the validity of the results of the analysis.



Question

In translating the results of an experience investigation into assumptions, the purpose for which the assumptions will be used is an important factor.

State the other factors that should be taken into account.

Solution

Other factors to take into account in setting assumptions are the:

- significance of a particular assumption to the overall result
 - relationships / consistency between the assumptions
 - the needs of the client
 - any legislative or regulatory constraints
 - margins in assumptions vs risk discount rate
 - time horizons over which assumptions will apply
 - credibility of results and hence need for margins.
-

5 Monitoring experience and control cycles

5.1 Use of the results

Monitoring of experience is fundamental to effective implementation of the actuarial control cycle or the risk management control cycle. The environment in which a provider operates is constantly changing and monitoring the effect of past actions can help in revising its strategy for risk management and in reassessing the risks that it faces.

The actuary will use the results of analysing the experience and the surplus arising to reassess his or her view of the future experience affecting the provider. This may result in changes to the assumptions or models used for pricing or for setting contributions or provisions.

This is an iterative process. The actuary is trying to estimate how the provider will progress in the future, based on what has happened in the past. As time goes by, the actuary will have more information. The assumptions and models resulting from this should get closer to what will actually happen. However, the actuary cannot exactly predict the future even if he/she can make financial sense of it.

Although in a *static* world the assumptions should gradually coincide with reality, in the *real* world the ever-changing nature of actual experience will prevent the actuary's assumptions from getting really close to reality. Thus the assumptions will normally need to contain margins.

6 Summary of the monitoring process

Monitoring investigations typically involve the following stages:

- the division of data into suitable groups that are homogeneous by risk – need to consider:
 - the volume of data in each cell (its credibility)
 - the risk factors for the investigation (*eg* age, gender)
 - changes that have occurred that will reduce the relevance of old data
- identification of any past trends, cycles and anomalies and random variation in the past data
- using the results to revise models and assumptions used – need to consider:
 - the purpose, and hence the need for accuracy and margins for prudence
 - allowance for future trends
 - likely differences in future experience from past experience.

These are the types of issue that would need to be considered if an exam question is asked about an analysis. The list may be particularly useful if the analysis is unusual.

The chapter summary starts on the next page so that you can keep all the chapter summaries together for revision purposes.

Chapter 38 Summary

Reasons for monitoring experience

Monitoring the experience is a fundamental part of the actuarial control cycle. The experience will be monitored so as to:

- update the method and assumptions so that they are more relevant to future experience
- monitor any trends in experience, particularly adverse trends, so as to take corrective actions
- provide management (and other key stakeholder) information.

Data required for monitoring

The basic requirement is that there is a reasonable volume of stable, consistent data, from which future experience and trends can be deduced.

The data ideally needs to be divided into sufficiently homogeneous risk groups, according to the relevant risk factors.

However, this ideal has to be balanced against the danger of creating data cells that have too little data in them to be credible.

As well as data on the feature being assessed, it is necessary to have data on the exposure to risk, divided into the same cell structure as the experience data.

Analysis process

For statistical factors, such as mortality and withdrawal, this will involve the calculation for each age band of the number of deaths (or withdrawals) divided by the number exposed to risk of death (or withdrawal).

The results can then be compared with assumptions or standard tables (if these exist).

For economic factors such as interest rates and investment returns, the analysis is simply a comparison between the actual returns and those assumed.

Other economic factors include expense inflation and salary growth. Expense analyses are covered in an earlier chapter. A salary growth analysis is likely to distinguish between general inflation-related salary increases and promotional salary increases.

Use of the results

The results of an analysis of experience should not be used blindly. Consideration should be given to whether the period under investigation was typical and whether the experience is likely to be representative of future experience.

Allowance should be made for:

- trends (including gradual changes over time)
- cycles
- abnormal events
- random fluctuations.

Before being used as assumptions, the results of experience analyses should also be adjusted to allow for data and modelling risk.

Monitoring and control cycles

Monitoring of experience is fundamental to effective implementation of the actuarial control cycle and the risk management control cycle.

This is an iterative process as it may result in:

- changes to assumptions or models used, *eg* in pricing, setting contributions and provisioning
- a change in the assessment of the risks faced by a provider or in its risk management strategy.



Chapter 38 Practice Questions

- 38.1 State the main purposes for which a general insurance company monitors:
- (i) claims data
 - (ii) expenses.
- 38.2 List factors by which the data might be analysed for the following investigations, assuming that the volume of available data is no constraint:
- (i) sickness experience of an insurer
 - (ii) withdrawal experience of unit trusts.
- 38.3 Describe how the salary increase experience of a benefit scheme would be analysed.
- 38.4 A bank identifies an adverse trend: more customers than expected default on their mortgage payments. Suggest actions the bank might take as a result.
- 38.5 A new life insurance company entered the insurance market three years ago and offers a wide range of protection and savings contracts. Since launch, the company has suffered from very high withdrawal rates across the whole range of its contracts. These rates are higher than those anticipated in its pricing bases and higher than those experienced by the rest of the market.
- Exam style**
- (i) Describe possible reasons for these high rates of lapse and surrender. [7]
 - (ii) Describe possible actions that the company could take to improve its persistency experience. [7]
- [Total 14]
- 38.6 A general insurance company writes only motor insurance business. Five years ago it revised its premium basis with a view to improving its overall profitability. Pre-tax profits since then, however, have fallen steadily each year.
- Exam style**
- Describe the main investigations that would be carried out to investigate the recent reduction in profits. [12]
- 38.7 A life insurance company launched a without-profit critical illness contract ten years ago. The volume of new business sold has risen significantly in the last three years. Under the contract no benefit is payable on death or lapse. The company is about to review the profitability of the contract.
- Exam style**
- (i) Describe how the company might analyse its critical illness claims experience since launch. [8]
 - (ii) Describe how the company might use the results of this analysis to set assumptions for calculating the profitability of the contract. [5]
 - (iii) Explain why the results of this analysis may not be indicative of future experience. [6]
- [Total 19]

The solutions start on the next page so that you can
separate the questions and solutions.



Chapter 38 Solutions

38.1 (i) ***Why analyse claims data***

There are many possible purposes, including:

- reviewing premium rates and setting rates for new or amended products
- estimating the cost of outstanding claims to set provisions
- comparing actual claims run off against previous estimates
- providing management information
- analysing the sources of surplus
- assessing the relative profitability of different blocks of business
- monitoring the adequacy and use of reinsurance
- monitoring the company's solvency position
- assessing and improving the underwriting and claims management processes
- financial planning.

(ii) ***Why analyse expenses***

A general insurance company analyses expenses in order to allocate expense costs correctly between the different classes and rating groups in the portfolio.

This enables the insurance company to:

- measure the past performance (profitability) of each insurance class
- determine the expenses loadings for premium rating
- determine the expenses loadings for provisioning
- spot any inefficient areas of the business in order to implement cost-cutting exercises
- conduct a financial planning exercise (expense budgeting)
- analyse its sources of surplus
- manage its cashflow position, in order to ensure that liquid funds are available to pay the expenses.

38.2 (i) ***Sickness experience of an insurer***

The data might be analysed by:

- policy types, *eg* critical illness, income protection, long-term care
- policy conditions, *eg* different deferred periods and definitions of sickness
- age and gender
- duration from entry
- smoker / non-smoker status
- accepted on normal terms or special (*eg* medically-rated) terms
- sales channel
- target market
- occupation.

(ii) ***Withdrawal experience of unit trusts***

The data might be analysed by:

- type of contract, *eg* choice of unit funds
- duration in force
- source of business
- target market
- frequency of premium (with monthly premiums there are more opportunities to withdraw than if premiums are annual)
- size of premium (a high premium relative to income will be harder to afford than a smaller one, but a small one may not be considered worthwhile continuing with)
- premium payment method (premiums paid in cash are more noticeable than premiums paid directly from a bank account and so lead to higher withdrawal rates)
- age
- gender.

38.3 There are two increases to investigate – general inflation-related and promotional / age-related.

We need to use data for members present at both valuation dates, otherwise the answer may be misleading.

One method is to develop a table that compares, for various age groups, the actual average salary at this valuation and the actual average salary at the last valuation. Any increase is due to both general and promotional increases.

This can be compared with what was expected.

To analyse promotional increases separately, we need to identify the general inflation-related rises awarded each year over the inter-valuation period.

This is most easily done with the company's help.

Alternatively for each age group we could compare the average salary of *all* members at the last valuation with the average salary of all members at the current valuation. This should indicate the general increase in pay excluding promotional increases.

But, this figure can easily be distorted and should be treated only as a rough guide.

National salary inflation indices are also useful indicators.

Once the actual *general inflation-related* increases over the period have been identified, they can be removed from the figures to isolate the actual *promotional* increases, and hence can be compared against expected promotional increases.

38.4 The actions that might be taken by the bank include:

- re-pricing of products – taking a higher margin (interest rate) to allow for that proportion of customers who default
- re-design of products – *eg* allow some flexibility of mortgage repayments if this would help customers in temporary difficulties to avoid defaulting
- change the sales strategy – *eg* change the target market, reduce the amount that can be borrowed, for example a smaller multiple of salary or introduce a more stringent assessment of income and outgoings to check affordability
- withdraw from the mortgage market and focus resources on other more profitable products and services – may be too drastic if mortgage lending is a major activity
- do nothing – may expect trend to reverse itself or effect may be small.

38.5 (i) ***Reasons for high lapses and surrenders***

Key words and phrases to bear in mind are 'protection and savings', 'new', 'wide range', 'higher than ... rest of the market', 'higher than ... its pricing bases'.

Inappropriate selling

The policies may have been sold very aggressively. [½]

This could have had a number of forms:

- the company might have paid higher than market rates of commission to encourage sales [½]
- the products and the new company might have been very heavily marketed, perhaps including special introductory offers to entice sales [½]
- inappropriate or inadequate selling procedures may have been used. [½]

All these could result in policies being sold that do not meet the customers' needs. Once the immediate pressure of the sale has passed, such policies will have high withdrawal rates as there will be little incentive to keep paying premiums. [1]

Product terms & competition

Policyholders may find the same product elsewhere for a cheaper premium or lower charges, and so withdraw to take advantage of this. [1]

This may be especially likely if the company has priced its products realistically, and has attempted to recover a fair proportion of its development, set-up and other overhead costs early on. [1]

The company may have had difficulty in responding to market developments since launch, *eg* if other companies have introduced new product designs, this company may have suffered withdrawals as a result. [1]

If premiums and charges are reviewable and if the company has increased its premium or charges recently, a lot of policyholders may have withdrawn. [1]

Intermediaries may be worried about the financial security of the new company and may persuade policyholders (who may have taken out their policies through a different channel) to switch to a more established provider with better-known security. [1]

Poor performance

The company will have had no investment experience and have no established investment expertise. This could have resulted in poor investment performance on savings contracts compared with competitors, which will increase withdrawals. [1]

The company will have had to develop new systems, and administration delays and errors may have occurred leading to poor customer service. [1]

The company has offered a wide range of products from the start. This is likely to stretch the limited resources and expertise of a new company resulting in poor customer service. [1]

Similarly, if sales volumes have been good, the company may have under-resourced its admin functions. [½]

Mix of business

The company might have targeted sales at a particular market sector in order to reduce problems of competition. This class of lives may then by nature have higher lapse and surrender rates than are typical of the industry as a whole. [1]

The same result might have happened simply from the take-up of business occurring largely in such market sectors, possibly contrary to the company's intention or expectation. [½]

Other

It is possible that the surrender values under the new savings policies are higher than those of competitors, and so have led to higher surrender rates than the market average. [½]

The company may have received unfavourable media coverage. [½]
[Maximum 7]

(ii) ***Actions that can be taken***

Analysis and investigation

The insurer must first analyse the withdrawal experience in order to identify the exact reasons for the poor experience. [½]

For example, it may be able to identify particularly poor sales channels and agents, so that effort to rectify the problems might be targeted accordingly. [1]

It may be necessary to carry out surveys in order to identify better the reasons for the high lapses, eg survey those customers who have recently withdrawn. [½]

Business strategy

The company could reduce the number of product lines it sells, and concentrate on those that seem likely to be of most benefit to the company. [½]

This should improve the company's administrative capability for its remaining products, reducing errors and increasing the quality of customer service. [½]

Reducing the range of products might also enable the company to spend more of its resources in developing its investment capability, so improving its investment performance and help it gain a better reputation. [1]

A deliberate policy of improving the quality of customer service and contact with the customer can further improve persistency. [1]

The company could make more effort to reduce withdrawals, for example:

- issue reminder notices approximately one month prior to an annual renewal date [½]
- provide the sales team with the details of policies coming up for renewal, and ensuring that all non-renewals are investigated as quickly as possible [½]
- aim to have all premiums collected by automated payment methods. [½]

Ensure that products meet customer needs

The company needs to ensure that future sales meet customer needs. [½]

The company should provide suitable training to salespeople as to how the policy should be sold and to whom. [1]

If direct marketing channels are used, then adequate information needs to be provided so that individuals can make a correctly informed choice about whether to buy. [½]

The product design may need to be altered in order to meet better the needs of the target market. [½]

Premium rates and policy charges should be compared with those of competitors and adjusted where needed. [1]

Product design changes can also be used directly to provide a disincentive to withdraw, *eg* by increasing surrender penalties or by paying some kind of loyalty bonus. [1]

The company might aim for a different target market for which its existing (or new) products would be more suitable. [½]

Other

The company might alter its sales remuneration policy to reward good persistency, *eg* by introducing or increasing the level of renewal commissions and/or by having clawback of initial commission on early withdrawal. [1]

The company may be able to improve its brand image, and hence its reputation, through the use of suitable advertising or other promotions. [1]

If there are concerns about the company's financial security, then the shareholders could be asked to inject more capital to enhance its status. [½]
[Maximum 7]

38.6 *When asked to consider profits, it is often useful to consider the items that make up the profit figure, ie the items in the income statement. An income statement for a general insurance company will include the following items:*

+	<i>Premiums</i>
–	<i>Claims</i>
–	<i>Expenses</i>
=	<i>Underwriting profit</i>
+	<i>Investment income</i>
=	<i>Insurance profit</i>

Try suggesting investigations that could be carried out on each item, aiming for (at least) two investigations for each item.

The profit from the business will be the product of the profit per unit sold and the number of sales. It is necessary to review both aspects of this calculation. The number (or volume) of sales will be directly reflected in the premium figure in the income statement, and indirectly in the claim and expense figures. The profit per unit sold will be reflected in all of the premium, claim and expense figures.

The main investigations that could be carried out include:

Premium investigations

The amount of premiums in the income statement should be investigated. [½]

The investigations need to relate both to the number (or volume) of sales and to the level of the premiums. [1]

Comparisons should be made both with competitors and with expected values. [1]

In order to analyse volumes of sales we might perform the following investigations:

- Analysis of sales volumes compared with projections. [½]
- Investigate whether competitors have launched new variations of the contract that have proved more attractive in the market (new variations of contracts might attract policyholders away from the general insurance company, reducing sales volumes). [1]
- Investigate whether there have been any new entrants to the market who would have taken some of the market share for motor insurance business. [½]
- Investigate the effects of competition on persistency to see if the change in approach five years ago mirrored those made by competitors. If persistency has worsened for the general insurance company, then premiums will be lower overall. [1]
- Consider other reasons for lower sales volumes (if that is the case). [½]

In order to analyse the appropriateness of the general level of premiums we might perform the following investigations:

- Analysis of premium rates compared with those of competitors. [½]
- Investigate whether competitors have been running any loss-leading promotions. This would make the general insurance company's premiums seem relatively high. [1]

Claim investigations

The level of claims in the income statement should be investigated. [½]

The investigations might include:

- Claims analyses to investigate the effect of the change in the premium basis. [½]
- Analysis of general claims trends for example unusually large claims, high frequency, catastrophe events *etc* to see if experience is due to natural random variation. [1]
- Analysis of coverage and policy wording to see if any changes in premium were in line with the resulting changes in claims experience. [½]
- Analysis of effectiveness of reinsurance arrangements to see if poor experience is due to inappropriate cover. If the reinsurance arrangements are inappropriate then reinsurance recoveries will be low in relation to what the general insurance company expected (for a given reinsurance premium). [1]
- Adequacy of reserving / changes to reserving practices as the level of reserves may have been set at unnecessarily prudent levels. If the reserving (or provisioning) basis has strengthened over the period, then this will increase the claims figure in the income statement. [1]

Expense investigations

The level of expenses in the income statement should be investigated. [½]

Such investigations might include:

- Effects of any internal changes for example change in sales channel, commission rates, changes to internal processing, changes to claims handling *etc.* [1]
- Mix of business to investigate whether poor performance is due to poor coverage of overhead and other fixed expenses. Different cohorts will have different contribution rates. [1]

Underwriting profit investigations

It might be useful to look at premiums, claims and expenses together, *ie* underwriting profit. [½]

For example, to investigate:

- Underwriting profitability to check if poor results are due to quality of underwriting and to look at underwriting procedures and guidelines. [1]
- Underwriting performance on homogeneous cohorts of business to check for any adverse selection. [1]

Investment income investigations

Investment income is unlikely to be very significant for motor insurance business, other than for long-tail bodily injury claims. [½]

The company could investigate investment performance against peer groups, benchmarks and past performance to check if in this is line with targets / expectations. [1]

Other investigations

Other investigations on external factors might also be carried out, including the effects on profitability of:

- legislative changes [½]
- solvency requirements [½]
- road traffic factors *etc.* [½]

[Maximum 12]

38.7 (i) ***Analysis of critical illness claims experience***

In order to determine actual claims experience, the number of claims experienced is divided by the matching number of policies exposed to risk. [1]

The data should be split into homogeneous groups while keeping the volume of data within each group credible. [1]

The extent to which this is feasible will depend on the volume of business written. [½]

It is important to be clear about the definition of the exposure to risk for the denominator of the ratio. Normally this will be the average of the in-force policies at the year start and the year end (but this could be done more accurately if the data is available). [1]

Normally critical illness claims will be given a full year's exposure (rather than a half) in the year of claim. [½]

Ideally, the analysis would be broken down by year of claim. [½]

However, since significant volumes have only been sold for the last three years, it may be necessary to group the experience for some older calendar years together. [1]

Only business accepted at standard rates should be included. [½]

The most important levels at which to carry out the investigation are:

- gender
- age (grouped as required)
- smoker status
- duration since outset (grouped for longer durations) – experience will be lighter at early durations due to underwriting
- sales channel (this is an indicator of target market). [½ each]

If enough data exists then the investigation could also be split by:

- type of illness
- medical / non-medical cases
- occupation
- premium size
- premium payment method. [½ each]

As there may be a delay between the date of claim and when it is admitted, care needs to be taken to include the claim within the calendar year and duration to which it relates (*ie* based on when the claim happened). [½]

Claims experience should be analysed both net and gross of reinsurance. [½]

The company will then compare the actual claim rates experienced with those assumed in the pricing when the contract was designed, or with those in the current supervisory valuation basis. [1]

[Maximum 8]

(ii) ***Using the results to set assumptions for calculating profitability of contract***

Assumptions are required for both the current level of critical illness experience and the expected future changes in this over the duration of the contract. [1]

Consideration should be given as to whether the period under investigation was typical and whether the experience is likely to be representative of future experience. [½]

For example, the period under investigation may have been affected by abnormal events or by significant random fluctuations. [1]

Consideration also needs to be given to trends and cycles. [1]

The more recent years' experience would be used to help make an assumption about the current level of critical illness experience. [½]

This would likely be expressed as a percentage of:

- reinsurer's rates
- a standard table, if one exists
- the pricing basis, if different. [½ each]

The trend in experience for recent years would be used to help make an assumption about the expected future trend in critical illness experience. [½]

If the volume of data were sufficient, this trend would be considered separately for each type of illness to understand better the causes of the experience. [½]

It may be appropriate to make adjustments to the assumptions to allow for data and modelling risk. [1]

[Maximum 5]

(iii) ***Why results may not be indicative of future experience***

Credibility

The main limitation is the volume of data used in the analysis. [½]

The experience for durations of greater than three years is based on small volumes of data, so may not be credible. [½]

Similarly the trend in the experience is only based on significant volumes of data for the last three years. This is unlikely to be sufficient to give an indication of likely future trends. [1]

Changes over time

The following may have changed over the period of the investigation and/or in future: [½]

- underwriting standards [½]
- sales process / distribution channel [½]
- target market [½]
- average premium size [½]
- definition of a critical illness or the critical illnesses covered [½]
- claims admittance standards [½]
- medical advances – impacting speed of detection of critical illnesses and availability of preventative treatment, etc. [1]

Reductions in premium rates over the period of investigation may have led to selective lapses and worse claims experience. If this will not be a feature of the marketplace in future then the results will not give an appropriate assumption. [1]

Consumer pressure may lead to more pressure in future to admit claims that do not meet the strict definition. [½]

Other considerations

The historical data may have included abnormal events which are not expected to recur in future, and the analysis may not have removed these adequately. [1]

There will always be random variation. [½]

[Maximum 6]

End of Part 10

What next?

1. Briefly **review** the key areas of Part 10 and/or re-read the **summaries** at the end of Chapters 35 to 39.
2. Ensure you have attempted some of the **Practice Questions** at the end of each chapter in Part 10. If you don't have time to do them all, you could save the remainder for use as part of your revision.
3. Attempt **Assignment X5** which contains a mixture of Paper 1 and Paper 2 style questions relating to parts 9 and 10 of the course.
4. Attempt **Assignment X6** which is of Paper 2 style containing two case studies testing across the course to help you prepare for the Paper 2 exam.

Time to consider ...

... other ActEd products

Now that you have completed the course, you may find it useful to think about which products will be most useful to you between now and the exam. Here is a summary of the ActEd products you can choose from:

- Online Classroom
- Flashcards
- Revision Notes
- ASET
- Mock Exam
- Marking.

You can find lots more information on our website at www.ActEd.co.uk.

Buy online at www.ActEd.co.uk/estore

It may not be too late to consider a live tutorial. Please check our *Tuition Bulletin*, which is available on our website at www.ActEd.co.uk.

And finally ...

Good luck!

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Glossary

Syllabus objective

- 14 Have an understanding of the principal terms used in financial services, investments, asset management and risk management.

0 Introduction

In financial services many terms vary by company, class of business, market and country. An important part of any actuarial investigation is to verify the exact meaning of any important terms used. This glossary gives the definitions mainly used in practice.

The terms marked with * are taken from or adapted from the PMI/PRAG publication 'Pensions Terminology'.

(In the previous paragraph PMI is the 'Pensions Management Institute' and PRAG is the 'Pensions Research Accountants Group'.)

We don't recommend that you spend days rote-learning these definitions, as you do not have to be able to define each term using exactly the same words. However, you should be able to cover the key points clearly and without ambiguity. This is much more likely if you ensure that you *understand* the definitions.



Key information

Please note that the content of this chapter, as per other Core Reading material, is examinable. This chapter is not intended to be self-contained: further terms are defined within their respective chapters.

1 Provisions and reserves

A potential source of confusion is the term used to denote the value assigned to the liabilities. It has been the practice of accountants to:

- use the word *provision* to denote the value of a liability that is known or assumed to exist at the accounting date
- confine the term *reserve* to any amount, over and above the provisions, that is available to meet additional liabilities, either in respect of future events or in respect of past events for which the provisions may prove to be inadequate.

However, among insurers, and also among actuaries, there has been a long established practice of applying the term *reserve* to both categories.

In the European Union, following the adoption of the Insurance Accounts Directive and its enactment in the legislation of each of the Member States, it has become the practice to distinguish between provisions and reserves in insurance companies' shareholders' accounts and also in the accounts that form part of the statutory returns to the insurance supervisory authorities.

However, in North America and to some extent in the Lloyd's market, the practice of applying the term *reserve* to both categories continues. It seems likely that among actuaries and others the habit of using the term *reserves* for what are often called provisions will persist for some time even in the UK, notwithstanding the legislative changes.

2 Principal terms

Accrual rate*

The rate at which rights build up for each year of service in a defined benefit scheme.

Accrued benefits*

The benefits for service up to a given point in time, whether vested rights or not. They may be calculated in relation to current earnings or projected earnings. (Allowance may also be made for revaluation and / or pension increases required by the scheme rules or legislation.)

Accumulation of risk

An accumulation of risk occurs when a portfolio of business contains a concentration of risks that might give rise to exceptionally large losses from a single event. Such an accumulation might occur by location (property insurance) or occupation (employers' liability insurance), for example.

Acquisition costs

Costs arising from the writing of insurance contracts including:

- direct costs, such as acquisition commission or the cost of drawing up the insurance document or including the insurance contract in the portfolio
- indirect costs, such as advertising costs or the actuary's / underwriter's expenses connected with the establishment of the premium rating table.

Active member*

A member of a benefit scheme who is at present accruing benefits under that scheme in respect of current service.

All risks

A term used where the cover is not restricted to specific perils such as fire, storm, flood *etc.* The cover is for loss, destruction or damage by any peril not specifically excluded. The exclusions will often be inevitabilities such as wear and tear. The term is sometimes loosely used to describe a policy that covers a number of specified risks, though not all.

Anti-selection

People will be more likely to take out contracts when they believe their risk is higher than the insurance company has allowed for in its premiums. This is known as anti-selection.

Anti-selection can also arise where existing policyholders have the opportunity of exercising a guarantee or an option. Those who have most to gain from the guarantee or option will be the most likely to exercise it.

Arbitrage

In investment markets, the simultaneous buying and selling of two economically equivalent but differentially priced portfolios so as to make a risk-free profit.

In regulatory regimes, making use of the least onerous set of alternative rules that could be applied to a product provider.

Average earnings scheme*

A benefits scheme where the benefit for each year of membership is related to the pensionable earnings for that year. Such schemes are alternatively referred to as career average schemes.

Balance of cost scheme

A defined benefits scheme to which beneficiaries make a defined contribution and the main sponsor pays the remainder of the unknown cost of providing the benefits.

Bancassurance

An arrangement between a bank and an insurance company to allow the insurance company to sell its products to the bank's clients.

Bear market

A period of time during which investors are generally unconfident and stock market prices decline. (Compare with *Bull market*.)

Benchmark

A standard or model portfolio (eg investment index) against which a fund's structure and performance will be assessed.

Best estimate

An actuarial assumption which the actuary believes has an equal probability of under or overstating the future experience (*ie* the median of the distribution of future experience.)

Bid (also selling) price

The price at which a market maker offers to buy a security. The price at which the manager of a unitised financial product is prepared to buy back units from an investor.

Break-up basis

A valuation basis that assumes that the writing of new business ceases and cover on current policies is terminated. In relation to general insurance policies, current policyholders would normally be entitled to a proportionate return of the original gross premium. Deferred acquisition costs would probably have to be written off. Also known as a wind-up basis.

Bond

A bond is a form of loan. The holder of a bond will receive a lump sum of specified amount at some specified future time together with a series of regular level interest payments until the repayment (or redemption) of the lump sum.

Book reserve

A provision in a company's accounts for a future benefit liability for which no funds have been set aside.

Bulk rate

A premium rate applied uniformly per head on large benefit schemes across a membership type (independent of actual members' ages). Also called '*Unit rate*.'

Bulk transfer

The transfer of liabilities (and usually assets), relating to a group of members, from one benefit scheme to another.

Bull market

A period of time during which investors are generally confident and stock market prices increase. (Compare with *Bear market*.)

Cancellation

A mid-term cessation of a general insurance policy that may involve a partial return of premium.

Cap

An upper limit. For example, on a benefit, a contribution, benefit growth or a funding level.

Catastrophe

A catastrophe is a single event that gives rise to exceptionally large losses. The exact definition often varies and is often dependent on excess of loss wordings, eg it might mean all losses incurred in a 72-hour period from a single event such as a wind storm.

Catastrophe reserve

A reserve built up over periods between catastrophes to provide some contingency against the risk of catastrophe.

