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Actuarial Models

Assignment - 1

- 1) A model is an imitation of a real world system or process. Actuaries build and use models move back and forth between these keysteps continuously to improve the model. Key steps in development of model are :-
 - i) Developing a well-defined set of objectives which is to check a change in Regulatory capital requirement. This will be met by modelling process.
 - ii) Planning the modelling process which could be use of stochastic models but the company doesn't have any existing stochastic models so to have a validated model estimates have been made using worst case scenario model.
 - iii) The ~~necessary~~ data collected is new so necessary data would be analyzed properly for the model.
 - iv) The parameters for the model is defined. Along with it, a new parameter would be added which is to have a sufficient capital where there is less than 0.5% chance of liabilities exceeding Assets after one year. Appropriate parameter values are taken into consideration while modelling.
 - v) The model is Prepared and defined in such a way that it includes essence of Real world system. Some Refinements are made to make an accurate model and achieving the objectives.
 - vi) The change in regulatory capital Requirement is necessary and an important step so the Experts are involved and to get their ideas and feedbacks which helps to model real world system along with it making a valid conceptual model.



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- 2) vii) The ~~cont~~ company does not have an existing stochastic model so it is decided to use a simulation package to make estimates using worst case scenarios model which will be ~~an~~ appropriate for implementation of model.
- viii) The computer program for the model is written.
- ix) The program made is debug to make sure that sufficient capital is ^{kept and} less than 0.5% chances are there where liabilities will exceed assets after one year. This will help to make sure all intended operations are performed.
- x) The reasonableness of output is tested from the model
- xi) The model is reviewed thoroughly to get appropriate model which can show accurate values to change in input parameters which could ^{be} ~~possibility~~ of changes in Regulatory capital Requirement.
- xii) The output from the model is properly analysed
- xiii) The Relevant professional guidance is taken to ensure the standards are met and objective is met.
- xiv) The results from the model is documented well enough so anyone who picks from it can understand the work and can project assets and liabilities after every year if needed. Not only this, results are communicated effectively and explained precisely about keeping sufficient capital.

- 2) An insurance company providing policyholders options and investment related guarantees is a great service.

A stochastic model is one that recognizes the random nature of input components and multiple variables are looked upon. This helps to make model as accurate as possible to real world situation. However, there are some factors which could cause this probability to be inaccurate are:-

- i) Number of policies depends and so the service provided to them. If less policies are sold then there can be possibility of less investment amount.

- ii) Premium received can depend on number of policies sold and there is ~~few~~^{less} but probable enough chance of less policy sold.

- iii) The people hired wouldn't be able enough to manage the funds of ~~in~~ Policy holders investment amount and so Risk may be high. However, if they are able to manage funds ~~also~~ effectively then the Risk can be low.

- iv) The company using stochastic model to set a pricing model. They would have made proper and realistic model but due to some reason it might be not effective in its pricing which could lead to low funds in the account or not managed well enough.

- v) The model can be accurate but some things cannot be avoided or known. This Reasons could lead to rise in number of claims and this leads to liabilities exceeding Assets. ~~in this~~

These can be cases due to which probability can be inaccurate.



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3) The model for forecasting future mortality is prepared. The stages to go through in identifying an appropriate and effective model are :-

i) A well defined set of objective which is projecting future mortality is to be met by the model.

ii) The model is well planned and ways are found to validate model

iii) The data necessary ^{for making} ~~is~~ ~~can be~~ model can be collected and analyzed by life insurance company, Government and also from other sources to get valid data.

iv) The Parameters are ^{defined} ~~left~~ and in align with objective. The Parameters to check and get appropriate values mortality rate, health and living standards, any specific disease or eating habits ^{can} ~~can~~ be looked upon with other parameters also.

v) The model will be defined and Refined with capturing essence of real world system.

vi) The Experts in this field like health experts, doctors, etc will be involved, advices taken into consideration and feedbacks will help to validate the conceptual model.

vii) The simulation Package will be decided and after finding a suitable one, it will be implemented in making the model.

3) viii) The computer program of the model will be written.

ix) The program will be debugged several times to make sure the intended operation which is to prepare future mortality model is performing properly.

x) The Reasonableness of the output from the model is tested.

xi) The changes will be made to input parameters regularly. This will be Reviewed and carefully considered to check the model.

xii) The output of the model will be Analysed.

xiii) Relevant Professional guidance is taken and ensured that it is properly compiled with.

~~This is key steps of modelling~~

xiv) The results will be properly documented and communicated & effectively through the model.

These are key steps of modelling the forecasting of future mortality.

