IAQS | INSTITUTE OF ACTUARIAL & QUANTITATIVE STUDIES

Class: M.Sc Sem 3

Subject : Actuarial Practice 1

Chapter: Unit 4 Chapter 3

Chapter Name: Modelling Assumptions-II

Table of contents

Table of contents

1 Risk Classification in Life Insurance

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.

1 Risk Classification in Life Insurance

Heterogeneity

- 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 of identifying different risk factors of policyholders and classifying them into various homogeneous groups is known as **risk classification**.

List the eight risk factors the insurer would wish to identify when offering life insurance.

1 Risk Classification in Life Insurance

The central limit theorem (CLT) states that the distribution of sample means approximates a normal distribution as the sample size gets larger, regardless of the population's distribution.
Sample sizes equal to or greater than 30 are often considered sufficient for the CLT to hold.

1 Risk Classification in Life Insurance

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.

- **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.

- If the insurer has the **same premium rates** for smokers and non-smokers, then the smokers will be getting better terms than the non-smoker and more smokers will take out policies from that insurer and non-smokers will prefer another insurer with better terms for them. This is an example for adverse selection.

1 Risk Classification in Life Insurance

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.
- From a marketing point of view, prospective policyholders will want the process of underwriting to be straightforward and quick.

1 Risk Classification in Life Insurance

- 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.

2 The Need for Different Mortality Tables

Why is it 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, i.e., 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**.

2 The Need for Different Mortality Tables

Why is it necessary to have different mortality tables for different classes of lives?

- 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.

Table of contents

3 Causes of Variation in Mortality and Morbidity

In addition to variation by **age** and **sex**, mortality and morbidity rates are observed to vary:

- between **geographical areas**, e.g., countries, regions of a country, urban and rural areas
- by **social class**, e.g., manual and non-manual workers
- over **time**, e.g., 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

3 Causes of Variation in Mortality and Morbidity

- 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.

- Government authorities need to be made aware of these risk factors so as to bring about improvements in public health. This is of importance in insurance as identifying specific factors gives a precise idea of the individuals mortality or morbidity risk and thus enabling more accurate calculation of premiums and reserves.

3 Causes of Variation in Mortality and Morbidity

Occupation	Nutrition	Housing
Climate/geography	Education	Genetics

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. Sedentary or desk jobs such as that of an actuary will be less healthy than that of a fitness coach.
- 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.

3 Causes of Variation in Mortality and Morbidity

Occupation	Nutrition	Housing
Climate/geography	Education	Genetics

- 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.

- Getting **occupation specific mortality rates** is not always possible. Rates can be **unreliable** if category in which the deaths and occupation are recorded is different. This happens due to:

    - Entries on the census records, which are used to determine the exposed to risk, may not be specific enough, resulting in the wrong occupation being recorded.

    - Family of the deceased may glorify their occupation. For example an electrician may be labelled as an engineer.

3 Causes of Variation in Mortality and Morbidity

Occupation	Nutrition	Housing
Climate/geography	Education	Genetics

Estimates may be unreliable as a result of the following factors

1. **Previous Occupation** – information with respect to occupation in the census will relate to the most recent one. When workers are unable to continue in their existing occupation due to old age or sickness, a select effect can occur as they may then switch to a stress free job. This can lead to spurious mortality rates being associated with certain jobs, and recording the entire occupation history is not feasible.

2. **Classification** – previously wives were classified under the same occupation as their husbands. However, this is no longer the case as each one has their separate occupation. Correlation between their jobs exists.

3. **Lack of statistics** – for occupations where only a minimal number of members exist, insufficient data leads to unreliable statistics. However select occupations may at times give more detailed information and thus accurate statistics.

3 Causes of Variation in Mortality and Morbidity

Occupation	Nutrition	Housing
Climate/geography	Education	Genetics

Nutrition

- **Good nutrition** is having a **balanced diet** with the right kind 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.

- **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.

3 Causes of Variation in Mortality and Morbidity

Occupation	Nutrition	Housing
Climate/geography	Education	Genetics

- There are also **social and cultural factors** which encourage or discourage the consumption of certain foods and drinks, such as alcohol.
- **Sub nutrition** or the absence of adequate food may lead to general weakening of the body and a compromised immunity
- **Malnutrition** or the lack of essential vitamins and minerals can cause certain medical conditions which may increase mortality rates

3 Causes of Variation in Mortality and Morbidity

Occupation	Nutrition	Housing
Climate/geography	Education	Genetics

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.

List factors that could adversely affect the mortality of a homeless person in a developed country.

