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Sensitivity Analysis and Decision making using Excel tool

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Abstract: Decision making plays an important role for everybody at every moment. Every activity of life needs decision. Decision making is used for taking better action which needs to do analysis of information. Sensitivity analysis is helpful for doing analysis of information, which will help us for making correct decision. This paper reveals use of excel for making correct decision using sensitivity/what-if analysis. In this paper research has discussed two examples one is for deciding EMI for loan and second for deciding total monthly expenses and probable saving amount for individual. Similarly Excel can be used for data analysis in diverse areas.

Keywords: Decision making, Sensitivity Analysis, DSS, Simulation.

I. INTRODUCTION

“Right Decision at Right Time leads to Success”. For successful execution of any business one need to take right decision, one wrong decision may incur great lose failure. Many of the time sensitivity analysis and what-if analysis are used for same meaning. MS Excel has facility to do data analysis through its ‘what-if’ tool. This tool helps for making optimal decision based on present/current information. Thus one can observe sensitivity of change in input for its effect on output and deciding the best alternative among possible alternative.

II. DECISION MAKING

Decision making is the process of reducing any hesitation or uncertainty about the available options in order to attain a practical and sensible choice. Part of making decisions is gathering information before making the best choice.

Decision making is a cognitive process that results in the selection of course of action among several alternatives. It is day today activity for everybody. Decision making is an integral part of operations management. In business executives has to make decision to increase profit. Decision making plays an important role in business organization. So for making decisions there are different tools, techniques are available which can be used for getting optimal solution.

Decision making is usually defined as a mental process, which involves judging multiple options or alternatives, in order to select one, so as to best fulfil the goal of the decision maker [2,3,4]. There are two main components involved in decision making viz; the set of alternatives, judged by the decision maker, and the goal to be satisfied with the choice of appropriate alternative.

III. USE OF COMPUTER IN DECISION MAKING

Computer systems aid in formatting and manipulating data. Several tools with different capabilities can be interfaced to provide users with a single easily used language to present data in a way that will best support the end-user to compare, weigh and evaluate data. Computer helps to track data analysis for fast decision making, it increases accuracy, reliability and

timeliness required to solve problems. Computer automate the decision making process. Computer reveals new approaches to think about the problem space and it generates new evidence in support of a decision.

IV. TECHNOLOGY USEFUL FOR DECISION MAKING

A. Sensitivity analysis

One of the tools useful for the analysis in some decision making problems is sensitivity analysis. Most of the time Sensitivity and "What If?" analysis interchangeable. Sensitivity analysis is a process of varying input parameters of a model within allowed area and observing the resulting changes in the model solution. It explore how to achieve a outcome by respective changes in the sources

Sensitivity Analysis deals with finding out the amount by which we can change the input data for the output of our linear programming model to remain comparatively unchanged. This helps us in determining the sensitivity of the data we supply for the problem. If a small change in the input produces a large change in the optimal solution for some model, and a corresponding small change in the input for some other model doesn't affect its optimal solution as much, we can conclude that the second problem is more robust than the first. The second model is less sensitive to the changes in the input data. [5]

The current form of the spreadsheets is a consequence of a combination of factors: academic research, pedagogical design, and in-class experiences. Harvard Business School dropout who recognized that a computer-based tool to facilitate business analysis would have made his life a little simpler at the HBS, and might even help managers when they got out into the real world. [6]

"What-if analysis" as a "process of changing the values in cells to see how those changes affect the outcome of formulae on the worksheet.

Sensitive Analysis is a quantitative model and is part of the decision support system (DSS) which models information to support managers and business professionals during the decision-making process. There are four tools in Excel that are categorized as What-If or sensitivity analysis tools. They are Data Tables, Goal Seek, Scenarios, and Solver. [7]

B. Simulation

Simulation is a decision analysis and support tool. Simulation software allows you to evaluate, compare and optimize alternative designs, plans and policies. As such, it provides a tool for explaining and defending decisions to various stakeholders.