- 4) The documentation ^{of} the model is important and very useful to others who are not involved in this production. Key items included in documentation on the model are :-
- i) ~~For~~ All the Parameters used
 - ii) Assumptions used are listed ~~and~~ ^{with} their justification
 - iii) Sources of data are mentioned
 - iv) Type of model used like stochastic or deterministic model in which & the models prepared are Scenario based or proxy models.
 - v) The Limitations of the model known will be mentioned and ~~probs~~ stating how accurate it is.
 - vi) The objectives of the model will be stated
 - vii) The help, advice, feedbacks and name of Experts used in ~~the~~ preparing model are listed.
- 5) The manufacturer has data on age-specific ~~con~~ consumption rates for past ten years. The data collected is for greater number of years with an age-specific consumption which is a lot useful for a confectionary manufacturer. This has its own advantages and works in their benefit. The model has one parameter to focus on which makes it less complex and simple to use and interpret data. The model takes into account one variation of data which is age-specific threshold which helps the confectionery manufacturer implement it in model and tweak the model to get appropriate value. The model has one parameter which helps to get faster results and can be used or adapt to take into account

- 5) future aspects easily. The past data is of 10 years which helps to get a reliable data along with its of their own so no third party involvement is there. Not only this, the data can help to find and forecast future demand accurately. However, there are some disadvantages also. Past trends in consumption patterns can differ as advancements in time, so this may not be an proper or accurate estimate, of future.
- The consumption might differ due to eating habits of people, state of the economy and Age factor also. The changes in taste preferences could occur. The model would not take into inflation which could lead to loss in customers due to changes in price. A rapid rise in consumption can be unlikely to survive for long time and later on, competition could affect their sales and their future forecast can go wrong. The future forecast not only depends on age-specific but also on other factors like birth rate, mortality rate, etc. These reasons would need to be considered.
- The Advantages and Disadvantages of the strategy is clearly described and weighed upon.

6) The parameter change should not have a significant change however results of both model are different. There could be some reasons for ~~this~~ the difference in results. The model left in between by a student wouldn't have properly documented or effectively communicated because of which results might be different. Not only this, both actuarial student might have made mistakes or could be incorrect so results may vary. Although, the first student wouldn't have done it properly in first place and so the other one might not be aware of it and could have assumed it to be correct leading to differ in results. The runs wouldn't be done as expected. Second student might have made some changes according to him might be appropriate leading to different results. Lastly, the model wouldn't be sensitive enough to changes in parameters and some problems might not be identified leading to results being different.

- 7) The model is developed which is used in planning a new town. The proposed modelling approach can be on appropriate way or not. The model is simple and not complex enough which helps to understand it quickly and can be implemented faster. The data of age distribution of population in area should be from reliable sources and should be accurate enough to get better results. There can be some unforeseen event like spread of ~~specific~~ disease or changes in birth rate and mortality rate or natural disasters which could possibly change the age distribution. The Estimates of births and deaths could go wrong. The model is properly planned and easily interpreted which helps to communicate the results effectively. Looking only on current age distribution wouldn't help to making a model. The trends of national fertility and mortality rates compared to the data of the rural area needs to be assessed and compared to find out accurate results and take a proper decision. The Parameter is fixed to age distribution which helps to get better insights and is an useful data to know how many schools are required which helps to have a great Planning and allocating effectively could help ~~students~~ childrens to go in schools and Planning of town can be enhanced.

8) Constructing a model of sickness rates is a good way for company to evaluate the present and future health of its sick pay scheme. There are some factors which the company looks upon and takes into consideration when developing the model are :-

- i) A well defined objective is set which is developing a sickness rates model for the company's employees.
- ii) The modelling process is planned properly which could be inclusion of previous sickness data and find ways to make a valid model.
- iii) the data collected should be from reliable source and analysed properly. ^{data} ~~set~~ could be found from company's internal records and previous attempts data along with ~~set~~ external sources.
- iv) The parameters for sickness model needs to be defined which can be number of sick leaves, claims incurred, health and living standards and general trend in sickness nationally, etc.
- v) The model will be prepared in par with competitive parameters to have essence of real world system for accurate result.
- vi) The Experts in the field will be contacted and their advices as well as feedbacks will be constructively implemented. Experts could be doctors, healthcare staff, etc. This will help to get valid sickness model.
- vii) The simulation package will be decided with the Resources available and ^{on} capability of staff able to handle it.
- viii) The data will be reviewed, analysed, debug and relevant professional guidance is taken to ensure appropriateness of model.
- ix) The data will be documented and effectively communicated to make ~~it~~ ^{it} useful and helpful.