Ceding company (cedant)

An insurance or reinsurance company that passes (or cedes) a risk to a reinsurer. The term 'cedant' may also be applied to a Lloyd's syndicate.

Chinese walls

Regulations or practices intended to prevent conflicts of interest in integrated security or consultancy firms.

Claim

The most common meanings are:

- **as a noun: an assertion by a policyholder that an insurer is liable to make a payment in accordance with the terms of a policy**
- **as a verb: to make a request for payment from an insurer.**

Care is often needed to discover the precise meaning in a given context – eg whether a reference to ‘claims’ is to the number of claims or their cost.

Claim frequency

The number of claims in a period per unit of exposure, such as the number of claims per vehicle year for a calendar year or per policy over a period.

Closed scheme*

A benefits scheme which does not admit new members. (Contributions may or may not continue and benefits may or may not be provided for future service.) Similarly insurers can be closed to new business, or have closed funds.

Coinsurance

An arrangement whereby two or more insurers enter into a single contract with the insured to cover a risk in agreed proportions at a specified premium. Each insurer is liable only for its own proportion of the total risk.

Commission

Commission refers to the payments made by a provider to reward those who sell and subsequently service its products, whether they be independent financial intermediaries, tied agents or a direct salesforce. Typically, the amount of the commission depends on the type and size of contract.

Commutation*

The giving up of a part or all of a stream of future income for an immediate lump sum.

Composite insurer

An insurance company writing both life and non-life business.

Continuing Care

Nursing or medical care provided after retirement.

Continuing Care Retirement Community

A development in which retired persons can live as a community and received chosen levels of nursing or medical care.

Convexity

The convexity of a bond is defined as

$$C = \frac{1}{P} \frac{d^2 P}{di^2}$$

where:

P is the dirty price of the bond

i is the gross redemption yield on the bond.

Corporation tax

Tax on company profits.

Counterparty

The opposite side in a financial transaction.

Coupon

The interest payments on a bond.

Covenant

An agreement that is legal and binding on the parties involved. The expression is often used in association with corporate debt, because the borrower is bound to the terms of the agreement. The expression is also used in property investment because the tenant or lessee is bound to the terms of the lease agreement. In fact the meaning of covenant has been extended in the context of property investment so that it *usually* refers to the quality of the tenant, eg a tenant with a good covenant is a good quality tenant who is unlikely to break the terms of the agreement. This last meaning of the term may also similarly refer to the quality of an employer-sponsor of a benefits scheme.

Credibility

A measure of the weight to be given to a statistic. This often refers to the experience for a particular risk (or risk group) compared to that derived from the overall experience of a corresponding parent or larger population. The measure is used to determine a premium when using experience rating.

Credit rating

A rating given to a company's debt by a credit-rating company as an indication of the likelihood of default. Top rating is usually AAA. Credit ratings are much used.

Credit risk

Credit risk is the risk of failure of third parties to meet their obligations.

Custodian

The keeper of security certificates and other assets on behalf of investors.

Cyber risk

Any risk of financial loss, disruption, or damage to the reputation of an organisation from some sort of failure of its information technology systems.

Debenture

A loan made to a company which is secured against the assets of the company. Debentures usually have a floating charge over the assets of the company so that debenture holders rank above other creditors should the company be wound up. Debentures with fixed charges are called mortgage debentures.

Deferred member

A member of a benefits scheme who is no longer accruing benefits but who has accrued benefits that will be payable at a future date.

Deficit (or underfunding)

Where a benefits scheme or financial product provider has less assets than required by the funding plan to meet the liabilities.

Defined ambition scheme

A scheme where risks are shared between the different parties involved, such as scheme members, employers, insurers and investment businesses.

Defined benefit scheme*

A benefits scheme where the scheme rules define the benefits independently of the contributions payable, and benefits are not directly related to the investments of the scheme. The scheme may be funded or unfunded.

Defined contribution scheme*

A scheme providing benefits where the amount of an individual member's benefits depends on the contributions paid into the scheme in respect of that member increased by the investment return earned on those contributions.

Depreciation

An accounting convention whereby firms write down the value of their assets over time.

Derivative instrument

A financial instrument with a value dependent on the value of some other, underlying asset.

Discontinuance valuation*

An actuarial valuation carried out to assess the position if a benefits scheme were to be discontinued. The valuation may take into account the possible exercise of any discretion to augment benefits.

Discounted income model

A model for valuing investment which determines a present value for the investments by discounting the expected future income from the assets.

Dividend yield

The running yield (dividends divided by share price) on an equity.

Duration

The duration of a conventional bond (also known as the *effective mean term* or *discounted mean term*) is the mean term of the payments from the stock, where each term is weighted by the present value of that payment. In general:

$$\text{Duration} = \frac{\sum PV \times t}{\sum PV}$$

where:

t is measured in years

PV is the present value of the payment at time t calculated at the gross redemption yield.

Duration is closely related to *volatility*.

Early leaver*

A person who ceases to be an active member of a benefit scheme, other than on death, without being granted an immediate retirement benefit.

Economic value added

The percentage difference between the annual return on capital and the weighted average cost of capital.

Efficient frontier

An efficient portfolio is one for which it is not possible to increase the expected return without accepting more risk and not possible to reduce the risk without accepting a lower return. The efficient frontier is the line joining all efficient portfolios in risk-return space. In portfolio theory, risk is defined as variance or standard deviation of return.

Efficient market hypothesis

A hypothesis that asset prices reflect all relevant information.

Embedded value

It represents the value to shareholders of the future profit stream from a company's existing business together with the value of any net assets separately attributable to shareholders.

Equity

In investment:

Ordinary shares issued by a company as a share in the equity capital of a company. In effect the equity holders are the owners of the company. Ordinary shareholders have the right to receive all distributable profits of the company after debt holders and preference shareholders have been paid. They also have the right to attend and vote at general meetings of the company.

In life insurance:

This is a term that is difficult to define. In essence, it means that all policyholders are treated fairly. That is that some groups of policyholders do not benefit at the expense of other groups. In a proprietary company, equity also needs to be considered between policyholders and shareholders. Questions of equity arise in the distribution of surplus, in the determination of variable charges and in the determination of surrender values and alteration terms.

Excess

The sum, specified in the policy, that the insured must bear before any liability falls upon the insurer. The insured pays the first £E of every claim, where £E is the excess.

Excesses are widely used in personal lines of insurance such as motor insurance. They may be compulsory, in that they apply to all claims of the types specified, or voluntary to secure lower premiums.

Exclusion

An event, peril or cause defined within the policy document as being beyond the scope of the insurance cover.

Experience rating

A system by which the premium of each individual risk depends, at least in part, on the actual claims experience of that risk (usually in an earlier period, but sometimes in the period covered).

Exposure

This term can be used in three senses:

1. the state of being subject to the possibility of loss
2. a measure of extent of risk
3. the possibility of loss to insured property caused by its surroundings.

Extra premium

An extra premium is an addition to the standard premium payable under a contract in order to cover an extra risk.

Extra risk

An extra risk arises where a proposal for life insurance is not acceptable at standard rates.

Final salary scheme*

A defined benefit scheme where the benefit is calculated by reference to the final earnings of the member, and usually also based on pensionable service.

Financial gearing

The expression *gearing* or *financial gearing* is often used to refer to the impact on the profits for a company caused by fixed-interest borrowing. For a financially highly geared company a small change in the total profits might have a very large proportionate impact on the profits for shareholders. A company with lots of fixed-interest borrowing is *highly geared*.

Financial strength

This usually refers to the ability of a life insurance company to:

- withstand adverse changes in experience, including those arising from investment in higher yielding but more volatile assets
- fulfil its new business plans
- meet the reasonable expectations of its policyholders.

It is often measured by the level of its free assets.

Flexible benefits

Benefit provision under which the beneficiary has choice about the types or levels of benefits to be received. Will usually involve an option to receive salary instead of other forms of benefits.

Floor

A lower limit. For example on a benefit, a contribution, benefit growth or a funding level.

Free assets

This term is loosely used to refer to that part of a life insurance company's assets that are not needed to cover its liabilities. Opinion differs as to what should be included in the liabilities.

For example, in the UK the term is often used to describe the excess of the value of the assets over the value of the liabilities as reported for supervisory purposes.

Funding objective

The arrangement of the incidence over time of payments with the aim of meeting the future cost of a given set of benefits.

Gearing

The ratio of debt to equity. Often referred to as *financial gearing*.

Going concern basis

The accounting basis normally required for an insurer's published accounts, that is based on the assumption that the insurer will continue to trade as normal for the long-term future.

Group contract

This is a contract that covers a group of lives, where the group is specified, but not necessarily the individuals within it.

Guarantee (investment)

In the context of life insurance, this refers to a promise that the company will pay a specified sum of money – or sums of money – at specified times if a specified condition is fulfilled. The condition can be an event such as the surrender or maturity of a contract.

The term can also refer to the situation where a company guarantees the rate it will use, at some future date, to convert a lump sum into an annuity or vice versa.

Hedging

Action taken to protect the value of a portfolio against a change in market prices. Hedging involves holding offsetting positions in assets or portfolios, the values of which are expected to respond identically to market changes.

Hurdle rate

A target or minimum rate of return used in capital project assessment.

Immunisation

Ensuring that the discounted mean term of assets equals that of the liabilities and that the spread of the assets is greater than the spread of the liabilities. This means that a uniform change in interest rates will cause the reinvestment rate and capital value on assets to move in opposite directions so that a fund does not make a loss.

Indemnity, principle of

The principle whereby the insured is restored to the same financial position after a loss as before the loss. This is typical of most types of insurance. This contrasts with the new-for-old basis of settlement, often used in home contents insurance, under which the insured is entitled to the full replacement value of the property without any deduction for depreciation or wear and tear.

Index-linked gilt

A bond issued by the British Government for which the interest payments and the final redemption proceeds are linked to movements in the RPI.

Index-linked security

A security whose redemption value and / or coupon payments are adjusted to reflect inflation.

Index tracking

An index tracking fund (or an *index fund*) is an investment fund with the specific objective of tracking a particular index. The fund manager can either hold all the stocks in the index in the appropriate proportions (known as *full replication*) or use some mathematical model to choose a smaller sample of stocks which will perform as closely as possible to the index.

Insured scheme*

A benefit scheme where the sole long-term investment medium is an insurance policy (other than a managed fund policy).

Internal rate of return

The discount rate at which the Net Present Value of a series of cashflows is zero.

Lapse

A life insurance contract lapses if the policyholder ceases to pay premiums. In some cases a more specific definition is used: the policyholder withdraws, without the company making a payment – surrender value – to him or her.

Leasehold

A lease is an agreement which allows one of the parties (the leaseholder) the use of a specified portion of a building owned (or sometimes itself leased) by the other party for a specified period in return for some payment (the rent).

Lloyd's (of London)

Lloyd's is an insurance market that transacts mainly general insurance and reinsurance. Rather than being a company, it is a collection of underwriting pools ('syndicates') that comprise corporations and private individuals.

Long position

A long position in an asset means having an economic exposure to the asset. In futures and forward dealing the long party is the one which has contracted to take delivery of the asset in the future. (Compare *Short position*.)

Long-tailed business

Types of insurance in which a substantial proportion (by number or amount) of claims take several years to be notified and / or settled from the date of exposure and / or occurrence.

Managed fund*

1. An investment contract by means of which an insurance company offers participation in one or more pooled funds.
2. An arrangement where the assets are invested on similar lines to unit trusts by an external investment manager.

Market capitalisation

The total value at market prices of the securities at issue for a company, or a stock market, or a sector of a stock market.

Market risk

Market risk is the risk relating to changes in the value of a portfolio due to movements in the market value of the assets held.

Market value of assets

The market value of assets represents what they are worth in the open market, given a willing buyer and a willing seller.

Matching

Arranging assets and liabilities so that the cashflows generated by the assets can be expected to meet the liability payouts, either because the assets generate income of the right amount at the right time or because the market values of the assets are linked to the market values of the liabilities appropriately.

Member*

1. A person who has been admitted to membership of a pension scheme and is entitled to benefit under the scheme.
2. A person who is entitled to participate in the management (usually by having a vote at General Meetings) of a mutual insurance company or society.

Mismatching reserve

If the assets of an insurance company are not matched to its liabilities, it may be unable to meet claims as they fall due in the event of adverse future investment conditions. It may be required to set up a mismatching reserve that it can call upon if experience so requires.

Money purchase*

The determination of an individual member's benefits by reference to contributions paid into a benefit scheme in respect of that member, usually increased by an amount based on the investment return on those contributions.

Moral hazard

The action of a party who behaves differently from the way they would behave if they were fully exposed to the consequences of that action. The party behaves inappropriately or less carefully than they would otherwise, leaving the organisation to bear some of the consequences of the action. Moral hazard is related to information asymmetry, with the party causing the action generally having more information than the organisation that bears the consequences.

This is not the same as *anti-selection* which is also taking advantage of particular aspects of an insurance contract, but within the terms offered by the insurer.

Mutual insurer

A mutual insurer is owned by policyholders to whom all profits (ultimately) belong.

Net asset value per share

The book value of the shareholders' interests in a company, usually excluding intangibles such as goodwill, divided by the number of shares in issue.

New business strain

New business strain arises when the premium(s) paid at the start of a contract, less the initial expenses including commission payments, is not sufficient to cover the reserve that the company needs to set up at that point.

Nil claim

A claim that results in no payment by the insurer, because, for example:

- The claim is found not to be valid.
- The amount of the loss turns out to be no greater than the excess.
- The policyholder has reported a claim in order to comply with the conditions of the policy but has elected to meet the cost in order to preserve any entitlement to no-claim discount.

No-claim discount (NCD)

A form of experience rating in which policyholders are allowed a discount from the basic premium according to a scale that depends upon the number of years since the most recent claim.

Nominal value

This term refers to an amount of stock. It is the amount specified on the stock certificate. Dealings in debt securities are carried out in amounts of nominal.

Occupational scheme*

A benefits scheme organised by an employer or on behalf of a group of employers to provide benefits for or in respect of one or more employees.

Offer (also buying) price

The price at which a market maker offers to sell a security. The price at which the manager of a unitised financial product is prepared to sell units to an investor.

Open-ended investment company (OEIC)

An investment vehicle similar in corporate governance features to an *investment trust* but with the open-ended characteristics of a *unit trust*.

Operational risk

Operational risk refers to the risk of loss resulting from inadequate or failed internal processes, people and systems or from external events.

Option

The right to buy or sell an asset.

Option (health)

A health option is where the life insurance company gives a policyholder the right to increase or extend the death – or sickness – cover under a life insurance contract at some future time or times without further evidence of health.

Option premium

The price paid for an option. Received by the *writer*.

Option writer

The seller of an option.

Pay-as-you-go*

An arrangement under which benefits are paid out of revenue and no funding is made for future liabilities.

Preference share

A class of share which generally ranks ahead of ordinary shares. Preference shareholders are normally entitled to a specified rate of dividend (provided this is declared by the company for each dividend payment) and, unlike ordinary shareholders, are not entitled to residual profits. Although part of a company's share capital, from an investment perspective preference shares are much more like fixed-interest bonds, but with no guarantee that each future dividend payment will be declared.

Prime

Property that is most attractive to investors is called *prime*. Prime property would score highly on all of the following factors:

- location
- age and condition
- quality of tenant
- the number of comparable properties available to determine the rent at rent review and for valuation purposes
- lease structure
- size.

Profit commission

Commission paid by a reinsurer to a cedant under a proportional reinsurance treaty that is dependent upon the profitability of the total business ceded during each accounting period. Also used in other arrangements, such as commission contingent on claims experience.

Profit test

A profit test is a technique involving consideration of the cashflows arising under a contract to assess the expected profitability of that contract. It can be used to determine the premium or the level of charges under a contract.

Proprietary insurer

An insurance company owned by shareholders.

Privatisation

The sale of State assets or businesses, often to reduce government debt.

Rating basis

The collection of assumptions used to associate the risk premium with the characteristics of the risk being insured.

Rating factor

A factor used to determine the premium rate for a policy, which is measurable in an objective way and relates to the likelihood and / or severity of the risk. It must, therefore, be a risk factor or a proxy for a risk factor or risk factors.

Real yield

The yield on an investment after inflation has been allowed for. Often approximated as the difference between the nominal yield and the rate of inflation over the corresponding period.

Redemption

The return to an investor of the capital value of a debenture or other debt security. Redemption may take place on a fixed date or on one of a series of specified dates. The bond may include an option for the borrower to choose the date or for the lender to choose. The capital amount repaid may be fixed or linked to an index.

Redemption yield

The gross redemption yield (the word gross is often omitted), or yield to maturity, is the rate of return at which the discounted value of all future payments of interest and capital is equal to the *dirty price* of a debt security. The net redemption yield allows for taxation of the amounts received by the investor.

Reinsurance

An arrangement whereby one party (the reinsurer), in consideration for a premium, agrees to indemnify another party (the cedant) against part or all of the liability assumed by the cedant under one or more insurance policies, or under one or more reinsurance contracts.

Reinsurer

An insurer providing reinsurance cover. Some reinsurers do not write any direct or primary insurance business.

Requirement for capital

On a per contract basis, the requirement for capital is the amount of finance a company needs in order to be able to write that contract, *ie* the new business strain. This can be extended to the whole company where its requirement for capital is the finance it needs in order to be able to carry out its new business plans.

Retention

In the context of reinsurance, a company's retention is the amount of any particular risk that it wishes to retain for itself. It will then reinsure the excess over that retention.

Retail price inflation

The measurement of price changes at the retail (consumer) level.

Return on capital employed (ROCE)

Profit before interest and tax divided by capital employed, expressed as a percentage. An indicator of a company's efficiency in generating profit from its asset base.

Risk-based capital (RBC)

The assessment of the capital requirement for a provider by considering the risk profile of the business written and of any other operations.

Risk discount rate

A risk discount rate is a rate at which future uncertain cashflows might be discounted. It typically arises when carrying out a discounted cashflow assessment of value of a project. It represents the risk-free rate of return that the providers of capital demand plus an amount to allow for the risk that the profits may not emerge as expected from the project.

Risk factor

A factor that is expected, possibly with the support of statistical evidence, to have an influence on the intensity of risk in an insurance contract.

Risk premium

The amount of premium required to cover claims expected for a risk, *ie* average claim amount $\times$ average claim frequency. It may alternatively be expressed as a rate per unit of exposure.

The additional return required over the risk-free return to reflect the riskiness of future cashflows.

Running yield

The annual income on an investment divided by its current market value. Important examples are the flat yield on gilts, the gross dividend yield on equities and the rental yield on property.

Run-off basis

A valuation basis that assumes an insurer will cease to write new business, and continue in operation purely to pay claims for previously written policies. Typically expenses and reinsurance arrangements change after an insurer ceases to write new business.

Self-administered scheme*

An occupational benefits scheme where the assets are invested, other than wholly by payment of insurance premiums, with an in-house investment manager or an external investment manager.

Self-insurance

The retention of risk by an individual or organisation, as distinct from obtaining insurance cover.

Self-investment*

The investment of the assets of an occupational benefits scheme in employer-related investments.

Short position

A short position in an asset means having a negative economic exposure to the asset. In futures and forward dealing the short party is the one who has contracted to deliver the asset in the future. (Compare *Long position*.)

Short-tailed business

Types of insurance in which most claims are usually notified and / or settled in a short period from the date of exposure and / or occurrence.

Solvency

A provider is solvent if its assets are adequate to enable it to meet its liabilities. Supervisory authorities will usually have requirements, in terms of the values a provider can place on its assets and liabilities, for the purpose of showing statutory solvency.

Solvency margin

The solvency margin of a provider is the excess of the value of its assets over the value of its liabilities.

Specific risk

The risk of holding a share which is unique to the industry or company and can be eliminated by having a suitably diversified portfolio of shares of differing types of companies. This is sometimes also referred to as alpha, unsystematic, diversifiable or residual risk.

Spot interest rate

The n-year spot interest rate is the geometrical average of the interest rates that are expected to apply over the next n years. It is the redemption yield on an n-year zero-coupon bond. (See [zero-coupon yield curve](#).)

Strips

Debt securities comprise a series of coupons and (possibly) a final redemption amount. For certain such securities, each individual cashflow may be traded as an isolated zero-coupon bond, called a 'strip'. Sometimes the original security is issued in a stripped form; sometimes strips are created via brokerage firms in the market.

Surplus

1. Surplus is the excess of the value placed on a life insurance company's assets over the value placed on its liabilities. A negative surplus is usually called a strain.
2. A type of proportional reinsurance where the cedant retains the risk up to its retention level and reinsures the excess.

Surrender value

The amount paid out to a policyholder who terminates their contract before the contractual termination date.

Swap

A contract between two parties under which they agree to exchange a series of payments according to a pre-arranged formula.

The most common kind of swap is an interest rate swap, where one party with fixed interest cashflows enters a swap with another party based on a variable interest rate.

A credit default swap is an agreement where one party will compensate the other party in the event of a loan default or other credit event.

Non-investment swaps also exist, an important example being longevity swaps on annuity portfolios. Here, an insurer swaps its liability to make annuity payments in line with actual mortality experience with another party who will make payments based on a defined mortality index.

Systematic risk

The risk of the individual share relative to the overall market which cannot be eliminated by diversification.

Treasury bill

A short-term government debt security. Usually issued with a term of 91 or 182 days. No interest is paid, but the bill is issued at a discount to its redemption value.

Trust*

A legal concept whereby property is held by one or more persons (the trustees) for the benefit of others (the beneficiaries) for the purposes specified by the trust instrument. The trustees may also be beneficiaries.

Trust Deed*

A legal document, executed in the form of a deed, which establishes, regulates or amends a trust.

Trustee*

An individual or company appointed to carry out the purposes of a trust in accordance with the provisions of the trust instrument and general principles of trust law.

Underwriting

- 1. The process of consideration of an insurance risk. This includes assessing whether the risk is acceptable and, if so, the appropriate premium, together with terms and conditions of the cover. It may also include assessing the risk in the context of the other risks in the portfolio.**
- 2. The provision of some form of guarantee. In investment, underwriting is where an institution gives a guarantee to a company issuing new shares or bonds that it will buy any remaining shares or bonds that are not bought by other investors.**

Underwriting cycle

The process whereby relatively high and thus profitable premium rates that often result in an increase in the supply of insurance are followed by lower and less profitable premium rates usually associated with increased competition. These in turn may be followed by a decrease in supply as companies leave the less profitable market, reduced competition and a return to higher premium rates. This process is complex but appears to occur in all types of insurance and reinsurance, though at different speeds and to different degrees.

Underwriting factor

Any factor that is used to determine the premium, terms and conditions for a policy. It may be a rating factor or some other risk factor that is accounted for in a subjective manner by the underwriter.

Unit rate

See '[Bulk rate](#).'

Unitised contracts

After deducting an amount to cover part of its costs, each premium under a unitised contract is used to buy units at their offer price. These units are added to the contract's unit account. When the insured event happens the amount of the benefit is then based on the bid price value of all the units in the contract's unit account.

Unsecured loan stock

A form of long-term corporate debt which is not secured on any specific assets of the borrower.

Valuation rate of interest

The rate at which future liabilities and assets are discounted to the valuation date.

Vested rights

Benefits to which a member of a scheme is entitled, regardless of whether they remain an active member of the scheme.

Volatility

The sensitivity of the market price of an investment. A highly volatile investment is one which has a very unstable price. For fixed-interest bonds, volatility is specifically defined as the rate of change in the dirty price (P) of the bond for a change in the gross redemption yield (y).

$$V = - \frac{1}{P} \frac{dP}{dy}$$

Volatility is also known as *modified duration*.

Waiting period

1. In the case of occupational pension provision, the period during which an employee does not yet meet the eligibility conditions for membership of the occupational benefits scheme.
2. In the case of sickness benefits, the period beginning at the policy inception during which the policyholder is not allowed to make a claim.

Waiver of premium

This is a benefit attached to a contract under which regular premiums are payable. In the event of sickness or disability or, sometimes, unemployment, the premium payable under the contract, including the premium for the waiver of premium benefit, is waived.

Weighted average cost of capital

The aggregate return required by the providers of debt and equity capital, allowing for the effects of tax and the risks borne by the capital providers.

Winding-up*

The process of terminating a benefits scheme, usually by applying the assets to the purchase of individual insurance contracts for the beneficiaries, or by transferring the assets and liabilities to another scheme.

Withdrawal benefit

A benefit payable when an employee leaves a benefits scheme.

With-profit (participating)

A life insurance contract is with-profit if the policyholder is entitled to receive part of the surplus of the company. The extent of the entitlement is usually at the discretion of the company.

Without-profit (non-participating)

A life insurance contract is without-profit if the life insurance company has no discretion over the amount of benefit payable, ie the policy document will specify at outset either the amount of the benefits under the contract or how they will be calculated.

Yield curve

A plot of yield against term to redemption. Usually the yield plotted is the gross redemption yield on coupon paying bonds but other yields can be used.

Zero-coupon bond

A bond where the sole return is the payment of the nominal value on maturity.

Zero-coupon yield curve

A plot of redemption yields against term to redemption for (usually hypothetical) zero-coupon bonds.

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Subject CP1: Assignment X1

2019 Examinations

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You should spend 85 minutes on the Paper 1 style questions. You should spend 20 minutes planning your answers to the case study and 1 hour writing out your answers.

Instructions to the candidate

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2019 Examinations

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Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Total	
10	15	15	14	3	12	6	5	80	= _____ %

Grade: A B C D E

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Notes on marker's section

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A = Excellent progress B = Good progress C = Average progress
D = Below average progress E = Well below average progress

Please note that you can provide feedback on the marking of this assignment at:

www.ActEd.co.uk/marking

1 Paper 1 style questions

- X1.1** You have been appointed as the actuary to the Government of a developing country, which is considering introducing a State-sponsored retirement pension system. (There is currently no State-sponsored retirement pension provision.)

You have been asked to carry out a review of the external environment as a first step towards designing and implementing such an arrangement.

Describe the factors to be considered in this review, giving examples of the issues faced and the decisions to be taken. [10]

- X1.2** A general insurance company, which has only ever sold private motor insurance for standard cars, now wants to start selling insurance policies to owners of classic cars.

Describe how the actuarial control cycle can be used in the launch, pricing and ongoing management of this project. [15]

- X1.3**
- (i) Explain why the need to regulate financial markets is greater than for other markets. [3]
 - (ii) Discuss the factors, including the benefits and costs of regulation, which determine the appropriate extent of regulation for a financial services market. [6]
 - (iii) List the sources of information from which a personal investor can gain additional information to help with investment choice. [3]
 - (iv) Given the existence of the sources of information that you mentioned in part (iii), explain why information asymmetries might still present problems in financial services markets. [3]

[Total 15]

2 Case Study: The Federation of Professional Golfers

The Federation of Professional Golfers (the FPG) is a newly created voluntary association set up by professional golfers, with the stated goals of:

- supporting the interests of its members
- promoting the public image of the sport.

The FPG is funded by an annual membership fee. Membership is voluntary, but over 80% of the world's professional golfers have signed up. The FPG has been set up as a charitable organisation, managed by a Board of Trustees.

The Chair of the Board has read the following recent news article:

Modern athletes lose the Midas touch

Modern athletes have it all. Hero-worshipped by their fans, they earn fabulous salaries and travel the world surrounded by a trusted band of trainers and therapists who pander to their every need.

Or so we would believe. But the recent spate of high-profile sports men and women who have retired from their sport through emotional or physical injury tells a darker story. Worse, the stars who created the greatest sporting moments of history often now languish in poverty, their eye-watering salaries all spent, some even battling with drug and alcohol addiction.

The public often turns their back on these people, preferring to remember their glory days. Memories might last a lifetime but the gratitude of the public is short-lived!

As a result of the news article, the Chair wants the FPG to introduce a new goal: to promote the financial security of members.

