

Introduction To Actuarial Models - Assignment 1

1

Ans

The steps that would be undertaken in the development of the model are as follows

- (a) Develop a well defined set of objectives which in this case is to project the assets and liabilities of an insurer after one year with a view that sufficient capital is now held such that there is less than 0.5% chance of liabilities exceeding assets after one year
- (b) Plan the modelling process and how the model will be validated
- (c) Collection of data from appropriate sources. An appropriate internal source of data in this case would be the estimates made in the planning process of 'worst case' scenario
- (d) Cleaning, processing and formatting the data, thus making it appropriate to use
- (e) Determine the parameters and consider appropriate parameter values
- (f) Define the model initially by capturing an essence of the real world system. Refining i.e. the projection of assets and liabilities. Refining the level of detail can come at a later stage
- (g) Involve other experts to get a validity on the conceptual model
- (h) Decide on whether a simulation package or a general purpose programming language will be used for the implementation of the model. choose a statistically

reliable random number generator which will work in the context of the complexity of the model.

- (i) Write a programming code for the model.
- (j) Debug the program to check whether it is performing the intended operations as per model definition.
- (k) Test the reasonableness of the output from the model.
- (l) Perform sensitivity test. Consider even the 'worst case' scenarios or incorporate any other changes that are possible.
- (m) Analyze the output from the model. Check whether the output from the model give a less than 0.5% chance of liabilities exceeding the assets after one year.
- (n) Communicate and document the model and the results to the insurer.
- (o) Check whether all the professional guidances, data privacy, security and other laws have been complied with.

2

- Ans (a) There can be factors which could cause the reported probability to be inaccurate.
- (b) A model is an imitation of a real world system or process. No model can give output with 100% accuracy or optimization.
- (c) One of the factor that could cause this probability to be inaccurate is the ~~now~~ emergence of instances such as covid 19.
- (d) A limitation of any model is that there are certain factors which are unpredictable.

- (e) Another factor could involve the change in legislation
- (f) Also, it involves investments, which is somewhere highly volatile
- (g) Thus, as per all the assumptions and estimations of parameters incorporated in the model, the results are a good approximation to the real world data. However, there can be factors which will result this probability to be inaccurate.

3.

Ans. The stages to go through in identifying an appropriate model are as follows:

- (a) Understanding the assumptions that need to be made during the process. Since, it is important in choosing an appropriate model and verifying whether the chosen model is appropriate to use.
- (b) The model in which the noise or the random error is minimal with a constant variance.
- (c) The model that incorporates suitable and appropriate parameters as well as independent variables.
- (d) ~~The~~ Identifying the model whose results are a good approximation to the real world's mortality data.
- (e) Depending on the mathematical function, whether a linear or non-linear least squares regression method is used.
- (f) The extent of data available as well as the validity of the source of data. Since, models rely heavily on data. A good data input would give a good data output.

4

- Ans (a) Documentation of the model, its processes and results is a very important step in any modelling process.
- (b) The key items to be included in the documentation of the model are:
- (i) A full documentation of code as well as a brief explanation to the program
 - (ii) An audit trail consisting of the data variables, the processes as well as the steps taken and the changes made to the model at every stage
 - (iii) Any assumptions and limitations on the precision of the results of the model and the model itself
 - (iv) A good version control system
 - (v) The operating system details, programming language's version, the packages used, their versions, etc. needs to be documented as well
 - (vi) The ~~then~~ steps done by hand i.e. 'Painting and clicking'. This includes:
 - editing spreadsheets and figures
 - manually downloading data from a website
 - (vii) A brief description about the data collection process as well as the collected data itself.

5

- Ans c Advantages of modelling using the strategy mentioned:
- (a) The danger of spurious accuracy is prevented because the prediction is age specific and hence can be grouped.
- (b) Since, it is a comparatively a simpler process, it will

require less processing time.

(c) The strategy when implemented meets the goals and the objective of modelling.

• Disadvantages of modelling using this strategy.

(a) The variable of projected population is itself an estimation. Thus, an error or inaccuracy of that estimation would result in the model being inaccurate.

(b) The extrapolation is of a much larger period than even the known data set. Thus, this can lead to a higher deviation in the future.

(c) This strategy does not incorporate a number of other factors that can influence the demand for the product such as competition, the lifestyle, mortality, people tending to a healthier diet, etc.

6

Ans. The possible reasons leading to a difference in the results are as follows:

(a) Since, the revised run was assigned to a different student, there is a good chance that something was changed and not documented. Example of this might include that some other parameter value was changed or there was a 'printing and clicking' error.

(b) There would be something inaccurate between the relationship that is determined between the output variable and the input variable.

(c) The new student who was assigned the revised run, is not completely aware of the data and the collection process as well as the limitations of the

model

- (d) There might be an inaccuracy in the assumptions underlying the changed or the new parameter

7.

Ans. The appropriateness of the proposed modelling approach is as follows:

- (a) The proposed modelling approach is straightforward and easier to understand. The approach does not involve complex relationship between the variables of interest.
- (b) Here, the model assumes that the initial population of the new town will be the same as the rural area which may not be true.
- (c) Since, the population planning, mortality and fertility rates are the current data, the results from the model will hold true for a comparatively shorter time and might be less reliable in the longer run.
- (d) The birth and death estimates may not be as projected because of several factors such as literacy, family planning, etc.
- (e) A number of other factors have not been incorporated in the model such as the migration of people, the services already present in the rural area, people willing the children to study, etc.
- (f) Also, the data for mortality and fertility are the current national rates. They might not hold true for all the locations.
- (g) Other factors such as education policies, reach extent of reach with other towns or cities, etc. will also affect

the results of the model.

2

Ans Some of the factors that the company should take into consideration when developing the model are as follows:

- (a) The age group of employees falling sick
- (b) The location of residence
- (c) The duration of sickness
- (d) the morbidity rates
- (e) The past few years data associated with sick pay scheme
- (f) Reason for sickness
- (g) The compensation paid under the scheme as well as the inflows into the scheme.
- (h) The frequency of paying employees from the scheme.