

## Chapter 8 Risk Analysis

- Scenario Analysis
- Break-Even Analysis
- Monte Carlo Simulation

## Scenario Analysis

- A variation on sensitivity analysis is scenario analysis.
- For example, the following three scenarios could apply to Credit Policy:
  1. Base Case: sales, defaults, and interest rates would be as projected.
  2. Best Case: sales increase by 20%, defaults decrease by 2%, and interest rates decrease.
  3. Worst Case: sales decrease by 20%, defaults increase by 2%, and interest rates increase.
- Analyze the resulting changes to NPV under each scenario.

## Scenario Analysis

- Scenario Analysis, use Scenario Manager to compute NPV for Worst Case, Best Case, & Base Case as you change these variables.
- Compute expected NPV for each of the 3 Options from the 3 projected scenario values.

## Scenario Analysis

- Scenario Manager allows you to analyze the effects of different input assumptions.
- For example, call up Tools, Scenario, and specify the best case, worst case, and expected case.
- Specify the formulas to use in the scenario.
- Finally, request a summary to calculate the values.

Scenario Summary				
	Current Values			
		base case	Worst Case	Best Case
<b>Changing Cells:</b>				
Sales Current	\$ 120,000,000	\$ 120,000,000	\$ 100,000,000	\$ 140,000,000
Sales Option 1	\$ 135,000,000	\$ 135,000,000	\$ 115,000,000	\$ 155,000,000
Interest Rate	2.40%	2.40%	4.40%	0.40%
Sales Option 2	\$ 150,000,000	\$ 150,000,000	\$ 130,000,000	\$ 170,000,000
Default Option 1	3.50%	3.50%	5.50%	1.50%
Default Option 2	8.00%	8.00%	10.00%	6.00%
<b>Result Cells:</b>				
Current NPV	\$ 176,876.71	\$ 176,876.71	\$ 147,397.26	\$ 206,356.16
Option 1 NPV	\$ 183,228.18	\$ 183,228.18	\$ 149,275.64	\$ 219,596.91
Option 2 NPV	\$ 187,719.41	\$ 187,719.41	\$ 155,250.67	\$ 222,507.16

## Break-Even Analysis

- Common tool for analyzing the relationship between sales volume and profitability
- There are three common break-even measures
  - Accounting break-even: sales volume at which net income = 0
  - Cash break-even: sales volume at which operating cash flow = 0
  - Financial break-even: sales volume at which net present value = 0
  - Break-even between two options: sales volume at which NPV is equal between two options.
- We can use Goal Seek to perform break-even.

## • Goal Seek:

- Goal seek is a simple version of Solver, a linear program. This is a "what-if" tool that allows you to see what value a particular value needs to be to end up with a specific result in another variable.
- For example, what level of sales do you have to achieve to make net income exactly zero?
- Go to Tools, Goal Seek and then fill in the simple dialogue box
- Set cell: (this is the cell that you want to be a certain value)
- To value: (this is the value that you want the set cell to end up)
- By changing cell: (this is the cell that Goal Seek will change that will make the Set cell end up with the correct Set value, linked by formulas)

## Monte Carlo Simulation

- Monte Carlo simulation is a further attempt to model real-world uncertainty.
- This approach takes its name from the famous European casino, because it analyzes projects the way one might evaluate gambling strategies.

## Monte Carlo Simulation

- Imagine a serious blackjack player who wants to know if she should take the third card whenever her first two cards total sixteen.
  - She could play thousands of hands for real money to find out.
  - This could be hazardous to her wealth.
  - Or, she could play thousands of practice hands.
- Monte Carlo simulation of capital budgeting projects uses this same logic.

## Monte Carlo Simulation

- Monte Carlo simulation in finance projects is often viewed as a step beyond either sensitivity analysis or scenario analysis.
- Interactions between the variables are explicitly specified in Monte Carlo simulation; so, at least theoretically, this methodology provides a more complete analysis.
- While the pharmaceutical industry has pioneered applications of this methodology, its use in other industries is far from widespread.

## Monte Carlo Simulation

- Simulation that generates thousands of scenarios, changing the specified variables, and computes the output (NPV) based on the specified probability distribution
- Use ExcelSim on the website
- In our example, vary Sales, Default Rate, and Interest Rate, specify the Probability Distribution for each and the mean and standard deviation.
- This will generate 500 values of NPV, along with the standard statistics (mean, std dev, min, max, etc.)
- Then compute the NormsDist to find the probability that  $NPV \leq 0$  and compare to the Scenario Analysis
- Use Tools, Data Analysis to generate a Histogram on this data (how close does this look to the normal distribution?)

## NormsDist

- Returns the standard normal cumulative distribution function. The distribution has a mean of 0 (zero) and a standard deviation of one. Use this function in place of a table of standard normal curve areas.
  - NORMSDIST(z)
  - Z is the value for which you want the distribution.
- Example:
- =NORMSDIST(1.333333)
  - Normal cumulative distribution function at 1.333333 (0.908789)

## Monte Carlo Simulation

- Compute the probability that NPV is less than zero by calculating z and looking up in the table

$$z = \frac{0 - E(NPV)}{\sigma_{NPV}}$$

- Use NormsDist(z) to compute the probability