The Chair suggests that the FPG should commit to providing financial support to its members, through the provision of financial savings and protection products. The costs of these provisions will be funded by increasing the membership fee according to each member's choice of products.

The rest of the Board agrees to introduce the new goal, but is concerned that it does not have sufficient expertise to carry out the Chair's suggestion. They are worried that they may be sued if the FPG makes financial guarantees to its members that it is later unable to pay.

Meanwhile, the prestigious golf club 'Green Fairway' has requested that the FPG provides it with 'hole-in-one' insurance. This will indemnify Green Fairway for the cost of awarding prize money to any competitor who successfully hits a hole-in-one during its annual tournament (a prize it would otherwise be unable to offer). The prize money would be split equally between the competitor who hits the hole-in-one and a charitable donation to local causes.

Questions for Case Study

You need to answer the following questions for the FPG. Note your work needs to link to the information provided in the background information and should discuss / outline areas of professionalism / actuarial advice as required. Limited credit will be given to solutions where generic answers have been given that do not refer back to the information provided.

- X1.4** Describe the main financial needs of professional golfers, including:
- (a) how these might differ from the needs of most other people
 - (b) what types of financial resources and products (if any) might be used to meet these needs.
- [14]
- X1.5** Give examples of conflicts of interest faced by the FPG and its Board. [3]
- X1.6** Describe areas in which an actuary might be able to support the FPG. [12]
- X1.7** Describe the risks associated with offering the hole-in-one insurance. [6]
- X1.8** Suggest ways in which the FPG could implement its new goal while managing the concerns of the Board. [5]

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2019 Examinations

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Grade: A B C D E

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Feedback from marker

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1 Paper 1 style questions

- X2.1** Suggest ways in which the investment requirements of the following couples might differ:
- a couple in their 30s with two young children
 - a retired couple in their 60s. [6]
- X2.2** Compare the investment and risk characteristics of direct property investment and equities. [9]
- X2.3**
- (i) List four economic factors, other than inflation, that influence the level of government bond yields. [9]
 - (ii) 'If there is a time lag in indexation, lower expected inflation will increase the real yield on index-linked government bonds. So if we expect inflation to fall we should invest in index-linked government bonds.' Comment on whether you agree with the various aspects of this statement. [3]
 - (iii) Outline the circumstances that may cause the inflation risk premium on fixed-interest bond yields to change. [3]
- [Total 8]
- X2.4** You are the investment manager of a financial institution whose entire fund of €800 million is either invested in securities listed on the domestic stock exchange or held as cash. Just under 35% of the fund is invested in investment trust companies specialising in property and in overseas markets. It has been proposed that the fund should sell its holdings of investment trust shares. The money realised would be reinvested directly in property and overseas securities.
- (i) Discuss the merits of the current investment policy compared with the alternative of investing directly in property and overseas securities. [9]
 - (ii) Outline how the financial institution might achieve diversification within its property portfolio and portfolio of overseas assets if it were to invest *directly*. [3]
- [Total 12]

2 Case Study: All That Glitters

The 'All That Glitters' pension scheme is a small, defined benefit final salary pension fund, based in Ireland that is open to new entrants. The scheme sponsor is ATG Ltd, a large, successful corporation with an AA+ credit rating and a history of treating its employees well. Five years ago All That Glitters was enjoying a healthy funding position, but it is now underfunded, with assets well below the value of its liabilities.

The scheme actuary has suggested the following reasons for the fall in funding level:

- a sustained period of adverse economic conditions, including:
 - poor economic growth
 - low interest rates
- high levels of withdrawals of members from the scheme, which have obliged All That Glitters to realise assets at short notice and at a loss
- losses incurred due to investing in assets that appeared attractive at the time the investments were made, but which subsequently made a loss
- overly optimistic discretionary benefits having been paid out
- high expenses, including regulatory scrutiny as a result of the decreased funding level.

The trustees have decided to change All That Glitters' investment strategy, in an attempt to reverse the decline. They have asked the scheme actuary to construct a stochastic asset-liability model to assess the fund's investment position.

The scheme actuary has summarised the investment position of the scheme as follows:

- the current strategic benchmark for the fund is 80% domestic equities and 20% domestic fixed-interest government bonds
- an estimated 75% of the fund's liabilities are real and 25% are fixed in nominal terms
- the actuary recommends that an appropriate asset mix to match these liabilities would be 50% domestic equities, 25% domestic property and 25% fixed-interest undated bonds.

Two specialist managers currently manage the fund:

- a domestic equity manager whose style is described as 'growth'
- a passive bond manager that aims to match the 'over 15-year' government bond index.

(They have been unable to find a passive manager who specialises in undated bonds.)

One of the trustees has noticed that developing economies have performed better in recent years than some of the world's superpowers. They are disappointed by recent investment returns, and believe that the scheme's funds would be better invested in emerging markets. They have identified a company called 'Silver Lining', listed on the stock exchange of a small developing nation, which they say is currently undervalued and which therefore appears to be an attractive investment.

The scheme actuary has researched the company and found the following information:

- the most recent dividend payment was \$2, which was paid three months ago
- dividends have been increasing on average by 5% *pa* for the last eight years
- the required rate of return is 10%
- the stock is currently trading at \$35 per share.

Questions for Case Study

You need to answer the following questions relating to the 'All That Glitters' pension scheme. Note your work needs to link to the information provided in the background information and should discuss / outline areas of professionalism / actuarial advice as required. Limited credit will be given to solutions where generic answers have been given that do not refer back to the information provided.

- X2.5** Describe the risks inherent in the investment position of this pension fund. [3]
- X2.6** Describe how the actuary will have used their asset-liability model to derive an investment strategy for the fund. [6]
- X2.7** Describe the factors influencing the investment strategy followed by 'All That Glitters'. [16]
- X2.8** (i) Derive the price per share for 'Silver Lining' using a dividend discount model with a discount rate of 10%, and state any assumptions that you make. [4]
(ii) Comment on the appropriateness of using this model to value this particular share. [3]
[Total 7]
- X2.9** Discuss the advantages and disadvantages of the trustee's proposal to invest in 'Silver Lining' and any implementation issues. [13]

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Subject CP1: Assignment X3

2019 Examinations

Time allowed: 2¾ hours

You should spend 85 minutes on the Paper 1 style questions. You should spend 20 minutes planning your answers to the case study and 1 hour writing out your answers.

Instructions to the candidate

1. Please:

- *attempt all of the questions, as far as possible under exam conditions*
- ***begin your answer to each question on a new page***
- ***leave at least 2cm margin on all borders***
- *write in black ink using a medium-sized nib because we will be unable to mark illegible scripts*
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- *use highlighting in your script.*

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Subject CP1: Assignment X3

2019 Examinations

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Score and grade for this assignment (to be completed by marker):

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Total	
10	6	11	13	10	6	12	8	4	80	= _____%

Grade: A B C D E

Marker's initials: _____

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1 Paper 1 style questions

- X3.1** (i) Outline the advantages and disadvantages of a deterministic model. [3]
- (ii) Discuss the advantages and disadvantages of using a stochastic model to make sure that a product design remains profitable under all eventualities. [5]
- (iii) An insurance company offers an annuity that increases at the lower of retail price inflation (RPI) and 5% *pa*. Recommend a model that might be particularly suitable for pricing such a product. [2]
- [Total 10]

- X3.2** A reinsurer analyses the sickness claims experience of the individual companies it reinsures. List the reasons why the experience relating to income protection insurance business for two of its major clients might differ significantly. [6]

- X3.3** A life insurance company is considering entering the market for long-term care contracts. The contract will be single premium and benefits will start at the point that the policyholder needs long-term care.
- Discuss the factors the company must consider in designing this new contract to ensure a successful launch. Your answer should consider benefit and claims definitions as well as the normal product design considerations. [11]

- X3.4** A company has a defined benefit pension scheme. The benefits are defined in relation to the final salary (salary immediately preceding retirement) of the member. You are the actuary to the scheme and are about to value the scheme's assets and liabilities. Three years ago, at the time of the last valuation, *over half* of the liabilities related to the six senior employees of the company.

Two years ago there was a redundancy exercise in one part of the business. However, the active membership of the scheme is back to its previous levels following a recruitment exercise in a different area of the business.

- (i) Explain why past experience may be of limited relevance when setting the demographic assumptions for valuing the benefits of members who are not senior employees. Your answer should include specific reference to mortality, ill-health, withdrawal rates and other relevant assumptions. [9]
- (ii) Suggest how suitable demographic assumptions would be determined for valuing the senior employees' benefits. [4]

[Total 13]

2 Case Study: JKL Life Insurance

JKL Life Insurance is an established, leading life insurer offering a range of long-term life insurance products. It currently sells products via a network of brokers in its domestic market in Country A, a developed country.

Its product range includes both savings and protection products such as endowment assurances, term assurance and critical illness (CI) insurance policies. It has sold all these products for a number of years.

Over the last year, JKL Life Insurance has undertaken two significant projects, namely:

1. replaced its mainframe computer
2. built a new head office.

At the first meeting of the Board in its new head office, one of the agenda items was a concern around JKL Life Insurance's new business volumes. Over the last two years volumes have dropped across all product lines. The Board were sufficiently concerned about this, particularly given the recent significant expenditure, to employ an actuarial consultancy to review its business and suggest actions it could take to address the decline in new business.

The consultants have recently presented their results to the Board. One of the proposals is that JKL expand its proposition and launch a product in another country, Country B.

Country B is a rapidly developing country with a large population. Historically the population has been predominantly rural but the rapid industrialisation has led to a shift towards urban living from individuals seeking higher incomes. Many of those living in urban areas send large portions of their income back to support their families in rural areas. Literacy rates in the country have improved significantly in the last 20 years but vary around the country from 65% in some rural areas to 90% in the largest cities.

Launching a product in a new market was not something the Board had previously considered and they are keen to explore it further. The consultants have suggested that a suitable product would be critical illness insurance as there is no such product currently offered in Country B's insurance market.

Questions for Case Study

You need to answer the following questions for JKL Life Insurance. Note your work needs to link to the information provided in the background information and should discuss / outline areas of professionalism / actuarial advice as required. Limited credit will be given to solutions where generic answers have been given that do not refer back to the information provided.

- X3.5** (i) Describe three ways of categorising the expenses incurred by JKL Life Insurance and explain how they might be loaded into the premium when pricing a product. [6]
- (ii) Explain how JKL would translate the following costs into expense assumptions for its pricing model:
- (a) the cost of the replacement mainframe computer
- (b) the building costs of the new head office. [4]
- [Total 10]
- X3.6** Discuss the data sources available to JKL to help set the CI claim incidence rates for the new product. [6]
- X3.7** Discuss the principal factors that may cause a variation in the claim rates between JKL's existing product and the new critical illness product. [12]
- X3.8** Describe the steps JKL will take to project the profitability of the new product (you do not need to comment on the data). [8]
- X3.9** Explain why the premium actually charged for this business may be more or less than that determined as part of the pricing process. [4]

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Subject CP1: Assignment X4

2019 Examinations

Time allowed: 3¼ hours

You should spend 95 minutes on the Paper 1 style questions. You should spend 25 minutes planning your answers to the case study and 1¼ hours writing out your answers.

Instructions to the candidate

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Subject CP1: Assignment X4

2019 Examinations

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Score and grade for this assignment (to be completed by marker):

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Total	
8	13	12	10	7	5	7	8	10	20	100	= _____%

Grade: A B C D E

Marker's initials: _____

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1 Paper 1 style questions

X4.1 The government of a developed country is imposing the following regulation on nuclear reactor operators:

‘The costs of decommissioning nuclear reactors at the end of their working life must be paid for in full by the owners of such facilities. This expenditure will come at a time when the facilities are no longer productive, and the cost of it must be paid for with funds accumulated during the facility’s productive working life.’

A company operating such a facility is concerned about the implications of the new regulation.

- (i) Describe the risks faced by the company associated with *assessing the cost* of the regulation. [6]
 - (ii) Outline the management actions that are necessary to monitor and deal with the risk. [2]
- [Total 8]

X4.2 An employer offers a defined benefit post-retirement medical scheme. Outline the risks to which the employer is exposed as sponsor of the scheme. [13]

- X4.3**
- (i) Outline the main features of quota share, surplus and stop loss reinsurance. [8]
 - (ii) Determine the main types of reinsurance and extent of reinsurance that would be *most* suitable for:
 - (a) an insurance company writing motor insurance
 - (b) a large insurance company writing industrial property fire insurance. [4]
- [Total 12]

X4.4 A life insurance company sells without-profit critical illness policies

- (i) State the key reason why the company will wish to obtain medical evidence when underwriting these policies. [1]
 - (ii) List the medical information that the company may wish to obtain. [3]
 - (iii) Describe the options and the appropriateness of each one that would be open to the company if the underwriting process shows an applicant to have a higher than standard level of risk. [6]
- [Total 10]

- X4.5**
- (i) List different ways in which a life insurance company can diversify its business in order to reduce the risks it faces. [5]
 - (ii) Describe why too much diversification of business is not necessarily a good thing. [2]
- [Total 7]

2 Case Study: Royal Ping Insurance

Background

Royal Ping Insurance is a general insurance company which operates mainly in Europe and Asia, writing a wide variety of personal and commercial lines of business.

The company's board are pursuing a stretching growth target to increase the company's profits by 10% *pa* in each of the next three years. They are looking to use both internal growth and external acquisition in order to meet this target.

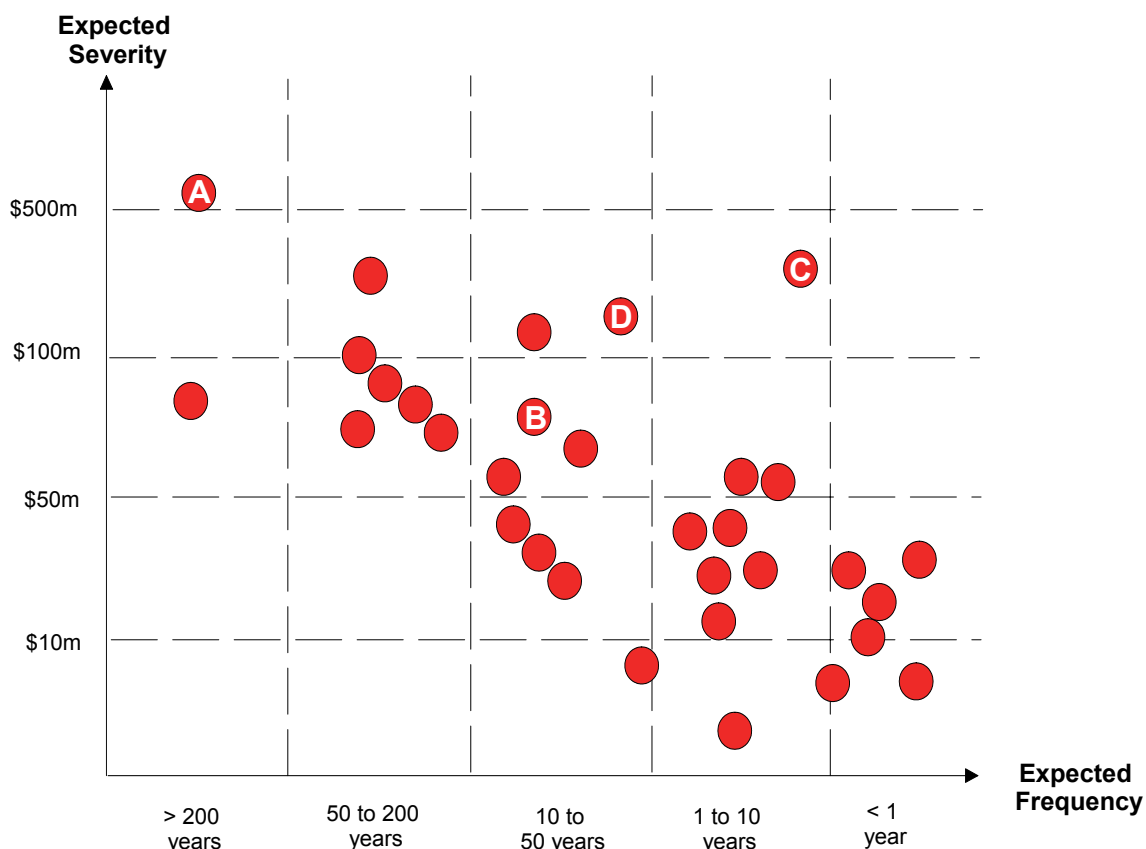
In particular the board of Royal Ping:

- has decided to extend its product range by offering product liability insurance for the first time
- has recently completed the acquisition a medium-sized US general insurance company.

You work for an actuarial consultancy which has recently been appointed by Royal Ping to advise on various aspects of the company's risk management.

Risk management function

Royal Ping's Chief Risk Officer (CRO) has provided various information about the current risk management arrangements. This information includes the following risk map used within the Royal Ping group risk function, mapping the expected severity and frequency of various risks.



The following risks are labelled on the risk map:

- Risk A – the risk of a catastrophic fire at Royal Ping’s head office
- Risk B – the risk of embezzlement of company funds by employees
- Risk C – the risk of adverse claims experience
- Risk D – the risk of a significant fall in asset values.

Royal Ping performs an evaluation of each risk in its risk map using either scenario analysis, stress testing or stochastic modelling.

Questions for Case Study

You need to answer the following questions for Royal Ping. Note your work needs to link to the information provided in the background information and should discuss / outline areas of professionalism / actuarial advice as required. Limited credit will be given to solutions where generic answers have been given that do not refer back to the information provided.

- X4.6** Outline the *other* information that it would be useful to have about each of the risks in the risk map. [5]
- X4.7** Discuss the various approaches Royal Ping might adopt to dealing with Risk A and Risk B. [7]
- X4.8** Describe how each of Risk B, Risk C and Risk D could be evaluated by Royal Ping. [8]
- X4.9** Discuss whether Royal Ping is likely to incorporate the recently acquired US company’s risk management into its group enterprise risk management arrangements or to manage its risks separately. [10]
- X4.10** Describe the business risks to Royal Ping from offering product liability insurance for the first time and suggest how each of these risks might be mitigated. [20]

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2019 Examinations

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Score and grade for this assignment (to be completed by marker):

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q9	Total	
<u>9</u>	<u>9</u>	<u>15</u>	<u>7</u>	<u>10</u>	<u>13</u>	<u>8</u>	<u>10</u>	<u>14</u>	<u>5</u>	<u>100</u>	= _____%

Grade: A B C D E

Marker's initials: _____

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A = Excellent progress B = Good progress C = Average progress
D = Below average progress E = Well below average progress

Please note that you can provide feedback on the marking of this assignment at:

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1 Paper 1 style questions

X5.1 You are an actuary for a large general insurer which writes a range of lines of business and is looking to grow by expanding into an overseas country. The company has identified a small insurer operating in that country and is considering purchasing it. You have been asked to provide an initial analysis of its accounts.

(i) List the key accounting ratios you would want to calculate when analysing the insurer's financial condition and the profitability of its business. [3]

(ii) Outline the factors that should be considered when interpreting the accounts. [6]
[Total 9]

X5.2 Outline the factors that determine the degree of prudence (and use of margins) in the actuarial assumptions used for valuing a defined benefit pension scheme. [9]

X5.3 A defined benefit scheme is being discontinued.

(i) Describe the possible options for the provision of outstanding benefit payments. [4]

(ii) For each option, discuss the costs involved and the benefit payments to members. [11]
[Total 15]

X5.4 Describe the factors that will affect the amount of surplus distributed / retained by a mutual life insurance company. [7]

X5.5 An insurer is carrying out monitoring of its critical illness insurance claim experience. Describe the features of the data required for the investigation and the factors that will influence the appropriate number of years of data to include. [10]

2 Case Study: Prosper Insurance

Background

Prosper Insurance Company is a life insurance company in a particular developed country. This country is not in Europe and so the regulatory solvency regime that applies is not Solvency II.

Prosper focuses on pensions products and its two main products are without-profit immediate annuities and unit-linked policies that are used primarily as a vehicle for saving for retirement. Prosper sells its products through independent intermediaries.

The unit-linked policies pay a benefit at retirement of the unit funds, with a guaranteed minimum benefit amount equal to the total of all premiums paid. The withdrawal benefit is 100% of the unit funds. On death before retirement, the benefit is 105% of the value of the unit funds.

Annual valuation

Prosper has just completed a year-end valuation. For this valuation:

- Assets are valued at market value.
- The provisions for the without-profit immediate annuities are calculated as the discounted value of the future annuity benefit and expense cashflows.
- The discount rate used to calculate the annuity provisions is based on actual yields on the assets backing the liabilities minus an allowance for default risk. A best estimate basis is used for other assumptions.
- The provisions for the unit-linked policies are calculated as a unit reserve equal to the unit fund plus a small non-unit reserve.

Over the year in question in the country in which Prosper is based:

- government and corporate bond yields fell at all terms
- equity market values rose.

Prosper changed its provisioning discount rates at the end of the year in line with these yield changes. Other elements of the best estimate basis used to determine the provisions have not been changed.

Prosper has performed an analysis of surplus for the year and an extract from this analysis is shown in the table below:

Source	Contribution to surplus	
	<i>Immediate annuities</i>	<i>Unit-linked</i>
Mortality/Longevity	+\$10.0m	−\$0.2m
Withdrawal	\$0m	−£8.0m
Investment return	−\$2.0m	+\$0.1m

Capital position

The directors of Prosper are concerned that although they are meeting regulatory capital requirements, the available year-end regulatory surplus is less than their target of two times the regulatory solvency capital requirement. The company's available economic capital is also below its target economic capital requirement at the end of the year.

Questions for Case Study

You need to answer the following questions. Note your work needs to link to the information provided in the background information and should discuss / outline areas of professionalism / actuarial advice as required. Limited credit will be given to solutions where generic answers have been given that do not refer back to the information provided.

- X5.6** Describe possible causes of each of the results shown in the analysis of surplus extract. [13]
- X5.7** Suggest actions Prosper could take to avoid losses arising in future in respect of unit-linked withdrawal experience. [8]
- X5.8** Compare an insurance company's economic capital and regulatory capital assessments. [10]
- X5.9** Describe possible actions that Prosper could take to improve its capital position. For each action, your answer should make clear whether it would improve the regulatory position and/or the economic position. [14]
- X5.10** Describe the actions a regulator can take if a company is unable to meet its regulatory capital requirements. [5]

END OF PAPER

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Subject CP1: Assignment X6

2019 Examinations

Time allowed: 3¼ hours

You should spend 45 minutes planning and 2½ hours writing out your answers.

Instructions to the candidate

1. Please:

- *attempt all of the questions, as far as possible under exam conditions*
- ***begin your answer to each question on a new page***
- ***leave at least 2cm margin on all borders***
- *write in black ink using a medium-sized nib because we will be unable to mark illegible scripts*
- *note that assignment marking is not included in the price of the course materials. Please purchase Series Marking or a Marking Voucher before submitting your script.*
- *note that we only accept the current version of assignments for marking, ie you can only submit this assignment in the sessions leading to the 2019 exams.*

2. Please **do not:**

- *use headed paper*
- *use highlighting in your script.*

At the end of the assignment

If your script is being marked by ActEd, please follow the instructions on the reverse of this page.

In addition to this paper, you should have available actuarial tables and an electronic calculator.

Submission for marking

You should aim to submit this script for marking by the recommended submission date. The recommended and deadline dates for submission of this assignment are listed on the summary page at the back of this pack and on our website at www.ActEd.co.uk.

Scripts received after the deadline date will not be marked, unless you are using a Marking Voucher. *It is your responsibility to ensure that scripts reach ActEd in good time.* If you are using Marking Vouchers, then please make sure that your script reaches us by the Marking Voucher deadline date to give us enough time to mark and return the script before the exam.

When submitting your script, please:

- complete the cover sheet, including the checklist
- scan your script, cover sheet (and Marking Voucher if applicable) and save as a pdf document, then email it to: ActEdMarking@bpp.com
- **do not submit a photograph of your script**
- **do not include the question paper in the scan.**

In addition, please note the following:

- Please title the email to ensure that the subject and assignment are clear *eg* 'CP1 Assignment X6 No. 12345', inserting your ActEd Student Number for 12345.
- The assignment should be scanned the **right way up** (so that it can be read normally without rotation) and as a single document. We cannot accept individual files for each page.
- Please set the resolution so that the script is legible and the resulting PDF **is less than 4 MB** in size.
- Do not protect the PDF in any way (otherwise the marker cannot return the script to ActEd, which causes delays).
- Please include the 'feedback from marker' sheet when scanning.
- Before emailing to ActEd, please check that your scanned assignment includes all pages and conforms to the above.

Subject CP1: Assignment X6

2019 Examinations

Please complete the following information:

Name:

Number of following pages: _____

Please put a tick in this box if you have solutions and a cross if you do not: ☐

ActEd Student Number (see Note below):

Please tick here if you are allowed extra time or other special conditions in the profession's exams (if you wish to share this information): ☐

Time to do assignment (see Note below): _____ hrs _____ mins

Under exam conditions (delete as applicable): yes / nearly / no

Note: Your ActEd Student Number is printed on all personal correspondence from ActEd. Quoting it will help us to process your scripts quickly. If you do not know your ActEd Student Number, please email us at ActEd@bpp.com.

Your ActEd Student Number is not the same as your IFoA Actuarial Reference Number or ARN.

Note: You should spend 45 minutes planning and 2½ hours writing out your answers. You should indicate how much you completed within this time so that the marker can provide useful feedback on your chances of success in the exam.

Score and grade for this assignment (to be completed by marker):

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Total	
5	8	20	12	5	6	19	15	10	100	= _____%

Grade: A B C D E

Marker's initials: _____

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Notes on marker's section

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1 Case Study: Buy-to-let property

A developed country suffered a financial crisis 10 years ago. The financial crisis was triggered by a failure of confidence in the banking markets due to an unsustainable amount of poor quality mortgage business having been sold. The country is still recovering from the resulting economic downturn, and the government has cut interest rates to a record low level.

As a result of the past problems, regulation has been tightened. Potential first-time homebuyers seeking to take out a mortgage are required to provide a deposit of a minimum of 10% of the property value and the amount borrowed cannot exceed 3x salary.

There is a shortage of housing stock suitable for first-time buyers, with many such new properties being purchased by 'buy-to-let' and overseas investors. There is pressure on the government to take action to increase access to the property market for first-time buyers.

Jo and Phillip are a married couple in their forties, homeowners with two young children. They have become disillusioned by the low returns that they can achieve on their cash savings and are considering using their savings to purchase a residential property to rent out. The purchase of the property would be financed by their cash savings and a small mortgage.

'You Claim We Pay' is a new proprietary general insurance company that was formed five years ago. It sells only residential building and contents cover. The company is considering extending its product range to include a new product providing cover to landlords renting out residential properties.

Questions for Case Study 1

You need to answer the following questions. Note your work needs to link to the information provided in the background information and should discuss / outline areas of professionalism / actuarial advice as required. Limited credit will be given to solutions where generic answers have been given that do not refer back to the information provided.

- X6.1** Explain why the government may have cut interest rates to record low levels. [5]
- X6.2** Describe the actions the government may take to increase access to property ownership for first-time buyers. [8]
- X6.3** (i) Explain the factors that Jo and Phillip should consider when choosing the buy-to-let property. [10]
- (ii) Contrast the risks faced by Jo and Phillip on investing in buy-to-let property as opposed to cash. [10]
- [Sub-total 20]
- X6.4** (i) Outline the cover likely to be provided by the 'You Claim We Pay' landlord insurance policy. [7]
- (ii) List the rating factors that might be used for this policy. [5]
- [Sub-total 12]
- X6.5** The pricing actuary at 'You Claim We Pay' has recommended that a reinsurance program be put in place in relation to the landlord insurance business. Demonstrate with examples why reinsurance is needed and the types of reinsurance that may be used. [5]
- [Total 50]

2 Case Study: Defined ambition scheme and investment

Company X is a car manufacturer. The company has been in existence for over 50 years and specialises in producing small family cars. The company is based in a developed country where it carries out all its manufacturing activities.

