



Assignment-1

① Steps in a modelling process:

i) Develop a well defined set of objectives, that need to be met by the modelling process. In the above scenario, "worst-case" scenarios are the primary motive to build stochastic models.

ii) Plan the modelling process, and how models are validated.

The plan must ascertain the capital requirement of the enterprise.

iii) Collect and analyse necessary data for the model.

All the historic financial statements, must be analysed, and "worst-case" scenario's impact must create a picture of how the company handles such circumstances.

iv) Define parameters of the model and consider appropriate parameter values. ~~the parameters of the model~~ The parameters of the model in such a case is usually proportion of assets & liabilities, time, duration etc.

v) Define the model by capturing real world essence.

The real world issues, like pandemics, risk averse, personal bias, need to be accommodated.



Subject: INTRODUCTION TO ACTUARIAL MODELS.

Chapter: Data Analysis

Continuation-question

vi) Decide whether a simulation package or general-purpose language is appropriate for implementation of the model. If necessary, choose a statistically reliable random number generator that will perform adequately in the context and complexity of the model.

This is like experimenting various values for the scenarios that may arise in front of the insurer.

vii) Write a computer program for the model.

viii) Debug the program to make sure it performs intended operations in model definition.

ix) Test the reasonableness of the output from the model.

x) Analyse the output of the model.

xi) Ensure that relevant guidance has been compiled with, for example, the Financial Reporting Council has issued a Technical Actuarial Standard on Principle for Technical Actuarial Work (TAS 100), which includes principles for models used in technical actuarial work.

xii) Communicate & document results of the model.



① Stochastic models.

- Stochastic models is one that recognises the random nature of the input components.
- To understand this better, deterministic model, (opposite of stochastic model) is the one that does not contain any random component.

During pandemic

During High premiums less claims

Normal scenario

Loss incurred: 20,000

Profits:

Profit: 30,000

↑
crore

↑
50,000
crore

↑
crore

Inputs:

- ① Number of insured
- ② Premium received
- ③ Other Benefits

The above is an example of stochastic modelling

- A singular case of the same is called deterministic modelling.
- The cause & impact may differ, but the range of outputs will remain the same.
- Based on risk appetite, one can decide, how much risk is he/she ready to bear.



③ Suitability of model.

In assessing the suitability of a model, for a particular model, it is important to consider the following:-

* Objectives of the modelling exercise

Implication: forecast future mortality

* Validity of the model for the purpose to which it is put.

Implication: choice of distribution, and how apt the assumptions are.

* Validity of the data used.

Implication: uncensored census data must be used to get results that are very close to reality

* validity of assumptions

example: one cannot ~~estimate~~ ^{estimate} the same rate of population growth assuming that the proportion of male & female are equal when the case is otherwise;

* The possible errors associated with the model or parameters used not being a perfect representation of the 'real' world situation being modelled

Implication: ~~Future health~~ ^{Future health} and ~~shall~~ ^{shall} play a major role in ~~population growth~~ ^{future mortality} of the country



Key Items for documentation of the model.

Parameters

- * The complexity of the model is determined by the complexity of the relationship between the various model parameters.
- * To build a model of a system or process, a set of mathematical or logical assumptions about how it works needs to be developed.
- * Future events affecting investments returns, inflation, new business, lapses, mortality, & expenses also affect these relationships.

Data

- * Data needs to be considered and judgements need to be made as to relevance of the observed data to the future environment.
- * Such data may result from past observations, current observations (such as rate of inflation) or from expectation of future changes.
- * Where observed data are considered suitable for producing the parameters for a chosen model, statistical methods can be used to fit the data.

Objectives

Before finalizing the choice of model, and parameter, it is important

⑤ Advantages of modelling

- system with long time frames such as the operation of a pension fund can be studied in compressed time.
- Different future policies or possible actions can be compared to see best suits the requirements or constraints of a user.
- In a model of a complex system we can usually get control over the experimental conditions so that we can reduce variance of the results output from the model without upsetting their mean values.

implication: extrapolated data understanding will be faster & quicker. Age specific data to total product consumptions can be understood with best ~~conditions~~ of modelling suited strategy

Limitations of modelling

- Model development requires a considerable investment of time and expertise.
 - As a rule, models are ~~used~~ more useful for comparing the set of results of input variations than for optimising output i.e. easier to predict outputs than what is required as inputs to a particular output.
- implication:

Heavy investment will be required to carry out modelling.



⑥ In a stochastic model, the output is a snapshot or an estimate.

In a stochastic model, for any given set of inputs, each run gives an estimate, only the model's outputs.

So to study the outputs for any given set of inputs, several independent runs of the model are needed.

Perhaps in the given situation, the new volunteer is unaware of the input given by the old actuarial student. Hence the estimates when run differ far more than usual.

Also, the model may require reruns to get a much clear picture.

⑦ The model used for building the new town is a ~~scenario & proxy model~~ deterministic model. ~~Most models depend on~~ input parameters, but it is a subset of stochastic modelling, i.e. it is only taking one set of parameters to estimate the future population.

However, appropriateness of such a model is a question.

(1) validity of assumptions:

what if the rural town progresses and chooses to have lesser or more than the estimated amount of kids.

(2) credibility of data.

In rural areas, the data often collected is incomplete, & countries like India suffer from identity issues



⑧ ~~The~~ The parameters the company must take into consideration when developing the model are:-

① logical assumptions

* Sick leaves are those not compensated in the holidays that employee is otherwise given

* Age of employee is directly proportional to the sickness of employee

* Employees have decent hygiene, and are not prone to extreme heat/cold since they work in large firm

② complexity of model

* genetic disorders.

* Diet insuitability

* Post work life of employee.

* Financial condition of employee.

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③ Future events

* Natural disaster / pandemic

* Insolvency