Simulation offers the benefit of constructing and analysing multiple "what if" scenarios without disrupting patient care or incurring significant cost. [1]

The term simulation is used in different ways by different people. Here simulation is defined as the process of creating a model of an existing or proposed system (e.g., a project, a business, a mine, a watershed, a forest, the organs in your body) in order to identify and understand those factors which control the system and/or to predict (forecast) the future behaviour of the system. Almost any system which can be quantitatively described using equations and/or rules can be simulated. [8]

Monte Carlo simulation in Excel can also be used to assist in "What If?" or sensitivity analysis. Spreadsheet models with probability distributions for inputs can simulate outcomes for a range of input parameters.

C. Sensitivity analysis using Excel

We can do sensitivity analysis using excel with data tables, goal seek, scenarios and solver. The same is applied here for equal monthly instalment (EMI) calculation for loan repayment using single variable and two variables. We can see how these EMI varies as interest rate changes. Table1 shows figures of loan amount, interest rate, loan period and EMI. EMI is calculated using PMT function.

The result of single variable (Interest rate) and two variables (Interest rate and loan amount) analysis is shown in table2 and 3 respectively. From these tables it is observed that EMI for interest rate 10.1 is same as original figures.

D. Data Tables

A data table is a range of cells that shows how changing one or two variables in your formulae will affect the results of them. Data tables provide a shortcut for calculating multiple results in one operation and a way to view and compare the results of all the different variations together on your worksheet.

Table I Single Variable Data Table with Single Values

Single Variable Sensitivity Analysis	
Loan Amount	Rs. 40,00,000.00
Interest Rate	10.10%
Loan Period(Months)	240
Equal Monthly Instalments (EMI)	Rs. 38,866.26

Table. II Single Variable data table with different Interest rates

Interest Rate	EMI
	Rs. 38,866.26
9.50%	Rs. 37,285.25
9.60%	Rs. 37,546.84
9.70%	Rs. 37,809.20
9.80%	Rs. 38,072.33
9.90%	Rs. 38,336.22
10.00%	Rs. 38,600.87
10.10%	Rs. 38,866.26
10.20%	Rs. 39,132.39
10.30%	Rs. 39,399.26
10.40%	Rs. 39,666.87
10.50%	Rs. 39,935.20

Table. III Two Variable Data table

Interest Rate	EMI						
	Rs. 20,00,000	Rs. 25,00,000	Rs. 30,00,000	Rs. 35,00,000	Rs. 40,00,000	Rs. 45,00,000	Rs. 50,00,000
Rs. 38,866.26	Rs. 18,642.62	Rs. 23,303.28	Rs. 27,963.94	Rs. 32,624.59	Rs. 37,285.25	Rs. 41,945.90	Rs. 46,606.56
9.50%	Rs. 18,773.42	Rs. 23,466.78	Rs. 28,160.13	Rs. 32,853.49	Rs. 37,546.84	Rs. 42,240.20	Rs. 46,933.55
9.60%	Rs. 18,904.60	Rs. 23,630.75	Rs. 28,356.90	Rs. 33,083.05	Rs. 37,809.20	Rs. 42,535.36	Rs. 47,261.51
9.70%	Rs. 19,036.17	Rs. 23,795.21	Rs. 28,554.25	Rs. 33,313.29	Rs. 38,072.33	Rs. 42,831.38	Rs. 47,590.42
9.80%	Rs. 19,168.11	Rs. 23,960.14	Rs. 28,752.17	Rs. 33,544.19	Rs. 38,336.22	Rs. 43,128.25	Rs. 47,920.28
9.90%	Rs. 19,300.43	Rs. 24,125.54	Rs. 28,950.65	Rs. 33,775.76	Rs. 38,600.87	Rs. 43,425.97	Rs. 48,251.08
10.00%	Rs. 19,433.13	Rs. 24,291.41	Rs. 29,149.69	Rs. 34,007.98	Rs. 38,866.26	Rs. 43,724.54	Rs. 48,582.82
10.10%	Rs. 19,566.20	Rs. 24,457.74	Rs. 29,349.29	Rs. 34,240.84	Rs. 39,132.39	Rs. 44,023.94	Rs. 48,915.49

10.30%	Rs. 19,699.63	Rs. 24,624.54	Rs. 29,549.45	Rs. 34,474.36	Rs. 39,399.26	Rs. 44,324.17	Rs. 49,249.08
10.40%	Rs. 19,833.43	Rs. 24,791.79	Rs. 29,750.15	Rs. 34,708.51	Rs. 39,666.87	Rs. 44,625.22	Rs. 49,583.58
10.50%	Rs. 19,967.60	Rs. 24,959.50	Rs. 29,951.40	Rs. 34,943.30	Rs. 39,935.20	Rs. 44,927.09	Rs. 49,918.99

E. Goal Seek

Goal seeking is the ability to calculate backward to obtain an input that would result in a given output. This can also be called what-if analysis or back-solving. The Goal Seek tool is helpful when you know the desired result from a model and want to find the appropriate input or decision variable levels.