3 Causes of Variation in Mortality and Morbidity

Occupation	Nutrition	Housing
Climate/geography	Education	Genetics

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.

3 Causes of Variation in Mortality and Morbidity

Occupation	Nutrition	Housing
Climate/geography	Education	Genetics

The following also vary according to geographical location:

- **Access to medical care and transport** – cities with modern and easily accessible medical centers can provide quick and effective medical treatments. Preventive screening can identify issues at the initial stage.

- **Road accidents** – cities are more prone to motor accidents, the traffic speed may be lower so the chances of injuries being fatal are small

- **Natural disasters** – the positioning of a country on earth makes it susceptible to natural calamities such as earthquakes, floods, hurricanes etc for example Japan is susceptible to earthquakes. It is debatable whether the recent rise in natural disasters can be attributed to global warming as a result of increased green house gas levels in the atmosphere.

- **Political unrest** – countries such as Syria and Iraq with political unrest, civil wars and violence have higher mortality rates because:
  Citizens are required to fight wars
  Increased risk of injury to civilians
  Food, clean water and medical facilities may be restricted in war hit areas

3 Causes of Variation in Mortality and Morbidity

Occupation	Nutrition	Housing
Climate/geography	Education	Genetics

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

3 Causes of Variation in Mortality and Morbidity

Occupation	Nutrition	Housing
Climate/geography	Education	Genetics

- 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.

- Education has its own effect on mortality however it is **highly correlated** with other factors with **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

3 Causes of Variation in Mortality and Morbidity

Occupation	Nutrition	Housing
Climate/geography	Education	Genetics

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.

Table of contents

4 Selection

Selection is basically dividing heterogeneous data into homogeneous groups. There are various types of selections:

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**.

4 Selection

- Temporary initial selection is a result of **heterogeneity** in a group existing only for the initial s years, after which the effect of that particular cause of difference wears off over time, thus leaving no heterogeneity in the group.

- The relative numbers at each duration since selection in the select group will affect the risk levels within the select group.

- The underwriting process is the main cause for temporary initial selection, since lives that are recently underwritten will have a better experience than lives underwritten 10 years ago, with this effect wearing off over time.

4 Selection

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 is on the basis of **factors** whose **effect remains permanent** with respect to mortality, i.e. the source of heterogeneity will remain permanent.

- Gender is one such factor as lives subdivided on the basis of sex will always exhibit different mortality.

Suggest examples of class selection.

4 Selection

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.

4 Selection

- **Mortality selection** is performed by grouping together lives who attain the same age in different time periods.
- Where time selection takes place, i.e. mortality shows significant variation 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.
- Finding an average rate does not solve the problem of variation mortality over time as it will not reflect the actual underlying mortality over the investigation period.

4 Selection

Adverse selection

- **Adverse selection (or anti-selection)** is characterized 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 purchasing the annuity are healthy and confident of surviving for a considerable period. Any chances of dying in the near future, would make them take a capital lumpsum instead.

4 Selection

- **Underwriting** is the process by which life insurance companies divide lives into homogeneous risk groups by using the 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.

4 Selection

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 general, **spurious selection** does not ensure **completely homogeneous groups**, where heterogeneity is present to a considerable extent.
- People in each group will be affected by a factor not used to define the group to different extents. Hence groups with different proportions of affected member 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.

4 Selection

- **Spurious selection** can be done away with when all sources of heterogeneity can be identified within the parent population.

- 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.

Suggest examples of spurious selection.

- **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.

- Existing policyholders tend to have a heavier mortality compared to new entrants due to:
  - Temporary initial selection at the underwriting stage which ensures that the entrants are relatively healthy, and
  - Healthier lives are more likely to lapse their policies

5 Mortality Convergence

- The **heterogeneity** amongst policyholders is most strongly at **working ages**.
- These variations can be large and have a material 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**.
- Difference in mortality brought about by factors such as occupation, geographic areas, socio-economic situation, etc are almost insignificant for people post retirement than they do for people of working ages.

Suggest a reason for mortality convergence.

- Detailed analysis of mortality convergence is complicated by the **low volumes of data** at the highest ages, as the number of people surviving till the highest ages is significantly low.

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.
- Married people tend to exhibit a lighter mortality because sick or disabled people are less likely to get married. Here marriage is operating as a selective decrement.
- Divorced or widowed individuals exhibit a higher mortality than married individuals. The stability of a family environment brought about by marriage may reduce stress.

Table of contents

7 Types of Expenses

The different **types of expenses** are:

- staff salaries, pensions contributions, national insurance contributions, etc
- commission payments
- office rent and related expenses including office equipment (eg computers)
- investment costs
- office consumables (eg stationery).