The company prides itself on treating its employees well and has offered a generous defined benefit pension scheme since the company started. The contribution rate to the scheme has increased significantly over the last 20 years. The management are concerned about the sustainability of continuing to offer the scheme and wish to explore other options for all future service for existing and new members.

Many other car manufacturers in the country offer a defined contribution benefit scheme. The scheme actuary has suggested however that Company X considers offering a defined ambition scheme, based on a defined contribution arrangement with a defined benefit underpin.

The contribution rate (as a percentage of salary) to the defined ambition scheme would be 8% (5% from Company X and 3% from members). The underpin would operate such that at retirement the accumulated defined contribution account for the member would be compared with the present value of a single life pension based on a 1/100th accrual rate and final salary. If the underpin were to bite then the defined contribution account would be increased to equal the present value of the defined benefit underpin, the cost of the underpin being met by Company X.

Company X is considering giving members' investment choice from a wide range of funds in the defined ambition arrangement. It is planning to use the 'Big Ambitions' investment company to provide the investment funds.

The 'Big Ambitions' investment company offers a range of investment funds, both traditional and more innovative.

Their more innovative funds include:

- the 'bridging loan' fund. A fund which provides loans to property buyers at a high rate of interest for short time periods so they can finalise the purchase of a property whilst they are awaiting approval for a mortgage from the bank. The loans are secured against the property that is purchased. Many loans are pooled together in the fund.
- the 'rare coin' fund. A fund specialising in the trading of types of coins pre-dating 1933 of which there are no more than a few hundred of each type in circulation.

Questions for Case Study 2

You need to answer the following questions. Note your work needs to link to the information provided in the background information and should discuss / outline areas of professionalism / actuarial advice as required. Limited credit will be given to solutions where generic answers have been given that do not refer back to the information provided.

X6.6 Outline why the contribution rate for the defined benefit scheme may have increased over time. [6]

X6.7 (i) Discuss the advantages and disadvantages to the company and members of offering a defined ambition scheme rather than a defined contribution scheme. [10]

(ii) Describe the financing methods that may be considered by Company X in order to meet the cost of the underpin. [4]

(iii) The company is considering offering members a choice of investments within the defined ambition arrangement. Discuss the disadvantages to the company of offering such a choice. [5]

[Sub-total 19]

The company has decided to fund the underpin in advance. It has asked 'Big Ambitions' to construct a suitable portfolio of investments for this fund. Company X's Finance Director has suggested that the performance of the various investment funds offered to members should be compared at regular intervals against that of competitor schemes.

X6.8 (i) Explain the objectives and process of constructing such a portfolio and the risks arising from the portfolio. [8]

(ii) Explain why care should be taken when making a comparison of performance against that of competitor schemes. [3]

(iii) Discuss the use of money-weighted rate of return and time-weighted rate of return as measures of performance. [4]

[Sub-total 15]

X6.9 Outline the risks associated with and suitability for the defined ambition scheme of investment in the following funds:

(a) the 'bridging loan' fund

(b) the 'rare coin' fund. [10]

[Total 50]

END OF PAPER

For the session leading to the April 2019 exams – CP1

Marking vouchers

Subject	Assignments	Mocks
CP1	6 March 2019	13 March 2019

Series X Assignments

Subject	Assignment	Recommended submission date	Final deadline date
CP1	X1	7 November 2018	9 January 2019
CP1	X2	28 November 2018	16 January 2019
CP1	X3	19 December 2019	30 January 2019
CP1	X4	2 January 2019	6 February 2019
CP1	X5	16 January 2019	20 February 2019
CP1	X6	6 February 2019	27 February 2019

Mock Exams

Subject	Recommended submission date	Final deadline date
CP1	27 February 2019	13 March 2019

We encourage you to work to the recommended submission dates where possible.

If you submit your mock on the final deadline date you are likely to receive your script back less than a week before your exam.

For the session leading to the September 2019 exams – CP1**Marking vouchers**

Subject	Assignments	Mocks
CP1	21 August 2019	28 August 2019

Series X Assignments

Subject	Assignment	Recommended submission date	Final deadline date
CP1	X1	15 May 2019	10 July 2019
CP1	X2	29 May 2019	17 July 2019
CP1	X3	12 June 2019	24 July 2019
CP1	X4	26 June 2019	31 July 2019
CP1	X5	10 July 2019	7 August 2019
CP1	X6	24 July 2019	14 August 2019

Mock Exams

Subject	Recommended submission date	Final deadline date
CP1	14 August 2019	28 August 2019

We encourage you to work to the recommended submission dates where possible.

If you submit your mock on the final deadline date you are likely to receive your script back less than a week before your exam.

Assignment X1 Solutions

1 Solutions to Paper 1-style questions

Solution X1.1

This question is testing the material in [Chapter 2](#), External environment.

The review should consider:

- the objectives of the Government, *eg* to provide an adequate pension for all or just to act as a safety net for the needy [1]
- the current approach to retirement provision [½]
- the implications for the private pension market of introducing State-sponsored provision. Will employers cut back on benefits? Will people save less? [1]
- eligibility for membership of the scheme, *eg* open to residents or citizens [1]
- whether membership of the scheme will be voluntary or compulsory [½]
- whether individuals or employers will be allowed to opt out of the State scheme [½]
- the needs of the population, for example consider: [½]
 - the type of scheme that is needed, *eg* defined benefit or defined contribution [½]
 - the level of benefits people are going to need [½]
 - whether benefits should be the same for all or means-tested [½]
 - the need for inflation-proofing of benefits in payment [½]
 - the need for dependants' benefits [½]
 - the age at which people will want to retire [½]
 - the need for any ill-health retirement benefits [½]
- the extent of benefit provision, *eg* will the current retired population also receive benefits? [½]
- the impact on other benefits already provided by the State, *eg* sickness and unemployment benefits *etc* [½]
- how benefit provision will be made for those who fall outside of the working population, *eg* carers and unemployed [½]
- demographic factors, *eg* the current makeup of the population ... [½]
- ... and how quickly it is changing over time, in particular whether the population is ageing [½]
- economic conditions, *eg* current and likely future investment conditions [1]
- social and cultural factors, *eg* in a developing country there may be a tradition of families looking after their elderly relatives. How is this changing over time? [1]

- other governments, *eg* look at the benefit provision of governments in a similar state of development to this country, including analysing the success of the different approaches adopted [1]
 - administration arrangements – consider the infrastructure in place for collection of contributions and delivery of benefits [1]
 - where will the revenue come from to support the benefits? [½]
 - the tax treatment of the contributions and retirement benefits [½]
 - the implications of the different approaches to financing, for example: [½]
 - PAYG or funding in advance? [½]
 - the availability of suitable investments if a funded approach were to be adopted [½]
 - how the capital adequacy, *ie* funding level, would be assessed if a funded approach is adopted [½]
 - political factors, for example: [½]
 - the likely reaction of individuals, *eg* to increased taxes and the benefits provided and the effect on government popularity [1]
 - the degree to which cross-subsidy will be allowed, from rich to poor and across generations [1]
 - environmental / ethical factors *eg* avoiding printing a large volume of paper [1]
 - how the country / government might be viewed by other governments / overseas bodies if it undertakes such a change. [½]
- [Maximum 10]

Solution X1.2

This question is examining the material in [Chapter 0](#) on the actuarial control cycle.

General commercial and economic environment [½]

The company should investigate, for example:

- the competition, *eg* their market share, premium rates and cover provided
- the current stage in the underwriting cycle
- any trends in this market sector, *eg* in classic car ownership / demand for insurance
- the nature of the claim risks, *eg* average claim frequency and size *vs* the business currently sold
- the economic outlook
- the types of policyholders attracted to buying products and their risk profile
- opportunities to 'cross-sell' to existing customers.

[½ for each example, maximum 3]

The key stakeholders need to be identified and their interests understood, *eg* shareholders, policyholders. [½]

Specifying the problem [½]

The company's primary goal is to set premium rates to achieve a certain profit criterion ... [½]

... and/or market share. [½]

The risks to the company of selling this product need to be identified and analysed and mitigated. [½]

Key risks of the new venture include:

- lack of data (as existing data on private motor insurance is likely to be of limited use) ...
... making it difficult to ascertain likely claims experience
 - not selling enough business, particularly as this is a niche market
 - that the competition react to a new entrant and alter their strategy.
- [½ each for any suitable example, maximum 1]

The strategic courses of action that could be used to handle the particular risks in question will be identified at this stage and considered in more detail when developing the solution. [½]

For example:

- the company could use industry data or reinsurer's data / assistance
 - well-targeted advertising to reduce the risk of insufficient sales
 - competitor monitoring and efficient administration processes so as to be able to respond quickly to competitor actions.
- [½ each for any suitable example, maximum 1]

Developing the solution [½]

The company needs to choose appropriate models to determine premium rates and assess the profitability of these rates. [½]

A profitability model can be used to show the impact of a particular set of premium rates and experience assumptions on the profitability of the contract and on the business as a whole. [½]

Key assumptions will include:

- claim frequency distribution
- claim amount distribution
- claims inflation

- volume / mix of business
- expenses (including commission) and expense inflation
- persistency rates (*ie* likely renewal rates)
- investment returns. [½ each, maximum 2]

The model should be dynamic, *ie* assumptions should interact. [½]

Sensitivity testing and scenario analysis will be carried out in order to understand the likely range of results. [½]

The implications of the results on all stakeholders should be considered ... [½]

... as should alternative options / solutions should be considered. [½]

Monitoring the experience [½]

Once the company has started to write business it should carefully monitor actual vs expected experience for all of the assumptions mentioned above ... [½]

... and investigate the cause of any departure from expected experience. [½]

The monitoring of experience should be carried out more frequently in the early life-time of the company. Any issues need to be spotted early and acted upon. [½]

The results of the monitoring should be fed back into the earlier stages of the cycle. [½]

For example:

- the solution may need to be redeveloped, *eg* in terms of the types of classic cars / drivers insured [½]
- assumptions could be changed and premium rates may need to be revised if they are inadequate. [½]

The insurer should also monitor competitors' reactions as this may influence the assumptions. [½]

Professionalism [½]

Ensure that any relevant guidance, for example regarding premium rate adequacy, is adhered to. [½]

Communications (verbal and written) must be clear. [½]

[Maximum 15]

Markers: give credit for the ideas even if they appear under one of the other control cycle headings, if the categorisation seems sensible.

Solution X1.3

This question is examining the material in [Chapter 3, Regulation](#).

(i) **Need for regulation**

To ensure confidence in the financial system as a whole ... [½]

... by guarding against the dangers of problems in one area spreading to other parts of the system, and the damage that would be done by a systemic financial collapse. [1]

To compensate for any asymmetries that might exist in financial transactions, for example asymmetries of: [½]

- information [½]
- expertise [½]
- negotiating strength. [½]

The need is greater than in other markets because:

- company failures elsewhere in the economy are likely to be less serious and less contagious [½]
 - financial contracts are long-term and have a significant impact on the future economic welfare of individuals [1]
 - financial contracts are complex. [½]
- [Maximum 3]

(ii) **Extent of regulation**

The benefits of regulation stem primarily from the:

- creation of efficient markets and correction of inefficient markets [½]
- protection of the consumers of financial products [½]
- maintenance of confidence in the financial system [½]
- prevention of financial crime. [½]

The main *direct* costs of regulation are incurred by the:

- regulator in administering the regulatory framework, *eg* collection and examination of information required for monitoring purposes [1]
- regulated firms in complying with the regulation, *eg* in maintaining appropriate records, collating requisite information and supplying it to the regulator and/or the investor. [1]

In practice, most of these direct costs are ultimately borne by the consumer in the form of either higher taxation and/or higher charges. [½]

In addition, there may also be *indirect* costs associated with differences in the behaviour of either financial services providers or investors compared to how they would have acted in the absence of regulation. [½]

These include:

- an alteration in the behaviour of consumers, who may be given a false sense of security and a reduced sense of responsibility for their own actions [½]
- an undermining of the sense of professional responsibility amongst intermediaries and advisors [½]
- a reduction in consumer protection mechanisms developed by the market itself [½]
- reduced product innovation [½]
- reduced competition. [½]

The appropriate extent of regulation for a particular financial services market will be that which maximises the benefits relative to the costs of regulation. [1]

In theory at least, this will occur when the marginal benefits of regulation are equal to the marginal costs over the relevant time period. [½]

[Maximum 6]

(iii) ***Potential sources of information***

- independent financial intermediaries and advisors, *eg* stockbrokers, actuaries, specialist financial advisors
- the financial providers themselves, *eg* a sales representative of a life office or a bank manager
- company reports and accounts
- the financial press, including specialist investment magazines
- books
- trade associations and consumer associations
- the internet
- her own knowledge and previous experience
- friends, relations and colleagues – informed or otherwise

[½ each, maximum 3]

(iv) ***Persistence of problems***

Information asymmetries may still exist because:

- the consumer might be unaware of the existence of the information
- the consumer may not understand the information
- it will normally cost money to obtain information
- information provided might be misleading, incomplete or incorrect
- contract wording may be in the favour of the financial services provider
- consumers may exhibit anti-selection, choosing the option most beneficial to them
- consumers may avoid divulging all information to the provider
- not all of the information may be in the public domain.

[½ each, maximum 3]

2 Solutions to Case Study questions

Solution X1.4

This question discusses the topics in [Chapter 4](#), Introduction to financial products and customer needs.

Players probably have much higher emotional needs than other people because they will be accustomed to much higher earnings. [1]

These emotional needs should be secondary to meeting their logical needs below. [½]

However, not all players will be so successful. If a player's earnings are comparable with the majority of the population, their needs will be similar. [1]

Players who live in certain developing countries will have more significant savings and protection needs, because State benefits may not be available. [1]

Living expenses while playing professionally [½]

Players must meet food costs / transport costs / household bills and the salary costs of their staff, eg caddy / coach / physiotherapist etc. [1]

This need is:

- current [½]
- real, linked to earnings and price inflation [1]
- much higher than usual, at least until retirement from professional sport due to: [½]
 - the costs of employing staff [½]
 - travelling costs. [½]

This need could be met from the players' current income, ie from: [½]

- prize money
 - sponsorship deals
 - investment returns on savings.
- [½ for each example]

Cost of purchasing a home [½]

Accommodation costs are a logical, current need. [1]

If the player is very successful, they could purchase a property in cash. Otherwise a mortgage is appropriate. [1]

Saving for retirement [½]

This is to meet a player's day-to-day living costs, after they retire from professional sport. [½]

These needs will probably:

- be lower than when they were playing professionally (due to lower travelling costs / training expenses) [1]
- start earlier than most other people (since players can't compete at a professional level as they get older). [1]

Since players are essentially self-employed, a personal pension plan is appropriate, probably purchased from an insurance company. [1]

However, any plan would have to allow for players needing a retirement income from an earlier age than is typically permitted by regulation. [½]

Alternatively, retirement needs could be funded from the player's own savings and investments (if the player is financially sophisticated enough to have planned this appropriately). [1]

Protection against illness / injury [½]

This is a current need. [½]

It is particularly important for golfers while they are still competing, since illness / injury could result in loss / reduction of income. [1]

Private medical insurance can contribute to some / all of the costs of treatment. [1]

If possible, it could cover the costs of treating stress-related illness, eg induced by playing in high-pressure events, or by travelling on tour for long periods. [1]

Income protection insurance can provide an income while the player is unable to work through ill health, but: [1]

- it is likely to be very expensive if a player wishes to continue an expensive lifestyle [½]
- it is likely to have a cap on the benefits provided. [½]

Critical illness cover can pay for a mortgage / healthcare or other liabilities, if a player is diagnosed with a serious illness. [1]

These could be very significant, if they have built up large current liabilities, eg employee contracts. [1]

Protection against making a hole-in-one [½]

This is a current need. [½]

It is particularly significant for players who do not earn very high incomes ... [½]

... because in some cultures, a player who scores a hole-in-one is expected to present lavish gifts to friends and competitors. [½]

Future healthcare [½]

As with other people, players can protect against future healthcare needs in old age through long-term care insurance. [1]

[Maximum 14]

Markers: give credit for other sensible needs and suggestions of products.

Solution X1.5

This question is testing the material in [Chapter 1](#), Actuarial advice.

The Board of Trustees

The FPG has been set up by professional golfers, so the trustees may themselves be professional golfers. [½]

Hence they may make decisions that benefit themselves more than other members, ... [½]

... eg they may lobby for higher prize money in tournaments they are likely to play in. [½]

The trustees will receive a salary out of the annual membership fee. They will want this to be high, which would not be in the best interests of the members. [1]

The trustees of the FPG may also be trustees of the 'local causes' who will receive the hole-in-one prize. [½]

They would therefore have an interest in providing the insurance, or in providing it at a low price. [½]

Since the Board should be managing the FPG in the best interests of its members, hopefully these conflicts won't arise. [½]

The FPG

The hole-in-one insurance itself presents a conflict between the stated goals of the FPG: [1]

- it promotes the public image of the sport, because some of the prize money is donated to charity [1]
- it is arguably not in the interests of members because the insurance policy may be sold at a loss (ie the members would in effect be accepting insurance risk). [1]

[Maximum 3]

Markers: give credit for other sensible conflicts.

Solution X1.6

This question is testing the Core Reading in [Chapter 1](#), Actuarial advice.

An actuary might:

- advise the FPG on the financial needs of its members ... [1]
 ... *ie* their current needs and future needs [½]
- help the FPG to understand how the needs of its members differ, [1]
 ... *eg* depending on each member's:
 - nationality (*ie* access to State benefits) [½]
 - earning power (*eg* world ranking) [½]
 - access to financial support (*eg* talent development programmes) [½]
- assist with the choice of products / contract design of these products and set terms and conditions ... [1]
 ... particularly because these will probably be different to standard products available in the market [½]
- advise on the annual membership fee, *eg*: [½]
 - how high the total fee income should be, in order to meet the costs of any financial provision, as well as other ongoing costs [1]
 - how this fee might differ for different categories of member, or for different nationalities [1]
- advise on the potential costs of providing the benefits as they fall due... [½]
 ... this would involve projecting cashflows, and setting assumptions regarding investment returns, claim frequencies, morbidity rates *etc* [1]
- help identify / quantify the key risks involved in providing these benefits ... [1]
 ... for example, the membership fees may be too low, and therefore subsequent benefits may not meet members' reasonable expectations [½]
- advise on how these risks could be managed, *eg* by: [1]
 - reducing options / guarantees [½]
 - purchasing reinsurance [½]
 - imposing a cap on the benefits offered *etc* [½]
- give advice on the appropriate level of provisions to be held [1]
- advise on meeting legislative requirements ... [1]
 ... these are likely to be onerous, if the FPG does decide to provide financial products to its members ... [½]
 ... and in any case there will probably be legislative requirements surrounding the management of a charity [½]

- help identify an appropriate investment strategy for the FPG ... [1]
 - ... although assets are likely to be small at least initially, since the FPG is only newly founded ... [½]
 - ... but could quickly become significant *eg* if take-up rates are high [½]
- help monitor experience as it emerges, and suggest corrective actions as necessary ... [1]
 - ... *eg* managing surrender values, controlling expenses *etc* [1]
- advise on how best to communicate the FPG's services to relevant stakeholders, *eg*: [1]
 - current members
 - prospective members
 - regulators
 - tax authorities, *etc* ...

[½ for each example, maximum 1]

 - ... in particular making sure that the information given is transparent and that all disclosure requirements are met [1]
- assist with appropriate corporate governance ... [1]
 - ... this is especially important since the Board may be relatively inexperienced [½]
- help identify the conflicts of interest outlined above. [1]

[Maximum 12]

Markers: give credit for other sensible suggestions / examples.

Solution X1.7

This question is testing the material in [Chapter 7](#), General insurance products.

The most significant risk is the uncertainty of claims experience. [1]

The size of a single prize will be known in advance ... [½]

... however the total claim amount is unknown because the number of claims (*ie* the number of holes-in-one scored during the tournament) is uncertain. [1]

It will depend on:

- the ability of the golfers (this sounds like a prestigious tournament, so it might attract the world's best players) [1]
- the prevailing weather conditions, which will affect the likelihood of a claim [½]
- the difficulty of the course [½]
- the number of players who enter the tournament ... [½]
 - ... for example, players may even be enticed to enter because of the hole-in-one prize. [½]

Since only one policy will be sold, claims experience will be very volatile ... [1]

... in other words, the risk cannot be pooled with similar risks to smooth experience. [½]

Green Fairway may deliberately make the course easier so as to increase the possibility of the prize being awarded, and hence increase publicity. [1]

This is an example of moral hazard. [½]

Lack of data means the pricing risk will be high, *ie* the policy may be sold at a loss. [1]

Reserving risk is also high, *ie* the FPG may not have sufficient funds to pay the claims. [1]

The FPG would be exposed to high liquidity risk (*ie* it would have to pay out a large sum at short notice). [1]

There will be no opportunity to benefit from economies of scale, so the expenses of managing the policy / meeting regulatory requirements will also be high and they will be uncertain due to lack of experience. [1]

Other risks, such as investment risk or the timing of claims payments, are low because the contract is very short-tailed and the dates of the tournament will be known in advance. [1]

[Maximum 6]

Solution X1.8

The question is primarily testing the material in [Chapter 5](#), Providers of benefits.

The FPG could take action to encourage its members to manage their finances. [1]

This could include:

- sending out educational literature to members (and prospective members) [1]
- providing a financial planning service [½]
- imposing a membership requirement, such that all members must demonstrate that they have purchased a minimum level of insurance and benefit provision. [1]

However, the first two of these actions would probably not accomplish the Chair's goals without further action being taken. [½]

The FPG could act as an intermediary between its members and relevant financial institutions, *eg* a life insurer or general insurer. [1]

This could involve:

- educating members about their financial needs [½]
- advising members on appropriate products [½]
- developing relationships with 'preferred' suppliers in each country, so that members of all nationalities can access financial products [½]
- discussing the financial needs and priorities with the financial providers, to ensure that the products meet the particular needs of professional golfers [½]
- acting as intermediary in the sale of products, *ie* so that members can make financial arrangements with the FPG rather than dealing directly with the financial providers. [1]

Alternatively, the FPG could go ahead with the Chair's proposal, but also purchase professional indemnity insurance. [1]

This would indemnify FPG (or the individual members of the Board) against legal liabilities resulting from negligence in the management of the FPG. [1]

For example, it could provide indemnity for:

- fines payable to the regulator [½]
- lawsuits brought by members against the FPG. [½]

[Maximum 5]

Assignment X2 Solutions

1 Solutions to Paper 1 style questions

Solution X2.1

The Core Reading for this question is covered in [Chapter 14](#), Choosing an appropriate investment strategy.

Method of savings

The younger couple is likely to be saving out of income and so regular savings schemes may be appropriate. [½]

The retired couple are more likely to be investing an accumulated lump sum than saving out of current income. [½]

Need for income vs capital growth

The younger couple will have many different investment goals in the short, medium and long term and so will have to split their savings appropriately ... [½]

... for example, a mortgage and school fees may be important liabilities ... [½]

... and income from investments may not be as important as capital growth over the chosen term. [½]

For the retired couple, income from the investments is likely to be crucial ... [1]

... investment goals will be shorter term ... [½]

... there will be a trade-off between maximising current income and allowing for capital growth. [½]

Tax

The younger couple are more likely to be higher rate taxpayers than the retired couple, so tax efficient savings may be more important. [½]

Risk appetite

If the younger couple have sufficient spare income they may be able to undertake some relatively risky long-term investments. [½]

The retired couple are likely to be relatively more risk averse because fluctuations in investment returns could mean fluctuations in day-to-day living standards and they will not be earning income to make up any shortfall. [1]

Liquidity

The circumstances of the younger couple may change over time, *eg* birth of a child meaning access to assets will be important ... [½]

... they may therefore need liquid / marketable assets. [½]

Immediate access to their capital might be less important to the retired couple. [½]

[Maximum 6]

Solution X2.2

This question examines your understanding of [Chapter 9](#), Equity & property markets.

Similarities

- expected higher return than less risky investments, *eg* government bonds [½]
- real investments [½]
- usually viewed as long-term investments [½]
- uncertain income stream and capital growth [½]

Differences

- property is less marketable than equity [½]
- property is much less divisible than equity [½]
- property investment offers an income stream which is likely to be in the shape of a step function (rather than yearly increments, which might be expected on equity) [½]
- property possibly yields a more stable income stream than the dividend stream from equities ... [½]
- ... although this dividend stream can be increased by diversification [½]
- income may be taxed differently on the two investments [½]
- income is usually payable quarterly on property, whereas dividends may be paid half yearly or annually [½]
- capital values can be stable for property investment in the short term due to infrequent valuations ... [½]
- ... whereas the market value of equities can be very volatile [½]
- property involves higher dealing expenses [½]
- property involves higher management expenses [½]
- valuations are less straightforward for property investment and produce less certain values [½]
- property is heterogeneous (*ie* each property is unique) whereas shares are easier to compare [½]

- property offers a greater opportunity to influence returns ... [½]
... for example, the characteristics of property investment can be changed by the owner [½]
- property has a higher intrinsic value (in most cases), *ie* the value of the site ... [½]
... whereas shares may be worthless if a company fails [½]
- property has a risk of voids if no tenant can be found [½]
- property suffers from depreciation and obsolescence risk, given it is a tangible asset [½]
- property is more likely to be subject to government intervention, *eg* the rights of tenants may be enhanced [½]
- in general, property is traded a lot less frequently than equity [½]
- property may have a higher utility value, *eg* the investor could move into the building. [½]
[Maximum 9]

Solution X2.3

This question examines your understanding of [Chapter 8](#), Bond & money markets and [Chapter 11](#), Behaviour of the markets.

(i) ***Economic factors influencing Government bond yields***

- short-term interest rates
- fiscal deficit
- exchange rate
- institutional cash flow

[½ each, total 2]

(ii) ***Comment***

Index-linked government bonds typically have a time lag in indexation. [½]

There is no protection against inflation in the final few months to redemption. [½]

Consequently, lower (higher) assumed rates of inflation do lead to higher (lower) real yields. [½]

However, this difference is very small, as the time lag is small, particularly for long-term stocks. [½]

In contrast, the real yield on fixed-interest securities is very sensitive to expected inflation as there is no inflation protection throughout the whole term. [½]

So, if we expect (ahead of the market) that inflation will fall, it may be best to invest in fixed-interest securities rather than index-linked securities. [½]

Furthermore, we should use only *our expectations* as a basis for an investment decision to the extent that they are different from the market as a whole ... [½]

... otherwise, the current market price of assets will already reflect our expectations. [½]

Finally, our choice of assets may also depend on the liabilities we have and our need to match them. [½]
[Maximum 3]

(iii) ***Explain circumstances leading to a change in the IRP***

The inflation risk premium is a margin to compensate investors against the future uncertainty relating to inflation. [½]

The inflation risk premium may change due to:

- a change in political certainty / stability [½]
 - a change in government commitment towards inflation control [½]
 - a change in monetary policy, *eg* a change in interest rates [½]
 - a change in the pace of economic growth [½]
 - a change in the level of inflation (higher levels of inflation are often associated with more uncertainty regarding future inflation and therefore a higher inflation risk premium) [½]
 - a change in the supply of index-linked government bonds relative to conventional government bonds ... [½]
- ... which may give an indication as to the Government's view of future inflation and its uncertainty. [½]

[Maximum 3]

Solution X2.4

This question is testing material from [Chapter 9](#), Equity & property markets and [Chapter 10](#), Other investment classes.