Here the goal is to keep equal monthly instalment to Rs. 35000.00. To achieve this goal there are three possibilities viz; one can borrow less amount, by reducing interest rate and by extending the loan period. These results are shown in Table 4, Table 5 and Table 6 respectively.

Table 4. Data table for less loan amount

Borrow Less Amount	
Loan Amount	Rs. 36,02,096.27
Interest Rate	10.10%
Loan Period(Months)	240
Equal Monthly Instalments (EMI)	Rs. 35,000.00

Table 5. Data table for less interest rate

Lower Interest Rate	
Loan Amount	Rs.40,00,000.00
Interest Rate	8.61%
Loan Period(Months)	240
Equal Monthly Instalments (EMI)	Rs. 35,000.00

Table 6. Data table of extended loan period

Extend Loan Period	
Loan Amount	Rs. 40,00,000.00
Interest Rate	10.10%
Loan Period(Months)	390
Equal Monthly Instalments (EMI)	Rs. 35,000.00

F. Scenario Manager:

The use of Scenario Manager in MS-Excel allows you to have a certain set of inputs and outputs for a "scenario", and then lets you view different scenarios of the outputs as the input changes. We can use scenarios to forecast the outcome of a worksheet model. We can create and save different groups of values on a worksheet and then switch to any of these new scenarios to view different results."

A scenario is a set of values that Excel saves and can substitute automatically in cells on a worksheet. You can create and save different groups of values on a worksheet and then switch to any of these new scenarios to view different results.

Here scenario is created to observe changes in monthly saving after getting promotion and joining new company. This scenario is shown below in the Table 7.

Table7. Scenario Summary result

Scenario Summary	Current Values:	Promotion	Original	New Company
Changing Cells:				
Monthly Income	Rs. 28,000.00	Rs. 25,000.00	Rs. 20,000.00	Rs. 28,000.00
Rent	Rs. 1,000.00	Rs. 1,000.00	Rs. 1,000.00	Rs. 1,000.00
Travel	Rs. 1,200.00	Rs. 1,000.00	Rs. 1,000.00	Rs. 1,200.00
Food	Rs. 5,000.00	Rs. 5,000.00	Rs. 5,000.00	Rs. 5,000.00
Shopping	Rs. 5,000.00	Rs. 5,000.00	Rs. 5,000.00	Rs. 5,000.00
Going Out	Rs. 1,200.00	Rs. 1,200.00	Rs. 1,000.00	Rs. 1,200.00
Electricity	Rs. 1,000.00	Rs. 1,000.00	Rs. 1,000.00	Rs. 1,000.00
Phone	Rs. 500.00	Rs. 500.00	Rs. 500.00	Rs. 500.00
Gas	Rs. 1,000.00	Rs. 1,000.00	Rs. 1,000.00	Rs. 1,000.00

Water	Rs. 500.00	Rs. 500.00	Rs. 500.00	Rs. 500.00
EMI	Rs. 1,700.00	Rs. 1,700.00	Rs. 1,700.00	Rs. 1,700.00
Other	Rs. 1,000.00	Rs. 1,000.00	Rs. 500.00	Rs. 1,000.00
Result Cells:				
\$B\$17	Rs. 8,900.00	Rs. 6,100.00	Rs. 1,800.00	Rs. 8,900.00

V. CONCLUSION

In the above section MS Excel What-if analysis tool is applied for EMI calculation for desired loan amount for desired period as well as planning for monthly expenses for individual. It is observed that excel is very useful tool for doing sensitivity analysis which will help for better decision making for grate future. Hence one can take decision about fixing their EMI and observe the effect of output parameter after changing some input data/parameters using scenario manager. Excel is useful not only for data processing at many purposed in day today life but for critical decision making also.

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