The expenses incurred by an organization 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.

7 Types of Expenses

Fixed vs variable expenses

In practice, all **expenses vary in the long term**, which removes the difference between fixed and variable expenses then. Here we define them in the **short term**.

Insurance Company Expenses

Variable expenses that depend on the amount of business written are:

- **Commission** – depends on the level of premium income earned
- Potential **costs for sending contract documents** and **claim forms** – depends on the number of contracts sold and the number of claims
- **Legal expenses** – depends on the claim amount

7 Types of Expenses

- There is no explicit distinction between fixed and variable expenses. Some expenses may fall under either of the two categories.

- For example, the processing cost incurred for a new contract may be a fixed expense, as the company does not pay higher salaries when new contracts are sold. However, if marginal sales of contracts result in paying bigger bonuses to the staff or making overtime payments, then this expense is considered a variable one.

- 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.

7 Types of Expenses

- **Isolating variable expenses** is particularly important in assessing the contributions needed to provide benefits on future financial events.

- Having isolated the variable expenses, we are left with **fixed expenses**. The spreading of fixed expenses across contracts, largely depends on the **estimated value of the amount of new business** to be written.

- **Indirect fixed expenses are also known as overheads.**

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.

7 Types of Expenses

Direct vs indirect expenses

- **Direct expenses** relate to a particular class or classes of business.
- For instance, direct expenses relating to endowment assurance may include underwriting costs, commission, contract administration, claim settlement expenses etc.
- **Indirect costs** relate to the support functions such as:
    - Computing
    - Human resources
    - General management

Table of contents

8 Expense Allocation-Principles

Expenses form an important component of the total outgo analyzed 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. They need to be allocated between

- Classes of business
- Functions

The main idea behind this manner of expense allocation, is to **incorporate** them into **premium loadings**. Thus, each **policy contributes** an appropriate amount to the total level of expenses.

8 Expense Allocation-Principles

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, the underwriting department has to deal with several classes of business. Their costs or salaries can be allocated to each of these classes based on the time that was recorded as being spent underwriting each of them.

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.

8

Expense Allocation-Principles

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 – computer usage to a certain degree can be readily identified as belonging to a particular product line. For example, valuations run would be a renewal expense whereas quote calculations would be new business, and both can be readily allocated to the relevant class of business.

However, some expenses such as the company's internal email system cannot be easily identifiable as belonging to which department or product. In this case, they can either be allocated to departments in proportion to other known costs, or in proportion to staff numbers.

IT Staff – where tasks are readily identifiable as belonging to a particular class of business or function, salaries can be allocated based on the time spent on each task.

2. 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.

8 Expense Allocation-Principles

Allocating expenses by functions

- 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**.
- By function we mean an **activity or operation** such as an expense relating to the activity of underwriting or administering the contracts
- 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).

8 Expense Allocation-Principles

- 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.

8 Expense Allocation-Principles

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.

8 Expense Allocation-Principles

- **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 one such example, as the higher the sum assured, the more detailed and expensive the underwriting tends to be than for smaller sum assured amounts.

8 Expense Allocation-Principles

- **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.

8 Expense Allocation-Principles

- **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.

Hence expenses for life insurance business are allowed for through a **fixed expense loading per claim**, and for general insurance business they are expressed as a percentage of the claim amount.

8 Expense Allocation-Principles

Adjustments to expense loadings for pricing purposes

- Once **expense loading** are established for each policy based on previous data, they need to be **adjusted** to allow for the following

To reflect cross-subsidies

- For general insurance business, at times **same premiums** are charged for new and renewal business, even though renewal business are cheaper to administer and may have lower underwriting costs.

- This results in expense loading for renewal business being higher than the actual expenses of renewal and loading expense for new business being lower than the actual expense of writing new business. This leads to **renewals subsidising new business**.

- Also, in case of life insurance companies, when expense loadings are taken as a percentage of sum assureds instead of a fixed amount, **larger policies will be making a higher contribution** towards fixed costs,. Thus. the **cross subsidy** benefits smaller policies.

8 Expense Allocation-Principles

Inflation

In reality, the actual expense loadings need to account for any expense inflation. The idea of expense allocation is based on past data, whereas the expense loadings in the premium rates needs to reflect the level of expenses occurring while the business is in force.

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.

Topics covered

- Risk classification in life insurance
- Mortality convergence
- The need for different mortality tables
- How decrements can have a selective effect
- Causes of variation in mortality and morbidity
- Types of expenses
- Selection
- Expense allocation – Principles