(i) ***Merits of the current investment policy***

Advantages

The investment trusts provide expert management. [½]

This is particularly true in property investment (which needs great expertise) ... [½]

... and overseas equity investment in the more unusual regions. [½]

Investing in property companies may give some exposure to gains from development activities or to particularly large properties ... [½]

... this is difficult to obtain directly. [½]

Some of the practical problems of overseas investment (*eg* different accounting practices, language, time zones) are avoided, or at least passed on to someone else. [½]

Diversification within the overseas / property markets will be greater than if the institution invests directly. [½]

This may be particularly useful for property, where large unit sizes could make diversification difficult. [½]

Particularly with property, the current policy of using investment trusts gives greater marketability ... [½]

... and divisibility than direct investment. [½]

Currently the institution may be benefiting from any gearing in the investment trusts. [½]

Investment trusts are likely to stand at a discount to their net asset value. So the assets, and the resulting income stream, may be enjoyed cheaply ... [½]

... or the investor may benefit from a narrowing in the discount whilst holding the investment. [½]

Valuation of the institution's investments in a property-based investment trust is simpler and more objective than the subjective valuation of direct property investments. [½]

There may be tax advantages. [½]

Disadvantages

The biggest drawback is that the fund does not have direct control over all the underlying assets. [½]

It also has to pay management fees through the investment trusts. These will reduce its investment return. [½]

A fund of this size may be able to invest more cheaply itself. [½]

Gearing could introduce unwanted volatility. [½]

The discount to net asset value could widen. [½]

Investing in property via investment trusts does not give the diversification away from the equity market that direct property investment would offer. [½]

The financial institution could derive some utility from direct property investment, *eg* it could occupy one of the properties owned. [½]

There may be tax disadvantages. [½]

[Maximum 9]

(ii) ***Range of assets if it were to invest directly***

Property

- different sectors: offices, shops, industrial *etc* [½]
- different locations: city centre vs provincial [½]
- different countries: domestic vs overseas [½]
- different tenure: freehold vs leasehold [½]

Overseas

- different asset types: equities, bonds, property ... [½]
- different geographical regions: Americas, Europe, Asia ... [½]
- different currencies [½]
- different industries [½]

[Maximum 3]

2 Solutions to Case Study questions

Solution X2.5

The Core Reading for this question is discussed in [Chapter 16](#), Investment management.

Risks inherent in fund set-up

Strategic risk

The strategic risk of the fund is the risk that the strategic benchmark (chosen by the trustees for the fund) – 80% equities and 20% bonds, performs badly relative to the liability split of 75% / 25%. [1]

Strategic risk also encompasses the risk that the portfolio thought to best match the liabilities (in this case, 50% equities, 25% property and 25% fixed-interest undated bonds) underperforms the liabilities. [½]

Structural risk

There is a structural risk inherent in the portfolio since the bond manager's benchmark is the over 15-year bond index, not undated bonds ... [1]

... hence the sum of the aggregate benchmarks given to the managers will not equal the strategic benchmark set by the trustees. [½]

Structural risk will also occur if the portfolio is not regularly rebalanced between equities and bonds to maintain the 80:20 weighting. [½]

Active risk

There is active risk in the fund to the extent that the equity manager may choose stocks that underperform the domestic equity market index ... [½]

... as we are told that the manager follows a growth style and hence will only select from a subset of stocks and not from the total market available. [½]

There may also be a small active risk inherent in the bond portfolio given that even a passive index manager cannot guarantee to perform exactly in line with an index ... [½]

... particularly with a small fund such as this, which may not be able to fully replicate the over 15-year index. [½]

[Maximum 3]

Solution X2.6

This question is testing the material in [Chapter 15](#), Asset-liability management.

The scheme actuary's starting point for the model would probably have been to specify the scheme's funding objective ... [1]

... eg to determine an asset allocation / investment strategy such that the probability of the funding level falling below x% over the next y years is less than z%. [½]

Given the recent regulatory scrutiny, the funding level might be defined on a statutory basis, although an in-house valuation basis could also be used. [½]

The model would project the cashflows associated with the scheme's asset proceeds and liability outgo. [½]

A decision would have been needed as to which variables to model stochastically ... [½]

... for example, investment returns and inflation. [½]

The withdrawal rate may be correlated with economic conditions, so the model should include a dynamic link between the two. [½]

For the stochastically modelled variables, probability distributions will have been determined along with parameter values ... [½]

... for example, mean investment returns / inflation rates, variances and correlations between returns on domestic equities and fixed-interest bonds. [½]

These assumptions should reflect expectations of future economic conditions, eg: [½]

- low bond yields, if interest rates continue to be low [½]
- low dividends, if poor economic growth continues to have a negative impact on corporate profits. [½]

Parameter values must also be chosen for the variables that will be modelled deterministically, eg mortality and expenses. [½]

The actuary would have chosen a trial asset allocation ... [½]

... and carried out a large number of simulations based on different values generated from the random variables. [½]

The results of the model will have been compared with the objective. [1]

The scheme actuary will probably have tried very many different asset allocations, leading to a range of potential asset allocation strategies that meet the objectives. [½]

Sensitivity and scenario testing will have then been carried out on these strategies to check their robustness ... [½]

... this will have led to a reduced number of acceptable strategies to be presented to the trustees ... [½]

... and the recommendation of a 50% / 25% / 25% asset strategy that meets the funding objective. [½]

[Maximum 6]

Solution X2.7

This question examines your understanding of the material in [Chapter 14](#), Choosing an appropriate investment strategy.

Liability profile of the scheme

It is likely that the scheme's primary objective is to hold assets that closely match the liabilities ... [½]

... by nature, term, currency and certainty. [½]

However, the cost of doing so may be unacceptably high in terms of lower expected investment returns ... [½]

... and would therefore be unlikely to improve the deficit. [½]

The term of the liabilities is likely to be very long, particularly if the scheme is relatively new. [½]

The nature (fixed or real or varying in some other way) of the benefits is also important in assessing the suitability of the assets. [½]

For example, many of the liabilities are real, so the benefits are likely to be a combination of:

- real – linked to earnings inflation, eg the accruing liability for a working employee [½]
- real – linked to price inflation, eg pensions may have inflationary increases [½]

The fixed liabilities probably relate to pensions in payment with no (or fixed) increases. [½]

The scheme may wish to continue providing discretionary benefits, particularly as beneficiaries have probably grown to expect them ... [½]

... this suggests the need to achieve high real returns. [½]

The liabilities are likely to be denominated in the domestic currency. [½]

Size of the assets – absolute

The actuary's recommendation to invest 25% of funds in indivisible assets such as direct property is unusual, since the fund is small ... [½]

... and will have a desire for diversification. [½]

Size of the assets – relative to the liabilities (ie the funding level)

Since the scheme is underfunded, there may be little scope to adopt a more aggressive investment strategy in search of higher returns. [½]

Existing asset mix

The scheme should consider its existing asset mix, as any change in its investment strategy will incur extra costs, *eg* dealing costs, tax *etc.* [½]

These costs should be avoided if possible, since expenses are already high. [½]

Level of risk

This is a defined benefit scheme, so both upside and downside risk lie primarily with the sponsor. [½]

The attitude to risk of the scheme trustees and of ATG Ltd should be considered. [½]

ATG Ltd is in a strong financial position and appears to be willing to contribute to the scheme. This will improve the scheme's security and could allow the scheme to mismatch its assets and liabilities, ... [½]

... although this carries the risk of a deficit if returns turn out to be worse than expected. [½]

If death benefits and ill-health benefits are insured then this reduction in risk may allow the scheme greater investment freedom. [½]

Liquidity

The scheme's fund is suffering from liquidity problems, since it has been forced to realise assets at a loss in order to meet its obligations ... [½]

... therefore it will need to invest an appropriate amount in liquid asset classes. [½]

It may be possible for ATG Ltd to identify the reasons for, and hence take actions to reduce, the high levels of withdrawals ...

... if this is achieved then it may be that the level of contributions and investment income is greater than the level of benefit outgo, such that benefits can be paid from contributions and investment income with no need to realise investments ... [½]

... that said the company may be unconcerned that withdrawals are high since it reduces its liabilities. [½]

Liquidity is also important if the scheme is using insurance contracts such as immediate annuities to provide benefits for pensioners. To be able to purchase the annuity, a lump sum must be made available. [½]

Diversification

The scheme should diversify its fund to reduce its volatility, particularly because it is small and underfunded. [½]

In particular, the trustees may choose (or be forced by regulations) to avoid investment in the debt or equity of the sponsor ATG Ltd (known as *self* investment) because of the resulting concentration of risk this represents. [1]

Restrictions

There may be statutory, legal or voluntary restrictions on the assets held. [½]

These restrictions may be more stringent than usual, due to the deficit. [½]

Statutory tests (*eg* assessing the funding position) may encourage the holding of certain asset classes and discourage the holding of others. [½]

The trustees and ATG Ltd may choose to avoid certain investments because of ethical / moral considerations. [½]

Objectives

There may be statements in the Trust Deed that relate to investment or in communications to members that have caused members to have certain expectations in relation to investment. [½]

Expected long-term returns on asset classes

Subject to All That Glitters' risk appetite there will be a desire to maximise returns. [1]

There should be a focus on long-term returns, rather than the tactical switch suggested by the trustee ... [½]

... although the trustee's preferences may have been having a significant effect on the fund's investment strategies, since similar switches have been made in the past. [½]

The fund managers, trustees and ATG Ltd should form an opinion on long-term return expectations. [½]

The other investment and risk characteristics of the available investments should be considered – *eg* marketability, reinvestment risk *etc* and the extent to which these characteristics are correlated between the different investments. [1]

Tax position

The scheme will wish to invest in a tax-efficient manner ... [½]

... so consider the tax treatment of both the scheme and the assets. [½]

For example, the scheme may wish to invest in government bonds if they are offered preferential tax treatment. [½]

Expenses

The expenses associated with investment in different assets should be determined and the return net of expenses considered. [½]

The strategy followed by other schemes / benchmarking

The scheme is unlikely to want to risk poor performance compared with its peers, and may want to specify that the strategy should not diverge beyond specified limits from those followed by other schemes.

[½]

[Maximum 16]

Solution X2.8

This question is testing the material in [Chapter 12](#), *Valuation of investments*.

(i) **Silver Lining share price**

Using the simplified dividend discount model, the share price is given by the formula:

$$V = \frac{D}{i - g} \quad [½]$$

where: D is the next dividend to be paid in nine months' time

g is the annual rate of growth of dividends over time

i is the rate of discount. [1]

The next dividend can be approximated as:

$$D = 2 \times (1 + 5\%)^{0.75} = \$2.07 \quad [½]$$

Hence the value of the share is:

$$V = \frac{2.07}{10\% - 5\%} = \$41.49 \quad [½]$$

We assume:

- that dividends are payable annually, with the next payment in nine months' time [½]
- that dividends grow at a constant rate g per annum in perpetuity [½]
- shares are held in perpetuity or are sold at a price consistent with the formula [½]
- that the required rate of return i is independent of the time at which payments are received [½]
- the share is held indefinitely or is sold at a price consistent with the formula [½]
- tax can be ignored. [½]

[Maximum 4]

(ii) ***Applicability of using the dividend discount model for valuing 'Silver Lining'***

This method is useful for comparing against other values, *eg* market value, to help an investor assess whether the share is cheap or dear. [½]

However, it is not suitable for assessing 'Silver Lining' because:

- although emerging economies can experience a rapid rate of growth, this is unlikely to continue indefinitely [½]
- the company operates out of a developing nation, so dividends are likely to be unstable [½]
- there may be particular influences making last year's dividend unsuitable as a basis for projecting [½]
- the discount rate, which will need to include a significant equity risk premium, will be difficult to set [½]
- the formula assumes a constant required rate of return but this may not be realistic [½]
- the past history for this share is unlikely to be representative of the future. [½]

It is also unclear how the data has been derived. If the scheme pays tax on its income from equity investment then it should use:

- the net dividends received [½]
- a suitable after-tax rate of return. [½]

[Maximum 3]

Solution X2.9

Tactical asset allocation is discussed in [Chapter 16](#), Investment management. Emerging markets are covered in [Chapter 10](#), Other investment classes.

Reasons why the tactical switch may be appropriate

If the dividend discount model is to be believed, the trustee is correct in stating that Silver Lining is currently trading at below its true value ... [½]

... since the model suggests a value of \$41.49 compared with a market price of \$35. [½]

Even if the dividend discount model is probably not appropriate, it may well still be the case that the stock is cheap as the market may not be efficient ... [½]

... therefore changes in the outlook for this asset may not be correctly reflected in changes in market valuations, and this provides scope for tactical switches to enhance returns. [½]

Similarly, changes in market valuations that are not justified by changes in the investment outlook provide scope for tactical switches. [½]

With the prospects of high growth rates, and the possibility of exploiting market inefficiencies, opportunities for higher expected returns exist ... [½]

... but with a correspondingly higher level of risk than for domestic investments. [½]

Since ATG Ltd appears to have a strong covenant, this may not be a problem. [½]

The economy and market of the developing country are likely to show low correlation with Irish equities. Therefore, 'Silver Lining' may provide a good means of diversification. [½]

Reasons why the tactical switch may be inappropriate

From the information provided it seems the fund has regularly made a loss in the past on such tactical switches, so it appears to lack the expertise to make effective asset choices. [½]

One of the reasons for investing in domestic assets is to match Euro-denominated liabilities. Investing in 'Silver Lining' will cause a liability mismatch. [½]

By moving away from its strategic benchmark (or the actuary's recommended strategy), the fund will tend to underperform, both in absolute terms and relative to the indices, when the domestic market does well. [½]

Since the domestic market has experienced disappointing returns recently, it seems likely that the fund will be selling at a low point in the market. [½]

The trustee should really be looking towards the future outlook of both markets. [½]

Markets in small economies can be highly affected by the enormous flows of money generated by changes in sentiment of international investors ... [½]

... which means that returns may be more volatile. [½]

Emerging markets tend to have less stable currencies and so more volatile returns. [½]

'Silver Lining' may have poor marketability and this lack of marketability may not be acceptable to the fund. [½]

Implementation issues

The main problems for All That Glitters when making a change to its asset allocation are the:

- time needed to effect the change and the difficulty of making sure that the timing of deals is advantageous [½]
- dealing costs involved [½]
- possibility of the crystallisation of capital gains leading to a tax liability. [½]

The trustees should consider whether such a radical change of investment strategy falls within its remit, *eg*: [½]

- its trust deed [½]
- legal and regulatory constraints [½]
- the risk appetite of trustees, ATG Ltd and members. [½]

It sounds like the trustee proposes investing in emerging markets in general, not just Silver Lining. If this is the case, the term *emerging markets* needs to be defined as it encompasses a wide range of countries. [½]

The existing investment managers may not have the expertise to invest in the emerging markets. [½]

Settlement and administration of emerging market deals is more complex. [½]

A decision should be made as to whether investment in emerging markets should be done directly or indirectly, *eg* through collective investment schemes. [½]

[Maximum 13]

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1 Solutions to Paper 1 style questions

Solution X3.1

The Core Reading for this question is covered in [Chapter 17](#), *Modelling*.

(i) **Advantages and disadvantages of a deterministic model**

- + It is easy to explain to a non-technical audience, ... [½]
 - ... since it does not involve the explanation of probability distributions. [½]
 - + It is clear which economic scenarios have been examined. [½]
 - + The model is usually simpler than a stochastic model, and therefore less time consuming ... [½]
 - ... and less costly to develop and run. [½]
 - It is more difficult to determine which economic scenarios to test ... [½]
 - ... and the testing may not cover a sufficient range of scenarios. [½]
 - It is not a good model for valuing options and guarantees as it is difficult to model the variability in take up rates or the guarantee biting. [1]
- [Maximum 3]

(ii) **Advantages and disadvantages of a stochastic model**

- + Using a stochastic model, a large number of simulations can be run to identify which eventualities are and are not profitable for the product being designed. [1]
- + A stochastic model may, due to its random nature, identify a potentially poor scenario for the product that would not have been thought of as a specific scenario to test under a deterministic model. [1]
- + A stochastic model takes into account the variability of the model parameters and the covariances between them. [½]
- + The output of a stochastic model forms a distribution of values from which statistics such as the mean and the variance of the output can be calculated ... [½]
- ... such information is useful in understanding the *risks* inherent in the product design. [½]
- + A stochastic model is useful for modelling any options and guarantees embedded in the contract design, since the likelihood of option take up, or of guarantees biting, can be explicitly allowed for. [½]
- A stochastic model can take longer and be more expensive to run. [½]
- A stochastic model is likely to be more complex to design and test, leading to potentially increased operational risk. [½]

- The output from a stochastic model may be difficult to interpret and to communicate to senior management. [½]
 - The model output is only as good as the input and depends on the choice of probability distribution and its parameters for the stochastically modelled variables. [½]
 - Whilst a stochastic model is a useful tool for making sure that all eventualities have been tested, there is no substitute for experience. [½]
 - The best course of action is often for the actuary to consult as many people as possible about possible eventualities and to think the unthinkable! [½]
 - In practice, it will be impossible to design a product that remains profitable under all eventualities, as the cost would be prohibitively high making the product unmarketable. [½]
- [Maximum 5]

(iii) ***Choice of a suitable model***

A stochastic model may be particularly useful since it can provide information to the insurance company on the *likelihood* of future price inflation being less than or greater than 5% (by considering a range of investment scenarios). [1]

A stochastic model can be particularly suitable for modelling economic parameters ... [½]

... *eg* inflation, since appropriate distribution functions can be chosen quite easily. [½]

Stochastic modelling may be particularly important as no matching assets are available ... [½]

... and therefore a stochastic model can be used to investigate the mismatch between the liabilities and whatever asset mix (*eg* of conventional and index-linked bonds) is held. [½]

[Maximum 2]

Solution X3.2

The Core Reading for this question is covered in [Chapter 18](#), Data and [Chapter 19](#), Setting assumptions.

The companies might have different policy conditions such as different:

- definitions of sickness [½]
- waiting periods – this is the period after the sale of the policy, before cover starts [½]
- deferred periods – this is the amount of time the policyholder must be ill for, before the benefit becomes payable [½]
- off periods / linked-claim periods – this is the amount of time that must lapse between two bouts of illness, in order for them to be considered as two separate claims. [½]
- exclusion clauses [½]
- rehabilitation clauses [½]
- level of annual benefit [½]
- maximum levels of cover, eg maximum proportion of pre-claim income [½]
- additional benefits, eg partial benefits if return to work part-time [½]

The companies might have different:

- underwriting at outset [½]
- underwriting at claim stage [½]
- ongoing claims control [½]
- distribution channels [½]
- target markets ... [½]
- ... eg by occupations, socio-economic groups and geographical location. [½]

These factors could lead to:

- a different mix of policyholders (eg by age, sex, occupation, smoker/non-smoker, rated/non-rated lives, medical history) [1]
- different levels of anti-selection / moral hazard. [½]

The insurers could be operating in different territories with different tax or regulatory regimes. [½]

The reinsurer might be comparing different contracts, such as:

- group or individual [½]
- unit-linked versus conventional [½]
- stand-alone versus a rider benefit. [½]

The reinsurer may be comparing experience over two different time periods. [½]

[Maximum 6]

Solution X3.3

This question is examining the material in [Chapter 22](#), Contract design.

Benefit definitions

The form of the benefits must meet the needs of customers. [½]

A benefit that pays for the costs of care throughout the remainder of life (rather than as a cash sum) may be considered to be the option that best meets the needs of the customer. [½]

However, a cash sum benefit reduces the risk to the insurance company of longevity or of the cost of care increasing ... [1]

... and is administratively easier. [½]

However, it will create a marketing risk in that the benefits may not be enough to cover the eventual cost of care. [½]

The company should decide whether the contract should be without-profit, with-profit or unit-linked. [½]

If index-linked cash benefits are chosen, the company must decide on an appropriate index. [½]

Policyholders would prefer such an index to be linked to the costs of care, although such an index may not necessarily exist. [1]

The benefits should be designed to be integrated with any benefits provided by the State. [½]

The company may take advice from its reinsurer on the design of benefits. [½]

Claims definitions

The claims definitions might relate to the number of activities of daily living that the policyholder is unable to carry out. [½]

Such activities of daily living may include washing, feeding, dressing *etc.* [½]

The tighter the claims conditions, the lower the risk of unanticipated claims ... [½]

... but the less marketable the contract will be. [½]

The better the underwriting, the easier it will be to obtain reinsurance ... [½]

... and the more likely experience is to be in line with expectations. [½]

For competitive reasons, the company may want to ensure that its claim definitions are not too far out of line with those used by the rest of the market. [½]

Alternatively, it may want to differentiate itself from its competitors by using different claims definitions. [½]

Profitability

The company will want to ensure that the contract is profitable ... [½]

... *ie* that the premium charged will be sufficient to cover the benefits to be provided and the expenses in most foreseeable circumstances, with some left over for profit. [1]

Profitability conflicts with marketability and competitiveness. [½]

Competition

In general, the company will not want the structure of premium rates and/or level of cover to depart too far from those of competitors. [1]

Options and guarantees

Innovative design features such as options and guarantees may enhance marketability ... [½]

... for example, a choice of levels of cover or location of care provider. [½]

However the company should take care that options and guarantees (*eg* guaranteed surrender values) are not too onerous, and recognise the extra costs and financing requirements involved. [1]

Risk appetite

Consider the risk appetite of the parties involved. The level of risk accepted by the insurer will depend upon the company's ability or willingness either to absorb risk internally or to reinsure it. [1]

Offering different levels of cover helps cater for different risk appetites amongst consumers. [½]

Key risks to the insurer include:

- a lack of past data (as this is a new contract)
- longevity risk
- morbidity risk
- care cost inflation, if benefits are not fixed
- lack of demand
- anti-selection, due to a lack of experience.

[½ each, maximum 1]

Financing requirements

Consider designing the contract to minimise the financing requirements / new business strain. [½]

A unit-linked contract could lead to lower financing requirements. [½]

Cross-subsidies

The company needs to consider the extent of any cross-subsidies between contracts, *eg* large and small contracts. [1]

The marketing advantage of simplicity conflicts with the desire to avoid cross-subsidies. [½]

Administration

It is necessary to ensure that the contract as designed can be administered on the company's systems. [½]

Consistency

Consistency of design with other contracts, will make administration easier and reduce associated costs. [½]

Regulation

Consider any statutory or regulatory requirements imposed on the contract design, *eg* relating to: [½]

- the premium charged and/or the level of provisions that will need to be held for the contract. [1]
- sales practices, such as cooling-off periods, or information that must be provided to potential customers. [1]

Accounting requirements

Consider the effect that the contract will have on its accounting requirements. [½]
[Maximum 11]

Solution X3.4

The Core Reading for this question is covered in [Chapter 19](#), Setting assumptions.

(i) *Relevance of past experience**Demographic assumptions generally*

Past experience is only relevant if you believe that it is going to continue into the future. [½]

The past data will only be useful if it is credible in quantity and relevant, *ie* homogeneous in quality. [1]

The total number of past members may be quite small ... [½]

... as over 50% of the past liabilities are due to only six members. [½]

It is therefore unlikely that the numbers will be sufficient to give a credible amount of data. [½]

Random fluctuations will have a large impact on the results. [½]

Several years of experience could be grouped to give a credible amount of data ... [½]

... but if there have been changes over those years the data will not be homogeneous. [½]

The type of membership has changed significantly over the last three years ... [½]

... the overall profile of the scheme has changed as one part of the business has grown and another has shrunk ... [½]

... this will invalidate past experience. [½]

The age profile of the membership may have changed a lot, *eg* if the redundancies affected older people but the recruitment was targeted at younger people. [½]

Changes in the way data has been recorded will invalidate the analysis ... [½]

... as will errors in past data. [½]

Mortality

The mortality experience of the new membership may differ from the experience of the past membership if the types of occupation have changed over time. [½]

The mortality experience may also exhibit the effects of time selection as a result of improvements in mortality. [½]

Withdrawal rates

The intervaluation period has seen the redundancy exercise as an exceptional event and expansion in another area. This will lead to abnormal withdrawal rates. [½]

However, if the company intends to make further redundancies and the company pays generous benefits to those made redundant, it may be prudent to assume a margin. [½]

Retirement rates / redundancy

Early / ill-health retirement rates may also have been affected if generous redundancy packages have been offered to those near retirement. [½]

If the company anticipates further redundancies with improved terms it may be prudent to allow for them. [½]

New entrant assumptions

The large-scale recruitment exercise may have been a one-off. Check with the company before setting new entrant assumptions. [½]

Salary scale progression

Salary progression will be another area where allowance for homogeneity will be needed. [½]

Presumably in the area of redundancies there will be low expectations of salary growth ... [½]

... but in the area of recruitment salary levels may have to grow more rapidly to recruit staff. [½]

A check with the company about future recruitment plans both in terms of numbers and salary levels would be useful. [½]
[Maximum 9]

(ii) ***Setting suitable demographic assumptions for senior employees***

Pre-retirement mortality: it will be prudent to assume that there are no deaths, if the death-in-service benefits are less valuable than the retirement benefits. [½]

Post-retirement mortality: prudence dictates that it should be light as senior employees will have enjoyed a good quality of life and will therefore be expected to live longer. [½]

Mortality rates are likely to be based on standard tables as there is insufficient scheme experience ... [½]

... and these would be adjusted to reflect the expected better than average experience. [½]

Withdrawal: assuming withdrawal benefits are less valuable than accrued benefits then prudence dictates no allowance should be made. [½]

Retirement rates: reflect actual senior employee plans if possible. [½]

Early and ill-health rates: value the most costly option that the members have ... [½]

... and check if any of them are actually ill and likely to take this option. [½]

Marital status: assume 100% married for prudence or use actual marital status (as only six of them so easy to check). [½]

Age difference between member and spouse: use actual age details if available. [½]

Salary scale: reflect the expected progression of pay and impact of pensionable bonuses etc. [½]
[Maximum 4]

2 Solutions to Case Study questions

Solution X3.5

The Core Reading for this question is covered in [Chapter 21](#), Expenses.

(i) **Categories of expenses**

Expenses can be categorised as fixed or variable: [½]

- Fixed expenses are those that do not vary with business volumes, *eg* maintenance on the new building. [1]
- Variable expenses are those that vary directly with the level of business that is being handled at that time, *eg* it may be linked to the number of endowment contracts sold, or the amount of premium received in respect of its CI insurance policies. [1]

Expenses can also be categorised as direct or indirect: [½]

- Direct expenses can be identified as relating directly to a particular class of business, *eg* underwriting costs for the term assurance business. [1]
- Indirect expenses are those that do not relate directly to any class of business, *eg* the new mainframe computer. [1]

All variable expenses are direct but fixed expenses can be direct or indirect. [½]

Expenses can also be categorised according to functionality, for example: [½]

- maintenance of existing business (including investment expenses) [½]
- termination (*eg* claims underwriting for the CI insurance policies or maturity expenses for the endowment assurances) [½]
- new business expenses (split by line of business). [½]

The loading for expenses could be:

- a fixed amount per contract [½]
- a percentage of the premium charged, *eg* commission payable to JKL's brokers [1]
- a combination of the above. [½]

[Maximum 6]

(ii)(a) **The cost of a replacement mainframe computer**

This is an indirect (overhead) cost. [½]

There could be some initial allocation between classes of business if only part of the system (relating to particular classes of business) has been replaced. [½]

An annual cost would be derived from spreading the cost of the system over its estimated working lifetime. [½]

The cost could then be allocated between classes of business and functionality in proportion to computer usage, if known. [½]

The cost could be allocated to each contract as an amount per contract in force using some reasonable method, ... [½]

... *eg* dividing the total cost by the number of contracts in force. [½]

(b) ***The building costs of JKL's new head office***

Again this is an indirect (overhead) cost. [½]

The office will probably be an asset of the company, in which case once the office is built a notional rent would be charged to each department, probably based on the floor space occupied. [1]

This notional rent could be split between classes of business (*eg* endowment assurance, CI insurance *etc*) and function in the same proportion as for salaries. [½]

The cost could be allocated to each contract as an amount per contract in force using some reasonable method, *eg* dividing the total cost by the number of contracts in force. [½]

[Maximum 4]

Solution X3.6

This material is discussed in [Chapter 18, Data](#).

