

Introduction To Actuarial Models

Assignment -1

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1. As the company already has a “worst case” scenario model it is assumed that the “worst case” scenario is the assets exceeding the liabilities by a large margin.

The following are the steps in the development of the model

Step 1: I would define the objectives which need to be fulfilled by the modelling process. My objective is to ensure that there is 0.5% probability that the liabilities exceeds assets in one year while complying with the regulatory capital requirements.

Step 2: Collecting the necessary data for the model from valid sources. For this model I will look at the internal data of the company to get information about the current assets and liabilities. I will also study the “worst case” scenario model to understand what all factors affected the scenario based model and try to use the same parameters for my model.

Step 3: Determining the parameters for the model. The parameters that would affect the model for the insurer are changes in the interest rate, the rate of inflation, liquidity of assets, depreciation, the total revenue of the company from the past few years, the amount of debt the company has taken, the cost of debt of the company. The effect on the company due to un foreseen events like the COVID-19 pandemic (since the number of claims would increase drastically).

Step 4: Valid assumptions about the model need to be made. Including assumptions about the discount rate and inflation rate. The inflation

rate will be assumed to be around 6%-7% in accordance with the current inflation rate.

Step 5: The model will have to incorporate the essence of the real world scenario this will be the current value of the assets and liabilities and the changes in inflation rate and the discount rate.

Step 6: Professionals from the company like the CA and CFO will review the model and give their feedback on whether this model is suitable and appropriate.

Step 7: Random number will not be used since all the numbers are already known. The model will be made as straightforward as possible.

Step 8: I would input this data into a spreadsheet using Excel analyse it and perform the necessary calculations.

Step 9: Several tests and trials will be performed to ensure that the model is fulfilling its objectives.

Step 10: Cleaning the data where I would look for missing or repeated values to make sure there aren't any errors.

Step 11: I would test the reasonableness of the output by comparing this model with the worst case scenario model.

Step 12: I would analyse the output and test make sure that the regulatory requirement has been complied with. And also to make sure that the objective is fulfilled by the output that is there is a 99.5% chance that the liabilities will not exceed the assets.

Step 13: All the steps taken while developing this model will be documented. All the parameters defined will be written down along with their values.

2. In a stochastic model the output is random because of the random nature of the input components. The output is an estimate of the

characteristics of the model for a given set of inputs. The inputs used and the parameters taken into consideration could be inaccurate. Since a stochastic model that projects characteristics of the model for a given set of inputs has been used to estimate the probability the number of policies issued, premiums collected and claims received has not been considered. Even the different type of policies sold by the insurance company hasn't been specified. This could be one of the factors which would cause the probability to be inaccurate.

The company's internal data about the current assets hasn't been analysed. And a model to project the company's cashflows hasn't been developed either. Only the options and guarantee costs have been looked upon and used to estimate the probability. These are the factors due to which the probability could be inaccurate.

3. While identifying which model would be appropriate I would go through the following steps:

Step 1: Defining the objective of a modelling. The objective of my model is to forecast the future mortality rate of small country.

Step 2: Check the validity of the data used. I will collect data about the number of deaths in the recent year, look at the data from the last census so that it will help me understanding the mortality rate from the past few years.

Step 3: Check the validity of the assumptions. While collecting the data it is given that I would assume that the living conditions of the people in the country would not go under major changes. Hence, the fertility and the mortality rates will remain similar in the next few years as well.

Step 4: Set the parameters like the number of people health conditions of people living in that area and other external factors.

Step 5: The model will be based on real world scenario and help from experts will be taken for reviewing the model.

Step 6: Check for the possible errors associated with the model or parameters used not being a perfect representation of the real-world situation being modelled. There is a possibility of unforeseen future events like the COVID-19 pandemic which could bring some drastic changes to the mortality rate of the country.

4.The following are the items to be listed in the documentation:

- i) The objectives of the model.
- ii) The assumptions made during the modelling process.
- iii) The input data.
- iv) List the sources from which the data was collected.
- v) List the factors / parameters affecting the model.
- vi) Explain on what basis was the model chosen.
- vii) The expert with whom the results were communicated.
- viii) Explain how this model would work in the real world system and how valid it would be.
- ix) Explain the validity of the inputs and the outputs of the model.

5. Advantages: Since the data is mostly internal it is probably correct and there are fewer chances of an error occurring. Also due to the fact that internal data is used model will be cheaper and resources can be saved. This model would probably be very simple and hence it would be easy to communicate.

Disadvantages: The consumption parameter chosen is sensitive to the pricing of the product and many other factors can affect this

parameter. Other scenarios are not taken into consideration while forming the strategy. For example there might be a new company in the market that might be a competitor of the manufacturer. Other factors like the price, advertisements, demand, supply, expenses of raw materials etc., aren't taken into consideration.

6. A stochastic model has a random set of input components. The output is only a snapshot or an estimate of the characteristics of the model for a given set of inputs. Several independent runs are required for each set of inputs so that statistical theory can be used to help in the study of the implications of the set of inputs. Due to this when the other student who produced the revised run may have taken a different set of inputs than the student who produced the original model run. This can be one of the reasons why the results from the models were significantly different. Such a stochastic model cannot be used to compare the results of the two models. In order to obtain similar results they should use the same set of inputs with changes made in only one parameter as requested by the actuary. Additionally, the original student might have made a mistake in the documentation process due to which the model developed by the second student might have errors in it. The actuary did not anticipate a significant change in the revised results but there is a possibility that in the real world scenario the parameter is sensitive and a slight change in it caused a drastic change in the results in the revised model run.

7. The data used to construct the model is appropriate. The model will be simple and easy to interpret. The planned population of the new town might have an error and hence that data could be wrong. The national fertility and mortality rates of the nation may not be applicable to the new town. Some extreme case scenarios like the

pandemic aren't taken into account. These scenarios are necessary because it could greatly affect the mortality rates of the country.

8. The following are the factors to be taken into consideration:

- i) Number of people that took a sick leave in the past few years.
- ii) The number of people amongst them that needed to be hospitalized.
- iii) The data should also include the hospital expenses of all the employees to get the gist of the minimum capital which will be required for the sick pay scheme.
- iv) The data for the ages of all the employees should be collected to understand the different age groups the employees belong in.
- v) Information about which and how many employees have health insurance policies already in force.
- vi) Health and working conditions of the employees
- vii) The cashflows of the company to understand how much money the company is capable of investing in this scheme.