

Assignment - 1

Q1] The steps required in development of this model are :

- Setting out our well-defined objective which is to project the asset and liability of the insurer after one year, so that sufficient capital is held. This is done due to regulatory changes.
- With the above objective in place, a modelling process will be designed to achieve the objective and a process of validation will be decided such as using previous years asset & liabilities to see accuracy of model.
- Collect and analyze necessary data for the model, such as using internal sources and the data used in calculation of 'worst case' scenarios.
- Determine the parameters such as investment returns, number of claims, ~~and~~ interest rates etc, all of which will be given suitable parameter values.
- Involve staff and designers of 'worst case' scenarios to check and provide data on the model and get feedback on the validity of model.

- Arrange the necessary software packages and languages required in running the model and then create the model
- Debug the program to see if the model behaves properly and provides sensible results
- Test the reasonableness of output, by comparing to previous year asset and liabilities or asking experts and staff through a ~~tuning~~ test
- Check the isolation and sensitivity between various inputs and how it affects the final output
- Analyse and document the output for a range of scenarios to make sure they ^{highlight} match the ^{scenarios with} 0.5% chance of liabilities exceeding asset
- Present findings to manager, with documentation and proper reasons for taking inputs and provide a number to management about the capital required to match regulations

Q2] Factors such as wrong input data, i.e. the wrong amounts of options and guarantees has been entered which would mean the entire output isn't accurate and useful. Other causes could be wrong parameters taken or wrong assumption taken regarding the relationship between parameters, i.e. the interest rate assumed or failure to understand relationship between claim and time of claim ~~when a year etc~~ actually paid etc. Other influence could be sudden ~~change~~ systematic change in market which hadn't been accounted for or change in management actions being different than what were discussed / assumed before. Being a stochastic model there could be error of taking insufficient scenarios simulations and basing the final probability of a small sample which could lead to significant error.

Q3] Steps • Set out the objective of the model which is forecasting future mortality. Refining the objective more by asking for purpose of project from the government

• ~~Identify the~~ Set out the modelling process to be followed, either could involve developing already existing mortality models or creating new model.

Also a proper validation method would be determined which would include experts from the government to perform tests etc.

- Data items would be needed to be collected, considering objectivity significant data would be found internally from government and other data places could include IIB.

- Parameters will be determined depending on complexity of model and whether more stochastic or deterministic approach is required.

- The program will be written after deciding and finalising appropriate statistical software.

- Debug the program to make sure it provides reasonable outputs and is performing as intended.

- Test the reasonableness of output by comparing either to past data enough growth or other countries in same stage as the one who has been modelled etc.

- Analyze the output and provide justified report to government of the country.

Q4] List down:

- The validation process of data collected and model
- Any assumptions made in the model and its effect on the model
- Analysis of the output of the model
- Limitation and problems with the model
- How the model parameters are related and their effects on output
- Range of scenarios or a proxy model
- What approach has been taken (stochastic / deterministic)
- Data and other items required for reproducibility of the process

Q5] Advantages:

- The model complexity is quite low and straightforward way to get average consumption figures.
- The supplier already has the existing data he needs to model this
- The model is relevant to supplier as it is divided as per age to give more accurate figures of demand.
- Communicating and explaining result is quite easy.

Disadvantage:

- The input data can be faulty, which could result in significant costs if over estimated or missed opportunity if under.
- The model ignores relationship between parameters and is working with very minimal parameters, hence not showing an accurate real life ~~area~~ limitation.
- Pricing of chocolates is key parameter being ignored.
- Model doesn't account for major economic or systematic changes, which could overall affect chocolate business due to it being luxury product.
- Model is predicting next 20 years consumption rate which means the accuracy of result will drop as years pass.
- Model is also ignoring competitors and their actions.

Q6] The separate results could be due to not following or maintaining steps of reproducibility by the original student. The error could be associated to the new students not knowing all the assumption made while making the model due to lack of documentation. It could also be due to different versions of software used.

or not the same set and being used, hence the randomness caused the major change in output. It could also be associated to wrong method by either of students in consideration.

Q7] The model seems appropriate as it takes into account population trends and distribution of the entire population to apply on the sample.

The model seems to be an over-simplified version and would be appropriate only as a rough estimate for deciding the number of schools, which could be problematic for existing government if under estimated. The model assumes a similar trend and distribution of population, ^{age} currently to estimate the new population distribution which ignores the effect of migration of people completely in the new city when it develops. Removing migration parameter could make the initial distribution as the mean age would be pushed upwards and this would adversely affect the further distribution layers added and for prediction.

Also national fertility and mortality rates could also be as a very strong assumption considering national estimates include range of different cities that

won't be representative of the new town. Rather past data on fertility and mortality of previously developed town could prove more appropriate in the above ~~scen~~ scenario.

Other aspects like type of town, is it industrial, port etc can affect age distribution significantly.

Hence the above model would not prove appropriate for accuracy but could only provide rough estimate which could later be used to validate the outcome of a proper model.

Q8] Factors that company should look into are:

- 1] The company should look into internal records to identify amount of sick leaves taken.
- 2] Company could divide the employees by age-bands, gender to determine the ~~most~~ distribution or get a sample.
- 3] Company could also divide employee as per pay or position to understand cost to company of sick leaves.
- 4] Other factors like months with highest leaves can be identified and it could be checked whether many leaves are taken all together or not.
- 5] Factors like health insurance if provided

by company could also be included.

5] An average age of the workforce and its growth rate could be identified.

6] Changes in workforce composition and increase or decrease could be factored into the modelling process.