Data sources

Company's own claims experience data on its existing CI insurance product [½]

JKL Life Insurance is a leading insurer in its own market and so should have a credible volume of data relating to critical illness claims. [½]

The data should be accurate as it is collected by the insurer itself. [½]

It should also be presented in an appropriate format that the insurer can use. [½]

The analysis itself may already exist since JKL probably monitors this for its existing business. [½]

Once the data are broken down into various groups (*eg* age, gender, reason for claim *etc*) the individual groups may not have sufficient volumes of claims to be credible. [½]

The claims experience on the existing business may not reflect the expected claims experience on the new business, *eg* there may be different levels of various critical illnesses in the other country. [1]

Industry or reinsurer data from the other country [½]

There is unlikely to be any industry or reinsurer data relating to critical illness claims in country B as critical illness insurance is not currently sold there. [½]

The insurer could consider whether there are other countries with similar characteristics whose data could be used instead. This may be available from the insurance industry in the country or reinsurers. [½]

Other country's population morbidity data [½]

General population data does not relate to the specific insured population. [1]

There may be national data available on critical illness rates in Country B that JKL could use, although this is likely to be quite crude, since Country B is a developing nation. [1]

This may also mean that the data may not be presented with sufficient detail to allow JKL to use it for setting its rates. [½]

It will need to consider how up-to-date this data is, as it may not be collected or updated frequently. This is particularly important since there has been demographic changes in recent years. [1]

For example, the data may record all diagnosis separately without indicating any earlier CI diagnosis against a particular patient, potentially leading to an over-stated claim rate. [½]

[Maximum 6]

Solution X3.7

This material is discussed in [Chapter 20](#), Mortality and morbidity.

The claims rate will be higher if the rates of illness are higher, so it is important to understand why sickness rates are different. [½]

Differences in the morbidity rates may be observed between the two products due to socio-economic and other differences between the countries the products cover. [½]

Differences could be due to variations in the:

- age and gender mix – for example, Country B may have more younger lives [1]
- geographic areas – for example, Country B being more rural and Country A more urban [1]
- social classes – for example, Country B may have more manual workers and Country A more non-manual workers. [1]

The difference in experience caused by these high-level factors are due to a number of underlying factors outlined below. [½]

Occupation

The differences in occupations between Country A and B may cause differences in the claims experience. [1]

For example, those working in rural areas of Country B may have more exposure to harmful chemicals. [½]

There may generally be fewer health and safety regulations in Country B. [½]

The general income level in Country B may be lower than in Country A as it is still developing. [1]

All these differences would be expected to increase the claim rate compared to Country A. [½]

Nutrition

Differences in standards of nutrition can have a big influence on morbidity experience. [1]

The low levels of income in Country B may make it hard to buy appropriate foods. [½]

There may also be a lack of education about nutritional choices in Country B. [½]

Poor quality nutrition can increase the risk of contracting diseases and slow down any recovery. [½]

Morbidity experience may also differ if one country experiences excessive or inappropriate eating leading to diseases such as heart disease ... [½]

... for example, this may be the case in Country A and therefore Country B may be expected to experience better morbidity rates for heart disease. [½]

Social and cultural differences between Country A and B may also affect nutrition levels. For example, Country A may have higher rates of alcohol consumption leading to increased risk of disease such as liver disease. [1]

Housing

The quality and quantity of housing available in each country may also vary causing differences in morbidity experience. [1]

In part this will be due to the lower income levels in Country B leading to a generally poorer quality of housing compared to Country A. [½]

For example, the housing in Country B may be:

- in a poor state of repair [½]
- have little / no heating or sanitation [½]
- be overcrowded, particularly as the population moves to urban areas. [1]

All these factors can increase disease such as tuberculosis and cholera, and also impact mortality in the longer term. [½]

Climate

The climate of Country B may differ to that of Country A due to a difference in geographic location, leading to variations in claims experience... [1]

... for example, Country B may be in a tropical region leading to a higher prevalence of disease such as malaria. [½]

There may also be impacts due to the rapid industrialisation of Country B ... [½]

... for example, building work may have been done on unsuitable land, leading to higher risks of flooding leading to diseases spreading and potentially deaths. [1]

More generally, the geographic location may also lead to differences in the risk from natural disasters. [½]

For example, Country B may be exposed to risks from droughts which could lead to famines and widespread morbidity and mortality. [½]

Education

Differences in the quality of education between Country A and B may also affect the claims experience. [1]

For example Country B may have: [½]

- lower education levels (as indicated by the low literacy levels in rural areas) leading to lower incomes [1]
- low levels of exercise [½]
- poor personal health care [½]
- less awareness of dangers such as:
 - alcohol [¼]
 - smoking [¼]
 - drugs [¼]
 - sexual lifestyle [¼]
- fewer public health campaigns. [½]

Some of these may have a direct impact on morbidity experience, for example smoking leading to increase in lung disease and lung cancer. [½]

Others, such as exercise levels, will improve general health and the ability resist disease. [½]

Note to markers – please award marks for appropriate alternative examples students mention.
[Maximum 12]

Solution X3.8

JKL will need set clear objectives for the model ... [1]

... to determine the appropriate premiums for the new CI insurance product. [½]

It will then need to choose the form of the model. It will have an existing model from its current CI product that it can use as a starting point for the new product. [½]

When modelling the business for Country B it is likely that a deterministic model will be used due to the difficulty in choosing distributions from an incomplete data set. [½]

Parameters and variables will then need to be identified. [½]

This will include parameters for:

- morbidity rates [½]
- mortality rates [½]
- expenses and inflation [½]
- withdrawals [½]
- new business volumes [½]
- new business mix [½]
- investment returns. [½]

It will need to ascribe values to the parameters. [½]

For some parameters it will be able to use its own past experience (such as expenses). [½]

Other parameters will need more analysis in order to determine the most appropriate rate to use in the model (such as morbidity rates). [½]

The model can then be constructed based on the expected cashflows including: [½]

- CI claim payments [½]
- premium income [½]
- expenses [½]
- commission [½]
- tax payments. [½]
- investment income. [½]

The goodness of fit will need to be checked to ensure it is acceptable. [½]

JKL should attempt to fit a different model if the first choice does not fit well. [½]

The model will then be run using estimates of the values of variables (such as the claim rates, withdrawals, expenses *etc*) in the future. [½]

The model will be run several times to assess the sensitivity of the results to different parameter values. [½]

In particular those assumptions where there is most uncertainty relating to the business for Country B such as: [½]

- CI insurance claim rates [½]
- new business volumes [½]
- new business mix [½]

[Maximum 8]

Solution X3.9

The Core Reading for this question is covered in [Chapter 23](#), Pricing and financing strategies.

Why premiums charged are not equal to the modelled premium

- There may be expense cross-subsidies between contracts ... [½]
 ... *eg* in the short-term, profits from Country A's CI insurance policies may be used to subsidise losses from Country B's to enable the new business unit to establish itself. [½]
- The premiums charged may be low to gain market share and establish the product in Country B. [½]
- The premiums charged may be high, reflecting the stage in the underwriting cycle where there are only a limited number of providers. [½]
- The premiums charged may be high as JKL will initially be the only CI insurance provider in Country B. [½]
- The company may offer a discount for premiums payable annually by direct debit rather than monthly by cheque. [½]
- Different premium levels may be charged according to the distribution channel used ... [½]
 ... *eg* the company may develop a tie with a bank that results in lots of business being written, enabling economies of scale and a reduced premium. [1]
- Some risks may have a very high expected cost, *eg* individuals with a history of heart disease and JKL may decide not to offer insurance for these categories at all. [1]
- The product may be sold as a loss leader, *eg* so as to increase the customer base in the new market so other (profitable) products can be sold. [1]
- Pricing simplifications, *eg* the price may be different to the cost if the premium can be paid monthly but the cost is calculated as an annual amount. [½]

[Maximum 4]

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Assignment X4 Solutions

1 Solutions to Paper 1 style questions

Solution X4.1

Chapter 25, Risk identification and classification can be helpful for answering this question.

(i) ***The risks faced by the company***

The future cost and timing of decommissioning will not be known with certainty in advance. [1]

Estimates of the future costs will require assumptions about:

- investment returns that can be earned on the accumulated funds [½]
- inflation of the costs of decommissioning [½]
- the time at which decommissioning will start [½]
- the time period over which decommissioning will be completed. [½]

Actual experience of any of these items may be different to expected, representing a risk to the facility. [1]

A decision needs to be made as to the strength of the assumptions, and there are risks attached to an overly cautious or a too optimistic basis: [1]

- The use of overly cautious assumptions to try to ensure sufficient funds are set aside will not be in the company's interest, since the money could be better used within the business. [½]
- The use of assumptions that are too optimistic will mean that the company may not have sufficient funds when the money is required. [½]

Operational risks

There are operational risks, eg: [1]

- errors in calculations and projection [½]
- incorrect choice of model [½]
- time and cost overrun in building and running the model. [½]

There may be a risk of further regulation being introduced, this could include: [½]

- more onerous requirements for decommissioning [½]
- more stringent requirements to demonstrate an appropriate level of funds has been set aside in advance. [½]

[Maximum 6]

(ii) Management actions

The management team should ensure they monitor the risk by requesting updated calculations at regular intervals ... [1]

... and between these regular dates if significant new factors come to light that would affect the fund. [1]

The management should liaise with other professionals, *eg* actuaries, to help them determine the figures. [½]

The management may place the funds under the custodianship of someone independent of the company, indeed this might be a requirement under the regulation. [½]

The management should ensure they participate in shaping any changes to the legislation in the future. [½]

[Maximum 2]

Solution X4.2

This question is examining the benefit scheme material from [Chapter 26](#), Financial product and benefit scheme risk.

The key risks to the sponsor are that:

- costs are greater than expected [1]
- payments are required at an inopportune time. [½]

Costs may be greater than expected

The cost of the benefit itself may change, for example: [1]

- new medical treatments may be developed that have to be paid for [½]
- the employer changes the benefits provided by choice [½]
- the employer changes the benefits provided in response to regulation. [½]

More people than expected accrue the benefit. This may be due to: [1]

- expansion of the company, so there are more employees [½]
- less stringent eligibility rules for entering the scheme. [1]

More people than expected receive the benefit. This may be due to: [1]

- improving mortality pre-retirement, so more people reach retirement age [½]
- improving mortality post-retirement, so people live longer (though not necessarily in good health) in retirement [½]
- an increase in morbidity, so that more people require treatment [½]
- the difficulty in ascertaining whether a claim is valid [½]
- changes to the scheme rules, for example to include dependants [½]
- a fall in the quality / availability of any State care that means people are more likely to take up their private care benefit. [½]

The inflation of medical costs may be greater than expected. [1]

If the scheme is funded, then the investment return earned on the investments may be less than expected leading to increased costs. [½]

In a worst case scenario the increasing costs could lead to insolvency of the employer. [½]

Payments at an inopportune time

The timing and level of the future individual benefit payments from this scheme are unknown ... [1]

... since they depend upon, when and how often people are ill, how long people need care, and the types of treatment required. [1]

This means it is difficult to determine an appropriate investment strategy, payments may be needed at inopportune times, leading to liquidity problems. [1]

This liquidity concern is magnified if the scheme is not funded, *ie* a PAYG approach is adopted. [½]

Further risks may result from:

- loss of funds due to fraud or misappropriation [½]
- incorrect benefit payments being made [½]
- inappropriate actions by custodians [½]
- benefits not meeting members' needs / expectations [½]
- administrative costs being greater than expected ... [½]
- ... this may be as a result of compliance with any new legislation that is introduced [½]
- fines due to any non-compliance with legislation [½]
- changes to the tax treatment of the scheme [½]
- incorrect decisions being made as a result of model or parameter error. [½]

[Maximum 13]

Solution X4.3

Reinsurance is covered in [Chapter 29](#), Risk transfer.

(i) **Features of types of reinsurance**

Features common to quota share and surplus reinsurance

Proportional reinsurance, *ie* each claim is split in pre-defined proportions between the insurer and reinsurer. [½]

Can be used to spread risk. [½]

Can be used to enable a larger portfolio of risk to be insured. [½]

Quota share

- the same proportion of each risk is reinsured.
- suitable for reinsuring small and/or homogeneous risks.
- can encourage reciprocal business between insurers. [½ each]

Surplus

- the proportion can vary by each risk reinsured
- for high volumes business, such as life insurance or personal lines insurance, the maximum cover and the retention limit are specified
- for commercial covers, the cedant can decide (within specified limits) on the proportion to cede for each individual risk
- flexible – enables amount ceded to be tailored to the size of individual risks ...
... and their variability
- suitable for reinsuring larger and/or heterogeneous risks
- able to fine-tune exposure
- administration more difficult than quota share [½ each]

Stop loss

- non-proportional – so claim split not pre-defined
- type of aggregate excess of loss reinsurance
- reinsurer pays for aggregate claims from all events caused by *all perils* covered by the direct written policy ...
... above a retention limit ...
... and up to an upper limit

- used to reduce the risk of insolvency
 - used to protect against accumulations of risk
 - used to smooth profits by reducing claims fluctuations
- [½ each]
[Maximum 8]

(ii)(a) **Insurance company writing motor insurance**

A motor account can give rise to the occasional enormous liability claim. [½]

These may relate to a single claim (*eg* bodily injury or death to a single driver) ... [½]

... or multiple claims (*eg* a motorway pile-up). [½]

So the insurer would need individual excess of loss ... [½]

... and aggregate excess of loss or stop loss reinsurance. [½]

Most property damage claims will be limited to the value of any vehicles involved in a claim.

Therefore, low layers of excess of loss reinsurance should be sufficient for these claims. [½]

However, bodily injury claims can be very large indeed, so reinsurance should be at sufficiently high layers to provide cover for any size of claim (*ie* unlimited). [½]

[Maximum 2 for this section]

(ii)(b) **Large insurance company writing industrial property fire insurance**

Industrial fire risks can be very large, so even a large insurer is not likely to want to retain all the risk for each policy. [½]

Surplus reinsurance might be used ... [½]

... (since industrial properties are relatively heterogeneous) ... [½]

... this would allow the insurer to tailor its reinsurance programme to the different characteristics of each property. [½]

Further reinsurance may be required to cope with very large risks. [½]

There is the risk of a large loss from one individual event (due to non-independence of risks) ... [½]

... therefore catastrophe excess of loss reinsurance may be used. [½]

[Maximum 2 for this section]

Solution X4.4

This question is examining the underwriting material from [Chapter 30](#), Other risk controls.

(i) **Why obtain medical information**

The company will obtain evidence about the health of the applicant so as to assess whether he or she attains the company's required standard of health ... [½]

... and if not what their state of health is relative to that standard. [½]

[Total 1]

(ii) **Medical information**

Medical information that could be used for underwriting includes:

- current health
- recent operations
- current medication
- medical history
- family histories of critical illness and early death
- a report from the applicant's doctor
- an independent medical examination
- standard medical tests, such as blood tests, urine tests, blood pressure tests *etc*
- specialist medical tests, *eg* MRI scan *etc*. [½ each maximum 3]

Answers such as age and gender do not directly provide the insurer with information about the applicant's health. Therefore they are not awarded credit.

(iii) **Options if an applicant has a higher than expected level of risk**

The applicant could be declined insurance. [½]

This option would only be adopted as a last resort, for the highest risk lives, when all other possible ways of dealing with a case are considered to be too risky for the company. [½]

An extra premium could be charged. [½]

For example:

- by adding a constant loading to all or part of the policy term [½]
- by loading the premium with a percentage increase that reflects the age and risk profile of the policyholder. [½]

This method is appropriate for cases in which the level of extra risk can be assessed with a reasonable level of confidence, and is not too excessive. [½]

The insurer may choose to reinsure the risk where appropriate, for example for large or unusual risks ... [½]

... passing part of the risk to a reinsurer in return for an appropriate reinsurance premium. [½]

A deduction could be made from the sum insured. The deduction could be a fixed amount or on a sliding scale. [½]

This method is appropriate if the policyholder could not afford an extra premium and the reduced sum assured would be sufficient to meet their needs. [½]

An exclusion clause could be imposed on the policy ... [½]

... if the policyholder is at risk of a particular illness, *ie* such that claims arising due to that particular illness would not lead to payment of benefits under the contract. [½]

However, there may be difficulties due to possible bad publicity in cases where the company does not pay out ... [½]

... and potential legal contests if there is uncertainty about a diagnosis and so the validity of a claim. [½]

The terms of the contract may be changed, *eg*: [½]

- the company could offer a stand-alone contract rather than offering a critical illness benefit as a rider on a term assurance contract [½]
- shorter-term contract. [½]

This would be appropriate if modifying the contract terms reduced the risk significantly ... [½]

... *eg* shortening the term of the contract if the incidence of a critical illness is expected later in life. [½]

The decision may be deferred to a later date ... [½]

... if it is felt that the current prognosis of future health is too uncertain to make a decision at the present time, but may become clearer at some future date. [½]

This could arise, for example, if the applicant has recently undergone some serious medical treatment. [½]

[Maximum 6]

Solution X4.5

Diversification is covered in [Chapter 30](#), *Other risk controls*.

(i) **Possible diversification of a life insurance company's business**

Diversification can occur by:

- product types, *eg*: [½]
 - savings products vs protection products [½]
 - annuities vs assurances [½]
- geographical areas of business [½]
- mix of customers within a geographical area, *eg*: [½]
 - high net worth individuals vs low earners [½]
 - by gender and age [½]
- reciprocal quota share [½]
- distribution channels used [½]
- salespeople within a distribution channel [½]
- providers of reinsurance [½]
- providers of other services, *eg*: [½]
 - IT outsourcing, consultants engaged [½]
- investments – asset classes [½]
- investments – assets held within a class. [½]

[Maximum 5]

(ii) **Problems of too much diversification**

Diversification over such a wide range of areas would be expensive in terms of administrative systems, staff training, management *etc*. [1]

The company would be too much of a generalist and not invest enough resources in any one area – and so may fail to achieve success in any of them. [1]

A more selective use of resources (*ie* less diversification) with targeting of efforts on chosen segments of the market might achieve better results. [½]

[Maximum 2]

2 Solutions to Case Study questions

Solution X4.6

Chapter 28, Risk measurement and monitoring is a good source of ideas for this question.

The risk map looks at *expected* severity and frequency of risks. It would be useful to have an indication of the *variance* in severity and frequency for each risk. [1]

It would be useful to have a description of each risk represented on the map ... [½]

... including knowledge of the owner of each risk ... [½]

... and how the risk is currently dealt with, *eg*: whether it has been [½]

- avoided [½]
- accepted [½]
- transferred [½]
- mitigated internally (and a revised assessment of the remaining risk). [½]

Ideally the results of the risk assessment would be carried out with and without possible risk controls, to estimate the effectiveness of proposed controls. [½]

This will enable the efficiency of risk controls to be assessed against their cost. [½]

It would be useful to know how much capital is needed to support each risk. [½]

It would be useful to know the correlations between different risks ... [½]

This would help to determine whether there are any:

- concentrations of risk [½]
- diversification benefits to be had from natural hedges. [½]

It would be useful to know the basis on which the expected frequency and severity have been calculated, for example: [½]

- statutory or internal [½]
- cautious, best estimate or optimistic. [½]

[Maximum 5]

Solution X4.7

This question is testing material in [Chapter 30](#), Other risk controls.

Markers: where points about Risk A could also be made about Risk B (eg assessment of cost vs benefits, insurance premiums including profit loadings) give credit if the point is made for Risk B instead. However, the same idea should not be given credit twice.

Risk A

Risk A is a very high impact but very low probability risk. [½]

It may be possible to diversify this risk away but only to a limited extent ... [1]

... for example by splitting the head office functions into multiple sites ... [½]

... but the extra costs of doing so must be taken into account in determining the cost of the risk. [½]

The fire risk and business interruption risk could be covered through insurance ... [½]

... again at a cost since the premiums will contain loadings for the insurer's profit and expenses. [½]

Safety controls, such as fire alarms and sprinkler systems, could be used ... [½]

... to reduce the likelihood and severity of fire damage. [½]

Again costs would be compared with benefits ... [½]

... for example, alarms might be relatively low cost and straightforward to install / improve ... [½]

... whereas sprinkler systems may be more complex and expensive. [½]

Management control procedures, such as disaster recovery planning could be implemented. [½]

Such procedures will not reduce the likelihood of occurrence but they could reduce the consequences of the risk. [½]

Since the expected frequency of the risk is less than 1-in-200 years, the company may simply decide that it is within their risk appetite. [½]

This means that the company accepts that it might be ruined by a rarer event, but has decided not to take such events into account in its risk management. [½]

Risk B

Risk B has a less severe impact than Risk A but is considerably more likely to occur. [½]

It is unlikely that Royal Ping will decide to simply accept this risk as within its risk appetite ... [½]

... and indeed its regulator(s) might require it to have controls in place. [½]

At the very least Royal Ping would hold capital against the risk it retains in respect of this risk. [½]

The main risk control used is likely to be internal controls, *eg*: [½]

- limits on payments an individual can authorise
- requiring multiple sign-off on transfers of monies
- improved staff training
- automatic flagging by the company's systems of unusual activity and/or transfers of large sums of money.

[½ each for up to two examples]

Fidelity guarantee insurance might also be used. [½]

[Maximum 7]

Solution X4.8

Methods of evaluating risk are covered in [Chapter 28](#), Risk measurement and monitoring.

Risk B

Risk B is an operational risk. [½]

Operational risks are not easily quantifiable since their frequency and amount is highly uncertain and subject to human intervention. [1]

This would make mathematical modelling of Risk B very difficult and/or inappropriate, *eg* it would be difficult to fit a probability distribution to either the frequency or amount. [1]

The best way of evaluating Risk B would be to use scenario analysis ... [1]

... since past data will probably not be complete or relevant enough to estimate a reliable distribution. [½]

This involves:

- grouping it with other similar risks pertaining to fraud [½]
- developing a plausible adverse scenario with the input from a wide range of senior individuals in the organisation [½]
- evaluating the financial consequences of the scenario occurring. [½]

Risk C

A stochastic model could be used to evaluate Risk C. [1]

Claim amounts or claim frequencies or both could be treated as random variables each with a probability distribution. [1]

When choosing the distributions, allowance should be made for the high uncertainty surrounding the new product liability class. [½]

A desired probability level, *eg* 0.5% could be chosen so that the model can then be used to determine the capital necessary to avoid ruin at this level (a VaR approach). [½]

Correlations between variables should be allowed for ... [½]

... for example between claim amounts and claims inflation, claims expenses and the economic situation. [½ for any suitable example]

Since stochastic models are complicated and time consuming to run, it may be necessary to simplify the model ... [½]

... in terms of, for example the time period considered or the number of stochastic variables. [½]

It is possible that the model be run stochastically to determine how bad the claims experience needs to be to survive 99.5% of the time ... [½]

... and then to run a deterministic projection using that risk event to determine the capital requirements. [½]

Risk D

Risk D is a market risk. [½]

Stress testing can be used to determine the capital to hold in respect of an extreme fall in asset values, ... [½]

... for example, a 30% decrease in equity values and a 10% increase in bond yields. [½ for any suitable example]

Stochastic modelling may also be used to assess the possible risk of insolvency. [½]

A fall in asset values may also affect the value of the liabilities, as the valuation of some of the liabilities may be linked in some way to asset values. [½]

Correlations between parameters should be allowed for ... [½]

... for example between the yields on different asset classes and between yields and inflation. [½ for any suitable example]

The scenarios should be specific to the company, designed to highlight weaknesses in its risk exposure ... [½]

... for example, the company's assets may be overly weighted towards European exposures rather than Asian exposures. [½ for any suitable example]

[Maximum 8]

Solution X4.9

Enterprise risk management is discussed in [Chapter 24](#), Risk governance.

Managing risk separately at the US company level

This option would require the least change, and so may offer short-term advantages, eg: [1]

- continuity with previous approach
- less costly
- less staff upheaval (eg avoiding relocation, redundancies, changing roles and systems).
[½ each for up to two examples]

Managing risks entirely 'locally' at the US company level may provide some advantages in terms of US staff feeling greater ownership / engagement with the risk management process ... [½]

... and possibly allow more engagement of staff who have expert knowledge of the specifics of the company's US business risks and the US market. [½]

Also, this approach would not completely prevent Royal Ping from taking advantage of any diversification benefits of the acquisition ... [½]

... as a crude allowance could be made by allowing the sum of the risk appetites of all business units (including the US company) to sum to more 100% of the group's overall risk appetite. [½]

Incorporating the US company's risk management into Royal Ping's group risk function

The very existence of a group risk function suggests that enterprise level risk management has hitherto been Royal Ping's chosen approach. [1]

To adopt a different approach in respect of the US business without a good reason would appear odd to various stakeholders, eg ... [½]

... shareholders, rating agencies, analysts ... [½ for any example]

... and may cause 'political' issues within the business about the difference in treatment. [½]

Royal Ping may also face adverse reaction from these other stakeholders if it adopts an approach that is out-of-step with best practice adopted by other multi-nationals. [½]

Incorporating the US company's risk management into Royal Ping's group risk function will not do away entirely with the need for a risk function within the US business ... [½]

... so the US Chief Risk Officer and risk staff will likely be retained, avoiding at least in part the potential short-term upheaval and loss of expertise outlined above. [½]

If Royal Ping does not incorporate the US company into its enterprise management arrangements, but instead allocates capital to support the risks retained by the company separately, it is unlikely to make best use of the available capital. [1]

This is because this approach makes no allowance for the benefits of any diversification or pooling of risks that the acquisition brings. [1]

For example, within a multi-national company, each business unit may be exposed to currency risks. However, it is likely that some of these currency risks will offset each other.

[½ for any suitable example]

Companies are under more pressure to deliver returns to shareholders, which means managing capital as efficiently as possible. [½]

Royal Ping's growth target suggests a board focus on maximising shareholder returns, highlighting the importance of efficient use of capital in this particular case. [1]

Developments in modelling technology and expertise have made quantifying risks and understanding their correlations much easier, ... [½]

... and hence have facilitated enterprise risk management and increased the benefits. [½]

Regulators are increasingly requiring that senior management take greater responsibility for managing risks on an enterprise-wide scale. [½]

Therefore Royal Ping may face adverse reaction from its regulator if it does not adopt an enterprise-wide approach. [½]

Regulatory systems are increasingly risk-sensitive and so increasingly reward the management of risk at the enterprise level. [1]

In recent years, there has been a much greater recognition of the variety of risks facing organisations and, in particular, their interdependency. [½]

Incorporating the US company's risk management into Royal Ping's group risk function would help to ensure consistency of approach to the treatment of risks, *eg* in their identification and analysis. [1]

It should also improve the quality of the risk management approach as the 'better' of the two current approaches may be implemented where there are currently differences. [½]

Incorporating the US company within the group risk function will enable the board to be more confident it has appropriate insight and oversight of the risk position of the group overall ... [1]

... and so will give confidence to its business planning and capital allocation decisions. [½]

It will also put the company in the best position to take opportunities to take on risk to add value ... [½]

... for example considering the US company as part of the group may allow it to take on risks it would have declined if considered as a standalone unit, if those risks are negatively correlated with risks elsewhere in Royal Ping Group. [½ for any suitable example]

Integration will also help to ensure that all parts of Royal Ping are using allocated risk budgets. [½]

If, for example, the US business was not using its allocated budget, this might actually be increasing risk for Royal Ping overall as it may be taking credit for diversification benefits that do not exist. [½]

[Maximum 10]

Solution X4.10

Business risks are discussed in [Chapters 25](#), *Risk identification and classification* and [Chapter 26](#), *Financial product and benefit scheme risks*.

Underwriting risk

There is a risk that the underwriting process is inadequate leading to inappropriate premiums being charged. [½]

This is especially likely since the company is offering the product for the first time and so will not have past data and expertise on which to base the underwriting. [½]

Possible mitigations include:

- Reinsurers or other external consultants may be able to provide useful data.
 - Royal Ping may be able to use some of its experience and data in respect of existing products if there is any overlap in the cover provided.
 - Royal Ping could price with a greater margin for uncertainty in the premiums for this new product.
- [½ each for up to two examples]

If the risk classification process is inadequate, there is an anti-selection risk, *ie* the risk of applications for insurance by product manufacturers who know their product represents a greater risk than has been reflected in the premium. [1]

Possible mitigations include the use of reinsurers' or other external expertise in deciding rating factors, proposal process *etc*. [½ for any suitable example]

Insurance risk

There is a risk that claims are made with a greater frequency than expected. [1]

This may be due to:

- inadequate data when pricing
- increasingly litigious societies
- a greater frequency of court awards in favour of the consumer
- loose policy wording
- bad publicity surrounding a particular product
- a greater incidence of fraudulent claims made against the product manufacturer, *eg* in the event of an economic downturn
- latent claims – *ie* claims that were not anticipated when the insurance was sold and hence were not reflected in the premium
- moral hazard
- changes in legislation.

[½ each, maximum 3]

Possible mitigations include a trial or small scale product launch, *eg* in just one location first ... [½]

... although differences in claims experience between locations will limit the effectiveness of this ... [½]

... and/or it would reduce the initial contribution of the new product to the company's growth target. [½]

The company could mitigate this risk using reinsurance ... [½]

... for example quota share reinsurance. [½]

There is a risk that claim amounts are higher than expected for many of the same reasons as above. [1]

There is a risk of a single large claim, *eg* due to death or serious bodily injury due to a product fault. [1]

There is a risk of an aggregation of claims, *eg* too much exposure to a particular manufacturer or product type. [1]

These risks could also be mitigated by appropriate reinsurance ... [½]

... in particular excess of loss reinsurance to limit claim sizes. [½]

Risk excess of loss reinsurance would mitigate the risk from individual large claims ... [½]

... and aggregate or stops loss would mitigate the risk from aggregations. [½]

Claims may be more volatile than expected. [½]

Quota share reinsurance would mitigate this risk ... [½]

... by enable the company to write more business, diversify its portfolio and smooth the volatility of its claim payments. [1]

A further possible mitigation is to increase the size of provisions held in respect of this business. [½]

There is a risk that claims handling expenses are greater than expected ... [1]

..., *eg* due to inefficient processes or more small claims with proportionately higher expenses than expected. [½]

Since the insurance company is launching this contract for the first time, there is a risk that the development expenses are greater than expected. [½]

Expense mitigations could include:

- outsourcing of claims management functions at fixed costs
- monitoring of the cost vs benefits of claim management processes (*eg* limits which trigger more involved claims investigation and management)
- reviewing of the pricing and policy design, *eg* levels of policy excess.

[½ each for up to two examples]

It is likely that reinsurance will be used since this is a new product offering. Business risks relating to reinsurance include:

- inadequate appreciation of the scale of the risks taken on by the insurance company and hence of its reinsurance needs
- doubts as to the availability and cost of the desired reinsurance
- reinsurance that is poor value for money
- failure to comprehend the coverage / limits of a reinsurance arrangement.

[½ each, maximum 1]

Financing risk

There is a risk that this insurance represents poor value for money to the providers of capital. [½]

In particular, this product launch may not have been the best use of the company's capital. Other opportunities may have represented better value for money, *eg*: [½]

- further acquisition
- expansion into new locations, *eg* Australia
- other product launches.

[½ each for up to two examples]

This may be particularly important to the board given the company's growth target. [½]

Further market research is a possible mitigation. [½]

Exposure risk

There is a risk of insufficient sales volumes, leading to fixed expenses not being recouped. [½]

This may be due to:

- the state of the economy in the countries in which Royal Ping operates
- competitive pressures, *ie* premiums too high
- poor product design, *eg* risks covered, exclusions
- an unfavourable stage in the underwriting cycle.

[½ each, maximum 1]

Possible mitigations include:

- choose timing of launch to suit economic conditions
- choose timing of launch to suit underwriting cycle, *ie* launch when profits are most likely to be possible
- diversify by geographical location, *ie* launch in several of Royal Ping's markets to limit impact of any one country's / region's economic activity
- review pricing and product design regularly.

[½ each for up to two examples]

Alternatively, sales volumes could be too high, leading to an unacceptable level of new business strain. [½]

There is a risk that the mix of business is not as expected. [½]

For example, if the pricing is such that renewals will subsidise new business, then there is a risk that not enough policies renew (*ie* that persistency is poor).

[½ for any suitable example of cross subsidies]

Possible mitigations:

- monitoring of liabilities accepted
- caps on business volumes
- review of pricing structure and product design.

[½ each for up to two examples]

[Maximum 20]

Assignment X5 Solutions

1 Solutions to Paper 1 style questions

Solution X5.1

The material for this question is covered in [Chapter 33](#), Reporting results.

(i) **Key accounting ratios**

Financial condition

- solvency ratio
- asset / liability ratio
- return on capital employed
- price / earnings ratio
- dividend yield or dividend cover

Profitability of business

- claims ratio (*ie* the ratio of claims to premiums)
- incurred expenses to premium income
- operating ratio, *ie* the sum of incurred claims and expenses to premium income
- commission to premium income
- outward reinsurance premiums to gross premium income

[½ each, maximum 3]

(ii) **Interpreting the accounts**

Consideration should be given to the accounting rules and conventions that apply in the country concerned ... [½]

... these may well be unfamiliar to the domestic insurer and would make comparisons difficult. [½]

The basis used to value the liabilities should be considered. [½]

This is difficult to determine from the accounts and will depend on:

- the internal model / assumptions used
- the management's risk appetite
- any actuarial judgement *etc.*

[½ each for relevant examples, maximum 1]

The basis used to value the assets should be considered. For example: [½]

- how does it treat realised and unrealised capital gains / losses? [½]
- whether assets are valued at market value or by some other method – if assets are valued at market value they are likely to be quite volatile, so current market conditions should be considered. [½]

The accounts may be distorted by exceptional events, such as:

- large / catastrophic losses
 - a redundancy exercise
 - mergers / acquisitions
 - exceptional expenditure, *eg* IT development *etc.*
- [½ each for relevant examples, maximum 1]

It may well be difficult to get a clear picture of the above factors due to the level of detail provided in the accounts. [½]

The company is small, so the results may be quite volatile. [½]

The position in the insurance cycle should be considered, since this can have a significant impact on profitability. [½]

The accounts in isolation do not give a clear picture of the condition of an insurer. Trends over time are more important ... [½]

... however such trends can be difficult to analyse because changes in the reserving basis might mean that year-on-year results are not consistent. [½]

The accounts should be compared to relevant competitors if possible ... [½]

... for example, those:

- based in the country concerned and subject to the same accounting rules
 - writing similar classes and mix of business
 - using similar levels of reinsurance.
- [½ each for relevant examples, maximum 1]
[Maximum 6]

Solution X5.2

The material for this question is covered in [Chapter 31, Provisions](#).

Factors determining the degree of prudence in assumptions

The purpose of the valuation ... [1]

... *eg* a degree of prudence is likely to be included in a valuation to assess the scheme's funding position, to ensure the security of benefits. [½]

The objectives of the client ... [1]

... *eg* the sponsor (typically the employer) may not want too many margins for prudence to be included, whereas if the client is the trustees then they would prefer a cushion for prudence. [½]

However, the trustees will not want to choose a basis that is so prudent it could encourage the sponsor to close the scheme, threaten the sponsor's solvency and active members' job security. [½]

For some valuations the assumptions may be prescribed, for example by:

- regulation [½]
- accounting standards. [½]

Alternatively, some of the assumptions may be prescribed ... [½]

... or there may be a minimum level of prudence that is acceptable. [½]

The characteristics of the scheme, *eg*: [½]

- size of the scheme (a larger scheme is likely to be more stable, and therefore may use a less prudent basis)
- scheme's funding level, *ie* the excess of assets over liabilities
- maturity of the scheme
- the risk profile of the assets held
- degree of certainty there is about likely future experience.

[½ each for relevant examples, maximum 1]

The attitude of the sponsor to risk should be considered ... [½]

... together with its ability to make good any shortfall in the future if a less cautious approach is adopted. [½]

The approach adopted by similar schemes may be considered. [½]

The degree of certainty about any one particular assumption that is being set will also be considered. [½]

For example if future mortality experience can (cannot) be predicted with a high degree of certainty then the margin in the mortality assumption may be small (large). [½]

Margins may need to be higher where there is a lack of data. [½]

Finally when introducing margins for prudence into individual assumptions, the actuary needs to consider the implications for the basis as a whole ... [½]

... in other words, there is a risk that small margins introduced in many assumptions could lead to a basis that is unintentionally too prudent. [½]

Past practice should be considered, as there may be a need to be consistent with previous valuations. [½]

There may be also be tax implications, ... [½]

... eg a more prudent basis would defer the sponsor's profit, and therefore defer its tax liabilities. [½]

The trustees should consider the financial significance of the assumptions. [½]

Assumptions for the discount rate, price inflation and life expectancy are likely to be critically important, and care should be taken that the level of prudence is appropriate. [½]

Other assumptions, such as family statistics, are likely to be less important for most schemes, and so it may be acceptable to use a best estimate assumption for these assumptions, and include margins elsewhere. [½]

Ultimately, the level of prudence does not determine the actual cost of the pension scheme. This is only known when all liabilities have been extinguished. [½]

However, for a funding valuation, the assumptions determine the contribution rate and so the pace at which funds are built up. [½]

[Maximum 9]

Solution X5.3

The Core Reading for this question is covered in [Chapter 34](#), Insolvency and closure.

(i) **Options for benefit provision**

The options can be categorised broadly as follows:

1. Run the scheme as a closed fund (*ie* no new entrants and no further accrual of benefits for existing active members). [½]

Benefit payments in respect of existing members are paid out of the fund's investment income and assets realised as required. [½]

2. Transfer the assets and liabilities to another pension scheme with the same sponsor. [½]

For example, if the benefit scheme is closing due to the sponsor merging with another company, then a new scheme might be set up for the newly merged operation. [½]

3. Transfer the funds to the member to extinguish the liability. [½]

Legislation may not allow an individual to receive the capital value of their benefits as cash. [½]

However, an alternative may exist that allows the individual to place the funds with either:

- an appropriate insurance company [½]
- the scheme of a new employer. [½]

4. Transfer the assets to an insurance company to invest and provide a group policy or an individual policy in the beneficiary's name. [½]

5. Transfer the assets and the liabilities to an insurance company to guarantee a specified level of benefits. [½]

6. Transfer the assets and the liabilities to a central discontinuance fund. [½]

Such a fund may be operated on a national or industry-wide basis. [½]

[Maximum 4]

(ii) ***Costs and benefits under each option***

Closed fund

Since the assets do not have to be realised and transferred elsewhere, there will be no up-front costs. [½]

The absence of such costs may lead to higher benefits than under the other options. [½]

If the scheme is in surplus on closure, or following closure the experience in the scheme is favourable, *ie* investment returns are higher than expected and mortality is heavier than expected, then a surplus will arise. This may be used to improve the benefits of remaining members. [1]

However, if experience is worse than expected and the scheme is in deficit, remaining members may have to face reduced benefits. [½]

In particular, as the scheme shrinks:

- it may suffer from diseconomies of scale [½]
- investment freedom will be increasingly constrained. [½]

Furthermore, eventually the scheme will become so small that it is impractical to run, at which point the assets and liabilities may be transferred elsewhere. This will incur costs, which may act to reduce benefits to the remaining members. [½]

Since the active members will need to find alternative provision for future benefit accrual, they may incur extra costs in setting up new arrangements ... [½]

... and having their funds fragmented might mean that fixed costs are relatively high, which could reduce the value of their benefit. [½]

Transfer of funds (to another scheme, to the beneficiary, to a third party)

There will be a cost involved in the transfer of funds, including the cost of:

- calculating transfer values [½]
- administration [½]
- realising the assets. [½]

In addition, assets may potentially need to be realised in unfavourable conditions. [½]

If the scheme is in deficit at the time of the transfer, then transferring the funds will crystallise that deficit and reduce the benefits. [½]

Transfer the assets and liabilities to another scheme with the same sponsor

Since the new scheme is with the same sponsor, the transfer costs may not be as large. In particular, assets may not even need to be realised. [½]

Members (employees) may be able to retain salary links, which could lead to higher benefits being paid in the future than under some of the other transfer options below. [½]

If the new scheme is large and financially healthy, members may benefit from increased security of benefits and even benefit increases due to economies of scale and a freer investment strategy. [½]

Transfer the funds to the member

Since benefits are being transferred separately to individual members, transfer and administration costs will be high. [½]

If the member is able to transfer their fund to a defined benefit scheme of a new employer, then it is possible that they might regain a salary link. [½]

However, the member may find that he/she is only offered a defined contribution option, either with the new employer or the insurance company. [½]

The benefits may be less (or more) than the benefits defined by the closing scheme depending on the performance of the new arrangement. [½]

The member is likely to have a choice over which pension arrangement to invest the funds in, therefore they can shop around for a good deal. [½]

However, since most individuals lack the expertise necessary to do this, they may need to seek advice, which will cost money. [½]

Transfer the funds to a third party to manage

Since all assets are being transferred together, transfer costs will be lower (than transferring them to individual members). [½]

The members may also benefit from economies of scale if the third party is large and already manages many other funds. [½]

Furthermore, the benefit payments may be more secure under the new arrangement, *eg* if the third party is an insurance company then they are unlikely to default. [½]

Such pension arrangements are likely to be defined contribution in nature. The benefits may be less (or more) than the benefits defined by the closing scheme depending on the performance of the defined contribution arrangement and annuity rates at retirement. [½]

The third party is likely to make regular charges on the fund to cover its expenses and a contribution to profit. [½]

The benefit is not predictable before retirement ... [½]

... and there is no scope for discretionary increases (unless a with-profit fund is offered). [½]

Transfer the assets and the liabilities to a third party who will pay a guaranteed benefit

Since all assets are being transferred together, transfer costs will be lower (than transferring them to individual members). [½]

The fund may also benefit from economies of scale if the third party is large and already manages many other funds. [½]

Furthermore, the benefit payments may be more secure under the new arrangement, *eg* if the third party is an insurance company then they are unlikely to default. [½]

Since the benefits are guaranteed, the third party will be taking on the majority of the risk. To compensate for this, it is likely to use significant margins in its assumptions – particularly in respect of very long-term liabilities of deferred members – which will increase the cost to the closing scheme of the transfer. [1]

The closing scheme may not be able to afford to buy out the full value of the members' accrued benefits. Members may have to accept a lower level of benefit than that defined in the closing scheme. [½]

The benefit is predictable ... [½]

... however, there is no scope for the members to receive discretionary increases. [½]

Central discontinuance fund

It is usual for a central discontinuance fund to pay only a proportion of the members' accrued benefits, *eg* 90%. [½]

[Maximum 11]

Solution X5.4

Factors affecting the distribution of surplus are discussed in [Chapter 37](#), Surplus and surplus management.

Provision of capital

One of the sources of capital for an insurance company will be to defer surplus *distribution* until some time after the surplus *arises*, and to retain and use the capital within the business for the interim period. [1]

This may be particularly necessary for a *mutual* insurance company whose other options for raising capital are more limited than those of a proprietary. [½]

The extent to which this deferral is possible will depend on:

- regulation and guidance in the country concerned [½]
- the method of surplus distribution [½]
- policyholders' reasonable expectations. [½]

Margins for future adverse experience

The more surplus the company holds back from distribution, the greater the cushion it has against adverse future experience. [1]

The company will want to smooth surplus distribution from year to year, holding back surplus in good years to fund distributions in poorer years. [½]

Business objectives of the company

The company is likely to have as one of its business objectives the maximisation of the surplus distribution to policyholders so as to improve its competitive position. [½]

If the company does not pay competitive payouts, its levels of new business may fall, with adverse effects for policyholders, *eg* through less spreading of overheads. [½]

However, meeting other business objectives will require capital, and so the company needs to be aware of the need to retain sufficient capital within the business to finance these activities, for example: [½]

- designing and launching new products [½]
- allowing appropriate investment freedom [½]
- meeting solvency requirements. [½]

Policyholders' reasonable expectations

Policyholders may have reasonable expectations as regards the *form* and *level* of the surplus distribution. [1]

Such expectations may be built up from:

- documentation issued by the life insurance company [½]
- the company's actual past practice [½]
- the general practice in the life insurance market. [½]

Failure to meet these expectations will lead to policyholder dissatisfaction and the risk of losing existing and/or new business ... [½]

... policyholders' reasonable expectations may also, in some countries, be grounds for intervention by the regulatory authority in the affairs of the company. [½]

Other stakeholder (including staff) expectations

Staff may have expectations relating to the ongoing security of their job and the level of bonuses and/or salary increases. [½]

[Maximum 7]

Solution X5.5

The data required for monitoring experience is discussed in [Chapter 38, Monitoring](#).

Features of the data

The basic requirement is that there is a reasonable volume ... [1]

... of relevant, stable, consistent data, from which future experience and trends can be deduced. [1]

Consistent means that, when comparing the experience of one group of policyholders with another say, the data used as a basis for the calculations for each group should be:

- in a similar form [½]
- preferably extracted from the same source [½]
- grouped according to the same criteria [½]
- equal in terms of reliability. [½]

The exposure data as well as the claims data may also be affected by inconsistencies, *eg* where lives counted as smokers in one time period are counted as non-smokers in another time period, due to a change in the definition of a smoker. [½]

Data will also be needed to make an estimate of any claims that have been incurred but not reported. [½]

As well as data on the critical illness claim rate, it is necessary to have data on the exposed to risk. [½]

It is important that this is divided into the same cell structure as the experience data because an analysis of experience has no validity unless experience and exposed to risk are matched. [1]

The data ideally needs to be divided into sufficiently homogeneous risk groups, according to the relevant risk factors, *eg*: [½]

- age
- sex
- duration from entry
- smoker / non-smoker
- sum insured
- accepted on normal terms or special (*eg* medically-rated) terms. [½ each]

Claims data should be split by type of illness. [½]

However a balance between the relevance and credibility of the data must be achieved and so divisions should not be into so many groups that the data cells have too little data in them to be credible. [1]

In practice, the level of detail in the classification of the data depends upon the volumes of data available. [½]

For example, it may be necessary to group data on deaths into, say, five-year age bands rather than single-year bands. [½]

Factors influencing the appropriate number of years of data

In order to increase the volume of data, we should not choose a time period:

- so long that it includes intervals that might have significantly different experience [½]
- so short that there is insufficient data to be credible. [½]

It will also be necessary to consider how long the contract has been sold for ... [½]

... If it is a relatively new contract, there may be insufficient data to be credible. [½]

Other factors to consider are whether there have been any changes in:

- underwriting procedures
- claims management procedures
- policy terms or definitions of illnesses
- sales method or target market
- premium rates
- legislation. [½ each]

Preferably only data post-changes should be included. [½]

However, this may result in there being too little data for credibility ... [½]

... and hence data from prior to any changes may need to be included, possibly adjusted for the effects of these changes. [½]

Trends and external changes should also be considered, for example: [½]

- the changing prevalence of critical illnesses, which may be due to changes in environment, *eg* a reduction in lung cancer cases following a ban on smoking in public places
- earlier diagnosis / screening programmes
- medical advances, *eg* advances that lead to cures for critical illnesses
- legislation.

[½ each]

[Maximum 10]

2 Solutions to Case Study questions

Solution X5.6

Surplus is discussed in [Chapter 37](#), Surplus and surplus management.

Mortality / longevity – immediate annuities

This item is positive (+\$10m) which indicates that the experience has been more favourable than assumed. [½]

So, more annuitants than assumed have died during the year. [1]

Possible causes of this include:

- random fluctuations [½]
- catastrophe, *eg* pandemic event [½]
- severe weather conditions, *eg* more people die in harsh winters [½]
- normal experience, with the difference being due to a poor best estimate longevity assumption being used in the valuation. [½]

Mortality / longevity – unit-linked policies

There is a mortality loss of \$0.2m for the unit-linked policies, *ie* the experience has been less favourable than assumed. [½]

As the death benefit is greater than the unit fund, this means that there have been more deaths than expected during the year. [½]

The causes of this could be the same as for the immediate annuities. [½]

Withdrawal – immediate annuities

The withdrawal surplus for immediate annuities is \$0, because there are no surrenders of immediate annuities. [1]

Withdrawal – unit-linked policies

There is a loss of \$8.0m for the unit-linked policies, *ie* the experience has been less favourable than assumed. [½]

It is not immediately clear what *less favourable* withdrawal experience means. [½]

As the surrender benefit is the value of the unit fund with no surrender penalties, it is likely that the company makes a loss on early withdrawals... [1]

... as it may not have recouped initial expenses. [½]

Even for withdrawals later in the policy term, a withdrawal probably results in a loss for the company... [½]

... as there is no surrender penalty to cover any surrender expenses ... [½]

... and as a result of the loss of a stream of future profits if the policy had remained in force. [½]

So, less favourable surrender experience for the company likely means that more policyholders than expected have surrendered over the year. [½]

Possible causes for this include:

- bad publicity for this company ... [½]
 - ... *eg* there may have been concerns about its financial strength [½]
- bad publicity for this product generally [½]
- encouragement of pension transfers by independent intermediaries [½]
- more transfers as a result of some regulatory change / new type of alternative pension vehicle [½]
- poor performance by the company leading to customer dissatisfaction, *eg*: [½]
 - poor investment performance [½]
 - poor customer service [½]
 - high charges [½]
 - product features being less attractive than those of competitors' products [½]
- adverse tax changes [½]
- changes in policyholder circumstances, *eg* lower real incomes in the country leading to customers being less able to afford premiums. [½]

Investment return – immediate annuities

The investment return item is –\$2.0m for the immediate annuities. So experience has been less favourable than expected. [1]

The immediate annuities are likely to be backed by a variety of bonds, ... [½]

... so it is the bond market movements rather than the equity market movements that are likely to have caused this element of loss. [1]

If the assets and liabilities were perfectly matched, the two values would have increased by the same amount. [½]

However, as there is an investment loss on the annuities, there must be a mismatch. [1]

Bond values will have risen during the year as bond yields have fallen at all durations. [½]

The discount rate for valuing the annuity liabilities is set by reference to matching assets, *ie* bond yields. A fall in bond yields, and so a fall in the discount rate, will result in an increase in the value of the immediate annuity liabilities. [1]

Liability values must have increased more than asset values, ... [½]

... suggesting the liabilities have longer average duration than that of the assets. [½]

This may have been a deliberate choice of the insurance company ... [½]

... *eg* to choose attractively priced bonds despite a duration mismatch ... [½]

... but may also partly be a result of a lack of availability of sufficiently long-dated bonds. [½]

The valuation discount rate for the immediate annuities is based on actual yields less an allowance for default risk. If this allowance has got bigger, then the valuation discount rate may have fallen more than the actual bond yields. [1]

This would cause the value of the liabilities to increase by more than the value of the assets. [½]

Investment return – unit-linked pensions

The investment surplus is \$0.1m for the unit-linked pensions, *ie* experience more favourable than expected. [½]

The investment experience in this case refers to both the increases in equity values and bond values. [1]

The increase in equity and bond values will be reflected in both unit fund asset values and the unit reserves. [½]

This element of the surplus therefore arises from the non-unit reserves being reduced. [½]

For example, higher equity and bond values and so higher current unit fund values will result in any future unit-related charge income being higher and this will reduce the non-unit reserves. [1]
[Maximum 13]

Solution X5.7

This question is about levers on surplus, from [Chapter 37](#), Surplus and surplus management.

How unit-linked withdrawal losses might be better managed in future

The company should review its experience investigations and assumptions to ensure that its best estimate assumptions are genuinely realistic and not unduly optimistic. [½]

The company should adopt good general systems and management controls, ... [½]

... *eg* frequent withdrawal experience monitoring and management information, good checks on data. [½]

The company should consider actions that might improve policy retention levels, *ie* reduce withdrawal rates. [1]

These could include:

- The sales process could be reviewed ... [½]
 ... for example remuneration structures could be amended to incentivise persistency and/or product literature may be amended to improve customer understanding and reduce mis-selling. [1]
- If individual advisers can be identified as the source of poor sales, their remuneration could be reduced or the company could stop selling business through them. [½]
- The possibility of changing or adding to the distribution channels employed may also be considered ... [½]
 ... especially if a bad advice problem is occurring. [½]
- The company could review and invest in systems and processes to improve customer service standards. [½]
- The company could introduce a 'customer retention team', *eg* to ask why the policyholder wants to surrender and ensure they are aware of any alternative courses of action open to them such as premium reductions. [1]
- The company could attempt to mitigate the effects of any poor publicity by briefing the financial press and analysts and possibly by communication with its customers. [½]
- It may also introduce regular communication with customers to build the customer relationship. [½]
- The company could change the product design and/or charges to be in line with or better than other products available in the market. [½]
- The company could enhance the level of benefits or offer some flexibility, *eg* a wider choice of investment funds / increased guarantees. [½]
- The company could change the product to directly encourage persistency, .. [½]
 ... *eg* reducing any annual management charges in line with duration in-force. [½]
- For a unit-linked pension, investment performance, in particular relative to other providers, will be important. If investment performance has been relatively poor, the investment managers and decision-making processes may be reviewed. [1]
- Alternatively, the investment function could be outsourced to an external manager. [½]
- An alternative investment-related action that may address poor persistency is to offer customers a wider range of investment choices. To do this, the company may increase its range of in-house funds, or it may offer links to funds of other companies that it believes its customers will find attractive. [½]

The company could introduce a surrender penalty on the product (to avoid or reduce the size of loss when a surrender occurs). [1]

This may be impossible for in-force policies, but could be introduced for future new business to control losses in future. [1]

[Maximum 8]

Solution X5.8

The question is examining material from [Chapter 36](#), *Capital requirements*.

Economic capital

Economic capital is a company's own assessment of its capital requirements ... [1]

... based on assets, its liabilities, and its business objectives ... [½]

... eg including planned new business. [½]

Typically it will be determined based upon:

- the risk profile of the individual assets and liabilities in its portfolio [½]
- the correlation of the risks [½]
- the company's risk appetite, ... [1]
- ... eg desired level of overall credit deterioration that the company wishes to be able to withstand. [½]

Regulatory capital

Regulatory capital requirements are prescribed by the regulator. [½]

There is a wide variety of possible regulatory approaches... [½]

...ranging from simple formula-based requirements... [½]

... to risk sensitive requirements determined using company-specific sophisticated models. [1]

In many jurisdictions, regulatory capital requirements have become increasingly similar to economic capital requirement calculations. [½]

For example, the regulator may require the company to incorporate an economic capital assessment as part of its regulatory requirements. [½]

Whatever the particular approach, regulatory capital requirements are likely to be assessed prudently. [1]

Comparison

Both assessments are approaches used to determine the amount of capital required to meet obligations in extreme, adverse circumstances. [½]

They are both normally defined as the capital required in excess of provisions held. [½]

Regulatory capital requirements may be higher than economic capital requirements because the regulations may incorporate more prudence than is used in the economic capital assessment. [1]

Regulatory capital requirements are less likely to allow for the benefits of diversification ... [½]

... or the regulatory regime may be less risk-sensitive than the economic capital assessment and so not fully reflect any risk management approaches that a company has in place. [1]

However, economic capital requirements may be higher than regulatory capital requirements in order, for example, to be able to fund a company's strategic plan ... [½]

... or to achieve a higher credit rating. [½]

This may be why Prosper Insurance is able to meet its regulatory capital requirements even though its available economic capital is below the target level. [½]

The company may use a higher confidence interval in its economic capital assessment than that which underlies the regulatory capital assessment ... [½]

... eg 1-in-500 year event rather than a 1-in-200 year event. [½]

A regulatory capital assessment is mandatory. [½]

An economic capital assessment may not be mandatory. [½]

The consequences of having insufficient available capital to meet the regulatory capital requirement are more severe than those of not meeting an economic capital target. [1]

For example, the regulator may intervene in the running of the company and ultimately may require it to close. [½]

A regulatory capital assessment is normally published. [½]

Economic capital position is not normally published ... [½]

... although it may be submitted to or shared with the regulator. [½]

[Maximum 10]

Solution X5.9

The question is examining material from [Chapter 35](#), Capital management.

The capital positions can be improved through either increasing the available capital ... [½]

... or reducing the capital required, ... [½]

... or both. [½]

Increasing available capital

The company could increase equity capital by issuing new shares ... [½]

... or by reducing dividend payments (although it might be some time before this has a significant effect). [½]

This would improve both regulatory and economic capital positions. [½]

It could use financial reinsurance techniques ... [½]

... which aim to exploit some form of regulatory or tax arbitrage in order to manage the capital efficiently. [½]

The reinsurer is usually based in a different country than the insurer in order for these differences in regimes to exist. [½]

Financial reinsurance would be expected to improve the regulatory capital position rather than the economic capital position. [½]

Prosper may be able to raise capital via a securitisation ... [½]

... thereby converting an illiquid asset into a tradable instrument. [½]

For example, Prosper may be able to sell a share of the future profits from its in-force annuities to the capital markets. [½]

Securitisation is typically intended to improve the regulatory capital position (depending on the regime in question). [½]

The impact on the economic balance sheet will be limited as future profits may already be receiving full credit (as not restricted by regulations). [½]

Prosper could seek to raise capital by issuing subordinated loan stock ... [½]

... *ie* debt where the interest and capital repayments are only paid if, after their payment, regulatory solvency capital requirements continue to be met ... [½]

... or in some countries if authorised by the regulator. [½]

The assets of the provider are increased (by the amount of the debt issued) but, because the repayments rank behind the policyholder liabilities, does not increase the liabilities on the regulatory basis. [½]

Therefore, again it is the regulatory capital position that may be improved. [½]

The available economic capital is not increased as both the debt asset and the repayment liabilities are shown on the realistic economic balance sheet. [1]

It may be possible to increase available capital through writing more capital-generating new business. [½]

However, if new business causes strain, *ie* if provisions exceed assets at early durations, then the company could reduce the level of new business written. [½]

It may be possible to re-organise the company in a more capital efficient way, *eg*: [½]

- funds could be merged, *eg* if regulatory requirements involve any fixed amounts per fund [½]
- assets could be changed if regulations exclude them from the balance sheet [½]
- the valuation basis could be weakened (if this can be justified). [½]

These re-organisations would typically achieve an improvement in regulatory rather than economic capital. [½]

It may be possible to run the business in a more efficient way and this better use of resources will improve the company's capital position over time. [1]

For example:

- better expense control – the company could investigate any cost savings that might be possible, *eg*: [½]
 - outsourcing, *eg* claims control process or day-to-day investment decisions [½]
 - using appropriate and cost-effective distribution channels [½]
 - staff training, to ensure staff are competent and efficient [½]
- adopting a more effective tax management policy [½]
- revising its pricing, *eg* reduce rates to attract more profit-making business or increase them to make more profit per policy. [1]

These actions should improve both the economic and regulatory capital positions over time. [1]

Reducing the capital requirement

The company could seek to reduce the capital requirement by reducing the levels of risk. [1]

All of these risk management techniques should reduce the economic capital requirement and so improve the economic capital position. [1]

Whether, and to what extent, they would reduce the regulatory capital requirement and so improve the regulatory capital position would depend on the particular regulatory regime ... [½]

... and in particular whether it is simple, *eg* formula-based (in which case regulatory requirements may not reduce) ... [½]

... or whether it is more sophisticated and risk-sensitive (in which case they may reduce). [½]

For example, Prosper could reduce risk by changing its investment strategy ... [½]

... *eg* by using only government rather than corporate bonds to match the immediate annuities ... [½]

.. and/or by hedging unit-linked guarantees using derivatives. [½]

Reinsurance could be used to reduce insurance risk, ... [½]

... *eg* mortality risk as there are death benefits in excess of the unit funds on the unit-linked policies. [½]

Longevity swaps could be used to reduce longevity risk exposure on the annuities. [½]

Prosper could remove any guarantees associated with the unit-linked savings policies. [½]

[Maximum 14]

Solution X5.10

This question is testing material from [Chapter 34](#), Insolvency and closure.

The regulator actions would be intended to protect the interests of existing or prospective policyholders. [½]

Depending on the regime there may be more than one trigger point for regulator actions, ... [½]

... for example a recovery plan may be required at a certain point, but direct regulator intervention and closure may then only happen if there is a more serious breach (*ie* a lower, minimum capital requirement has been breached). [1]

In most cases, the company will be required to establish a recovery plan, and this will be monitored closely by the regulator. [1]

For example, a recovery plan may include some or all of the following actions:

- changing to a less risky investment strategy [½]
- a plan to raise new capital [½]
- increasing the amount of reinsurance the company has in place [½]
- limiting the levels of new business sold. [½]

The regulator may require a company to close to new business ... [1]

... so that new policyholders are not entering a fund whose solvency may be in doubt. [½]

Closure to new business is normally a last resort, because it is unlikely that the insurance company would subsequently be able to re-open. [½]

If a company maintains the infrastructure to enable it to re-open, *eg* sales staff, marketing teams, new business systems ... [½]

... these costs will be a further drain on capital while no business is being written. [½]

If a provider closes to new business, it will still have outstanding liabilities from the in-force business written that will need to be met. [½]

However the savings from closing to new business together with the release of capital previously tied up in financing the new business strain of the business on the books, should enable the company to meet these liabilities in the short term. [½]

In the longer term, diseconomies of scale will bite and further actions will be needed. [½]

The insurer may be sold to, or merged with another provider who takes on the liabilities. [1]

The regulator could look to nationalise the insurer, *ie* bring it under state ownership ... [½]

... or transfer the liabilities (and assets) to an industry-wide insolvency fund. [½]

[Maximum 5]

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Assignment X6 Solutions

1 Solutions to Case study 1 questions

Solution X6.1

This question is testing the material in [Chapter 11](#), Behaviour of the markets.

The low interest rates will be used by the government to help the economy recover from the downturn. [1]

The low interest rates should aid the recovery because:

- low rates encourage consumer spending ... [½]
- ... as there is less incentive to save ... [½]
- ... and borrowing costs are lower [½]
- increased consumer spending leads to higher demand for goods and services and therefore increased profitability for companies [1]
- increased consumer demand leads to lower unemployment ... [½]
- ... and potentially higher wages, which may encourage further spending [½]
- a low cost of borrowing makes it easier for existing companies to raise the finance to expand ... [½]
- ... and it is more viable for new companies to start up. [½]

Low interest rates will make the currency less attractive ... [½]

... and so the currency may depreciate. [½]

Depreciation of the currency:

- makes exports more attractive [½]
- increases the cost of imports (both goods and raw materials) ... [½]
- ... so if the economy is export driven a reduction in interest rates may help the country recover from the downturn. [1]

[Maximum 5]

Solution X6.2

This question is examining the material in [Chapter 9](#), Equity and property markets.

The actions taken can be directed at the affordability of property or the availability of property ... [1]

... noting if more property is available then this will tend to control property prices and increase affordability. [½]

Affordability of property

Action – provide government-backed loans to first-time buyers at a lower cost than loans available in the market. [½]

Issue – not all first-time buyers will need such help ... [½]

... may have a negative impact on mortgage providers ... [½]

... and increased demand may push up property prices. [½]

Action – provide tax advantageous vehicles to help first-time buyers save for a deposit. [½]

Issue – costs will be met by taxpayers who may think this is unfair. [½]

Action – provide shared home ownership schemes, where the government buys part of the property. [½]

Issue – diverts scarce resources away from other government projects. [½]

Action – revise the regulation so that:

- less than a 10% deposit is required [½]
- individuals can take out a mortgage of greater than 3 x salary. [½]

Issue – this may mean the mortgage is unaffordable in future years, causing similar problems to those that led to the economic downturn 10 years ago. [1]

Action – act as a guarantor for the mortgage loan. [½]

Issue – there may be moral hazard, *ie* home-owners may be less careful about managing their finances as they know the government is backing their loan ... [½]

... there is concentration risk, *ie* when interest rates rise, mortgages may become unaffordable for many people at that one point in time. [½]

Action – remove / reduce any property taxes applying to the purchase of property for first-time buyers. [½]

Issue – may lead to an increase in the price of properties suitable for first-time buyers, *ie* sellers charge a higher price to 'share' in the tax break. [½]

Availability of property

Action – relax planning restrictions to enable more homes to be built and more quickly. [1]

Issue – may lead to inappropriate houses being built in the wrong locations ... [½]

... for example luxury apartments or executive home. [½]

Action – introduce regulation requiring developers to build property where planning permission has been granted within a set timescale. [½]

Issue – may lead to short-cuts and poor quality houses built. [½]

Action – require that each development includes a minimum percentage of low-cost starter homes. [½]

Issue – developers may bring forward fewer developments as they are less profitable. [½]

Action – provide low-cost loans to property developers. [½]

Issue – may be politically unpopular with the electorate. [½]

Action – place restrictions or use the tax system to make the purchase of second homes by overseas and/or domestic investors less attractive. [1]

Issue – may lead to a depreciation of the currency if there is significant investment from abroad. [½]

Issue – may be politically unpopular if many people are using buy-to-let property as an alternative to more traditional pension provision. [½]

[Maximum 8]

Markers: give credit for other sensible suggestions.

Solution X6.3

This question is examining the material in [Chapter 9](#), Equity and property markets.

(i) **Factors to consider when purchasing a buy-to-let property**

The couple need to decide on their objectives in relation to this investment, for example:

- the money they have available for the purchase, and the extent to which they will need to borrow to meet the full cost of the property ... [½]
... to the extent there is borrowing, it will be important that the rental income exceeds borrowing costs [½]
- whether they are prepared to carry out work on the property before letting it [½]
- whether they wish to be involved with managing the property on a day-to-day basis, or plan to pay a property management company to do this work [1]
- how they will deal with any periods of time where there may be a void [½]
- their long-term plans regarding the property, *eg* pass on to the children or sell. [½]

Comparables

Consider whether there are comparable properties and the price at which they are being sold ... [½]

... to gauge whether the purchase price is realistic. [½]

Age / condition / flexibility of usage

- If the property is in good repair it will attract a higher rent. [½]
- If the property is currently in poor condition then additional expenses will be incurred to improve the property to ensure it achieves a good rental income. [½]
- Need to check whether the property has all the appropriate certificates, *eg* boiler, energy efficiency. [½]
- Consider whether the property may be attractive to a range of potential tenants, *eg* is it flexible enough to be divided into units for different tenants? [½]
- The greater the flexibility of use the likely higher the rental level ... [½]
- ... and the reduced chance of voids. [½]

Location

- The exact location of the property will be key. [½]
- Consider the socio-economic conditions in the location and the impact on likely rental levels. [½]
- If the property is close to a university then it may attract high demand during term time, but leave a void in holidays. [½]
- If they plan to manage the property themselves then it will be important that the property is close to where they live. [½]
- Proximity of the property to public transport, shops, good schools *etc* which would mean a higher rent can be charged. [½]
- The exposure of the property to natural risks ... [½]
- ... for example has the property been flooded before? Is the area prone to subsidence? [½]

Lease structure

- Consider any lease currently in place ... [½]
- ... it may be that the property is purchased with existing tenant(s). [½]
- Check for any restrictions in the deeds of the property that restrict its use, *eg* prevent it from being rented out. [½]

Size

A larger property will be more expensive ... [½]

... but gives the opportunity to multi-let. [½]

Tenant quality

Consider the type of tenant that they wish to attract, and the property that will be attractive to that type of tenant. [1]

For example:

- they may wish to attract young professionals, who may pay a higher level of rent than other groups ... [½]
 ... but may only take short-term leases and increased risk of voids [½]
- they may wish to attract families, who are likely to desire a garden on the property and are more likely to be long-term tenants. [½]

Supply and demand issues

The availability of supply (and any new developments in the area) relative to demand. [1]
 [Maximum 10]

(ii) Risks of buy-to-let property investment compared to cash savings*Security*

Cash savings will be secure in monetary terms, but may suffer a loss in real terms, *ie* do not provide protection against inflation. [1]

Property investment is less secure ... [½]

... although there is intrinsic value in the land on which the property is built. [½]

Yield

The main risk with investing in cash is low returns, which may not be sufficient to meet the couple's needs. [1]

The long-term return on property investment is expected to be higher, reflecting the additional risks posed by property. [½]

These risks include:

- poor marketability, which may be of concern to the couple if they are likely to need to access their money quickly [½]
- poor liquidity, property has less stable values than cash investment [½]
- indivisibility, *ie* there is not the flexibility to sell just part of the investment [½]
- tenant default [½]
- void risk [½]
- obsolescence [½]
- depreciation [½]
- political risk, for example action taken by government: [½]
 - improving the rights of tenants [½]
 - capping the level of rent payments [½]
 - ... that enables more people to buy their first house therefore ... [½]
 - ... reducing demand to rent and/or ... [½]
 - ... reducing the level of rents achievable. [½]

The purchase of property leads to concentration risk, *ie* a significant amount of their assets invested in one asset class, as they also own a main property. [1]

There is interest rate risk, as if interest rate rises the cost of any variable-rate mortgage on the property will increase. [1]

There is a risk of poor tenants who damage the property's infrastructure or leave the property in a poor state leading to repair costs before the property can be re-let. [½]

There will be a financial and emotional cost of evicting a tenant who refuses to leave at the end of the lease. [½]

There is a risk of making a poor choice of property, and therefore achieving a low return, due to lack of expertise. [½]

Expenses

Expenses associated with a cash investment are likely to be very low. [½]

For property investment there is less certainty about the expenses, which may be higher than expected, for example: [½]

- insurance costs [½]
- maintenance costs [½]
- the fees charged by any management company. [½]

Tax treatment

The tax treatment between the two options may be different. [½]

There are a number of taxes affecting property, these could increase substantially over time. [½]
[Maximum 10]

Solution X6.4

This question discusses the topics in [Chapter 7](#), General insurance products.

(i) Cover provided by a landlord insurance policy

Buildings and contents cover will be required as would normally be the case for a residential building and additional cover to reflect that the property is being rented out to a tenant. [1]

Buildings insurance (to repair or rebuild the property) ... [½]

... including cover against accidental damage ... [½]

... and malicious damage to the property caused by tenants. [½]

Contents insurance to cover fixtures and fitting ... [½]

... and other contents if the property is rented out fully furnished ... [½]

.... including cover against accidental damage ... [½]

... and malicious damage or theft of contents by tenants. [½]

If tenants cannot remain in the property due to an incident (*eg* fire or flood) then: [½]

- cost of re-housing of tenants in alternative accommodation (for a maximum period of time) [1]
- loss of rental income. [½]

Property owners' liability cover, including: [1]

- Cover for legal fees incurred, *eg* if sued by a tenant. [½]
- Cover for the costs of eviction of squatters from the property. [½]

Replacement of keys if lost or stolen. [½]

Cover for multiple properties under one policy. [½]

Employer's liability cover, where the landlord is operating as a business with staff who maintain the properties ... [½]

... covering accident, illness or death causes to the employees due to negligence of the landlord. [½]

Cover against damage caused by terrorism. [½]

[Maximum 7]

(ii) **Rating factors**

Number of properties to be covered and then for each property: [½]

- cover required where there is choice (eg whether the policyholder want legal fees and employer's liability to be covered)
- purchase price of property
- type of construction
- type of property, eg flat, semi-detached house, detached house
- age of property
- postcode
- policyholder's previous claims experience on own residence
- policyholder's previous claims experience on this property
- whether property let furnished or unfurnished
- proximity of the property to trees (in relation to subsidence risk or risk of trees falling on the property)
- number of tenants
- type of tenant
- annual rental income
- voluntary excess level
- level of contents cover required.

[½ mark per bullet point, maximum 5]

*Markers: give credit for other sensible suggestions, maximum 2 marks.***Solution X6.5***This question is testing the material in [Chapter 29](#), Risk transfer.*

There is the risk of large individual claims, eg if a property let to many tenants is destroyed in a fire ... [1]

... individual excess of loss reinsurance may be used. [½]

There is the risk of many claims arising over a year from a common peril, eg flooding ... [1]

... aggregate excess of loss reinsurance may be used. [½]

There is the risk of an event, eg hurricane or earthquake affecting many properties ... [1]

... catastrophe excess of loss reinsurance may be used. [½]

The insurer is new to the market and therefore has limited expertise and data ... [½]

... reinsurance can give access to such expertise and data. [½]

The insurer may wish to use a quota share arrangement to share the risk on each policy as it enters this new market ... [1]

... this would enable the insurer to write more business and therefore increase its market share ... [½]

... and achieve greater diversification of risk. [½]

Surplus reinsurance may be used as risks are not homogeneous ... [½]

... it will enable reinsurance to be targeted towards the more significant risks. [½]

A loan may be provided by the reinsurer contingent on the insurer making profit. [½]

This loan can be used to meet the new business strain arising on selling the new product. [½]

As the product is new there is more uncertainty regarding future experience. [½]

Stop loss reinsurance may be purchased to 'stop the losses' above a certain loss ratio. [½]

[Maximum 5]

2 Solutions to Case Study 2 questions

Solution X6.6

This question is testing the material in [Chapter 37](#), Surplus and surplus management.

The contribution rate may have risen due to:

- increasing longevity [1]
- poor investment returns [1]
- default of some investments [$\frac{1}{2}$]
- salary growth higher than expected, increasing the liabilities for active members [$\frac{1}{2}$]
- expenses higher than expected [$\frac{1}{2}$]
- more stringent regulation [$\frac{1}{2}$]
- removal / reduction of tax incentives relating to employer contributions or investments for pension schemes [$\frac{1}{2}$]
- option costs greater than expected [1]
- contributions to any central discontinuance fund being higher than expected [$\frac{1}{2}$]
- increased number of deaths in service or fall in deaths in service, dependent upon whether deaths are a source of deficit / surplus for the scheme [$\frac{1}{2}$]
- pension increases greater than expected, *eg* if price inflation linked increases provided [1]
- fewer transfers out of the scheme than expected (assuming transfers out are a source of surplus) [$\frac{1}{2}$]
- more ill-health retirements than expected (if ill-health retirement benefits are more generous than normal retirement benefits) [$\frac{1}{2}$]
- benefit improvements (which may be required by regulation) [$\frac{1}{2}$]
- increasing maturity of the membership [$\frac{1}{2}$]

[Maximum 6]

Markers: give credit for other sensible suggestions / examples.

Solution X6.7**(i) Defined ambition (DA) scheme compared with the defined contribution (DC) scheme**

This question is testing the material in [Chapter 26](#), Financial product and benefit scheme risks.

Advantages to the company

Likely to help attract and retain staff due to the guarantee provided by the underpin [1]

... noting competitor companies do not offer such an underpin. [½]

A switch from salary defined benefit scheme to a pure DC scheme may be felt to be too great a step for existing members. [½]

The DA scheme provides an intermediate step which may be more acceptable, therefore maintaining good industrial relations. [½]

Offering an underpin may appeal to the paternalistic aims of the company. [1]

The underpin is set at a low level (only a 1/100th accrual rate) and therefore should not prove too onerous. [½]

Advantages to the members

DA scheme gives additional security as there is a minimum benefit. [1]

Members retain all the upside risk in the DA scheme, but have limited exposure to downside risk. [1]

Members who join late are likely to benefit from the underpin. [½]

Members with significant salary growth in later years are likely to benefit from the underpin. [½]

Disadvantages to the company

If the underpin bites then costs of benefit provision will be higher than if a pure DC scheme had been offered. [1]

The contribution rate for the DA scheme will be less stable and predictable than for the DC scheme. [½]

A sustained period of poor investment performance may lead to the underpin biting for many members ... [½]

... and therefore a significant cost for Company X ... [½]

... this may arise at a time that Company X's business is also performing poorly ... [½]

... for example a recession leading to a fall in the stock market and lower demand for new cars. [½]

Expenses will be higher ... [½]

... for example the cost of testing whether the underpin bites and modelling the likely timing and cost of the underpin. [1]

The DA scheme may need to meet the regulation that applies to both DC and DB schemes. [½]

The scheme will be more difficult to explain to members ... [½]

... and there is a chance that the benefits are not appreciated. [½]

Disadvantages to the members

The operation of the DA scheme may be difficult to understand. [½]

The underpin is set at a low level, such that it may not provide adequate protection. [½]
[Maximum 10]

(ii) **Financing the underpin**

The question is primarily testing the material in [Chapter 23](#), Pricing and financing strategies.

The underpin may be funded in advance, for example: [½]

- by regular contributions, gradually building up a fund to meet the cost if the underpin bites [1]
- by a lump sum payment when the member joins the scheme ... [½]
- ... although this may cause liquidity issues. [½]

Funding in advance leads to an opportunity cost for the company. [1]

The underpin may be unfunded, *ie* PAYG ... [1]

... with Company X providing the money to meet the underpin only when the underpin bites ... [½]

... this may cause liquidity problems for Company X ... [½]

... and does not give security for members. [½]

The company may have no choice in the financing method as it may be dictated by regulation. [½]
[Maximum 5]

(iii) **Disadvantages to the company of offering investment choice**

This question is testing the material in [Chapter 26](#), Financial product and benefit scheme risks.

As members have all the upside and limited downside risk in the scheme, they may choose risk-seeking funds to try to maximise returns. [1]

If these funds perform poorly then the underpin may bite. [½]

The company may choose to purchase derivatives to hedge such risks ...	[½]
... but this will have a cost.	[½]
The wide range of funds will be off-putting to some members ...	[½]
... noting the company will have a wide range of workers, some of whom will have limited investment knowledge ...	[½]
... such members may choose the very low risk, <i>eg</i> cash funds ...	[1]
... such funds are likely to achieve low returns and so the underpin bites.	[½]
It will be important to offer a default fund for members who do not feel able to make a choice.	[1]
The administration costs associated with offering many funds will be high ...	[½]
... particularly if members are allowed to switch funds frequently.	[½]
It will be important to clearly communicate the characteristics of each investment fund.	[½]
	[Maximum 5]

Solution X6.8

This question is testing the material in [Chapter 16](#), Investment management.

(i) **Portfolio construction**

When constructing the portfolio, there will be two conflicting objectives:

1. the need to ensure security [½]
2. the desire to achieve high long-term returns. [½]

The first objective suggests a portfolio is chosen that is well matched to the liabilities ... [1]

... in this case the liability is to provide a stable, real return ... [½]

... with sufficiently liquid / marketable assets to fund the underpin when necessary. [½]

It will be important that the fund is not too closely correlated with the investments offered to members ... [½]

... or there is the risk that when the underpin bites due to poor investment performance, this fund has a low value. [½]

The second objective encourages a move away from the benchmark portfolio in the interest of maximising returns. [½]

‘Big Ambitions’ will need to discuss with Company X the relative importance to them of stability and security versus potentially reducing the cost of financing the underpin by seeking higher returns. [1]

Construction of the portfolio will typically involve a two-stage process:

1. Establishing the strategic benchmark ... [½]
 ... taking account of the liabilities and the views of Company X in terms of the degree to which they will accept the risks from a mis-matched position. [½]

Strategic risk will arise if the strategic benchmark performs poorly relative to the liabilities (*ie* cost of the underpin). [1]

2. Implementation of the investment strategy within 'Big Ambitions' ... [½]
 ... where a decision is taken as to the freedom the fund managers should have to move away from the strategic benchmark ... [½]
 ... for example the ability to make tactical switches going over or under-weight in different asset categories by a certain maximum percentage. [½]

Investment managers will also be responsible for stock selection. [½]

The risk taken by the investment managers relative to their benchmark is active risk. [1]

In addition there may be structural risk is the sum of the portfolio benchmarks does not total the strategic benchmark. [1]

The overall risk taken is the sum of the active, strategic and structural risk. [½]

Big Ambition will need to ensure it acts with integrity and suggests an investment strategy most appropriate for the client. [1]
 [Maximum 8]

(ii) ***Why competitor funds may not be an appropriate benchmark***

Different fund managers may have different restrictions placed on them ... [1]

... the more severe the restrictions compared to the average manager the less appropriate the comparison. [½]

Returns may be affected by cashflows into or out of the fund. [1]

Funds may be of different sizes, impacting on the scope to diversify and the opportunities available. [½]

Need to consider whether the return on competitor funds includes reinvestment of income ... [½]

... if it does then the income on the actual portfolio should be excluded as cashflow (but included in the end-period value. [1]

If the return on competitor funds is capital only then the actual income from the assets held needs to be included as cashflows. [1]

Check whether expenses have been included or excluded from the benchmark so a valid comparison can be made. [½]
 [Maximum 3]

(iii) **Money-weighted vs time-weighted rate of return**

The money-weighted rate of return (MWRR) is the discount rate at which the present value of inflows to the portfolio equals the present value of outflows. [1]

MWRR allows for all cashflows and their timings. [½]

MWRR places a greater weight on the performance when the fund size is largest. [½]

It may not give a good reflection of manager performance if the manager had best performance of the fund after several withdrawals and then poorer performance when many new members joined ... [½]

... such cashflows into and out of the fund will be outside of the fund manager's control. [½]

TWRR is the preferred industry standard ... [½]

... it is not sensitive to contributions or withdrawals. [½]

It is defined as the compounded growth rate of 1 over the period being measured ... [1]

... no account is taken of flows of money into or out of the fund. [½]

TWRR will not identify managers who are good at managing small funds but poor at managing large funds. [½]

[Maximum 4]

Solution X6.9

This question is testing the material in [Chapter 9](#), Equity & property markets and [Chapter 14](#), Choosing an appropriate investment strategy.

(a) **Bridging loan fund**

The return offered is potentially high ... [½]

... as property buyers will be prepared to pay an interest rate higher than standard borrowing rates as they need quick access to funds. [1]

The loans are secured against the property which reduces default risk ... [½]

... however it may be expensive / time-consuming to recover funds if the property owners default on the loans. [1]

The investment is riskier than investing in a standard collateralised mortgage fund. [½]

Many loans are pooled together in the fund reducing exposure to risk. [½]

Returns are not guaranteed but are likely to be at a percentage over base rates ... [½]

... over time the returns are likely to be loosely real ... [½]

... matching the real liabilities of members. [½]

As the loans are short term and then new loans need to be negotiated, the expenses of operating the fund may be high ... [1]

... and there is reinvestment risk. [½]

Demand for bridging loans and hence the return that can be achieved will depend upon the economic outlook and the buoyancy of the property market. [½]

The fund offers diversification from more traditional asset classes ... [½]

... although is correlated to a degree with property funds. [½]

(b) ***Rare coins fund***

The return offered is potentially high ... [½]

... but uncertain. [½]

The coins will have some intrinsic value if made of gold or silver ... [½]

... but that intrinsic value will be far lower than the value as a rare coin. [½]

The return will be dependent upon:

- investor sentiment and fashion [½]
- whether further coins of the same type are discovered. [½]

Significant expertise will be required to choose the right coins to hold for the fund ... [1]

... the cost of such expertise will reduce the net of expense return. [½]

The fund will not provide an income stream ... [½]

... this may be a good match for the liabilities of members, as income would introduce reinvestment risk. [1]

There will be costs associated with storing and insuring the coins ... [½]

... which will impact on the net of expense return achieved. [½]

The fund will not provide a direct hedge against inflation. [½]

The fund may prove a hedge during times when more traditional investments are performing poorly. [½]

The fund offers diversification from more traditional asset classes. [½]

[Maximum 10]