

Chapter 9: Project Analysis

“WHAT-IF” Analysis

Project cash flows and NPVs may be estimated under different assumptions to improve the decision process.

Sensitivity Analysis

- A. Changing a single, specific variable within a range from most likely to optimistic to pessimistic and evaluating the NPVs is called **sensitivity analysis**.
- B. Sensitivity analysis reveals the significant variables, which, if varied or misestimated, would significantly change the NPV and acceptability of the project.
- C. Sensitivity analysis assumes that the individual variables are independent of each other. This is usually not the case. Sales cannot be varied without significantly affecting certain costs. This interrelationship between variables limits the extent that one variable can be changed without altering another, and thus, narrows the range of the sensitivity analysis.

Scenario Analysis

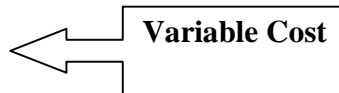
- A. Like sensitivity analysis, **scenario analysis** involves the same change of variables to see the impact on NPV, but scenario analysis differs from sensitivity analysis in that a particular combination of variables under specific assumptions is compared with another scenario of assumptions.
- B. Simulation analysis, an extension of scenario analysis, generates many scenarios and, with an estimate of their probability, generates NPV estimates for a wide range of scenarios.+

See Table 9-2 and 9-3

BREAK-EVEN ANALYSIS

- A. **break-even analysis** is the determination of the level sales where the project breaks even.
i.e. **Total revenue = Total cost**
- B. Estimating the accounting break-even point level of sales of a project requires identifying the level of fixed costs involved in the project and the variable cost/sales ratio related to the project.

- **Cost of sales:** direct cost of producing the merchandize (raw materials and labor)



- **Operating expenses:**
Selling, general, and administrative expenses:
Marketing expenses, salaries.
R & D expenses



- **Depreciation expenses**

Accounting Break-Even Analysis

The sales break-even point is estimated to be the fixed costs including depreciation divided by the percentage of sales contribution margin, or the fixed costs including depreciation divided by one minus the variable cost to sales ratio:

Fixed Costs Including Depreciation = Break-even Sales

[1 – (Var. Cost / Sales)]

How Come!!!

$$TC = TR$$

$$\Rightarrow \text{Fixed cost Fixed Costs including Depreciation}_+ \text{Variable Cost} = \text{Sales}$$

$$\Rightarrow F + V = S$$

$$\Rightarrow F = S - V$$

$$\Rightarrow \frac{F}{S - V} = 1$$

$$\Rightarrow \frac{F}{S(1 - V/S)} = 1$$

$$\Rightarrow \frac{F}{S(1 - V/S)} = 1$$

$$\Rightarrow \frac{F}{(1 - V/S)} = S$$

- C. A project that *just* breaks even in accounting income terms will have a negative NPV. WHY???

Economic Value Added or NPV Break-Even Analysis

- A. Accounting break-even analysis does not consider the cost of capital invested in the project.
- B. **Economic Value Added** measures the economic profit or profit in excess of all costs including the required rate of return to capital. Positive EVA adds value to the firm.
- C. The **economic break-even point** is the level of sales from a project needed to generate a zero NPV .
- D. With the cost of the project = the present value of cash flows = NPV of zero, the level of sales that generates the periodic cash flows needed to generate the given present value is the unknown.
- E. The sales level that produces an NPV of zero is always *higher* than the sales level for the accounting break-even point. WHY!!!!

Economic break-even point

Break-even Sales =

(Fixed Costs Including Depreciation)(1-T) + Annual cost of capital – Depreciation

$(1-T)(1 - (\text{Var. Cost} / \text{Sales}))$

Annual cost of capital is the annuity of the cost of the project using the opportunity cost of the project (%) and the project life (N).

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How Come again !!!

EVA = EBIT (1-T) + Depreciation – Annual cost of capital

EVA = (S – F – V)(1-T) + Dep. – Annual cost of capital

At break even point EVA = 0 ⇒ NPV = 0

$(S - F - V)(1-T) + \text{Dep.} = \text{Annual cost of capital}$

⇒ $(S-V)(1-T) - F(1-T) + \text{Dep.} = \text{Annual cost of capital}$

⇒ $(S-V)(1-T) = F(1-T) + \text{Annual cost of capital} - \text{Dep}$

⇒ $S(1-V/S)(1-T) = F(1-T) + \text{Annual cost of capital} - \text{Dep}$

⇒ $S = \frac{F(1-T) + \text{Annual cost of capital} - \text{Dep}}{(1-V/S)(1-T)}$

Operating Leverage

- A. Projects with a high proportion of fixed costs generate higher NPVs when sales are high than projects with low proportions of fixed costs (high proportions of variable costs). The contribution to fixed cost, sales less variable costs, contributes to fixed cost until the break-even point and thereafter contributes to profit/cash flows. The high fixed cost project will have a high contribution to profit for each higher level of sales.
- B. A project with fixed costs is said to have **operating leverage**. The extent of operating leverage or the extent of fixed costs versus variable costs/sales is called the **degree of operating leverage**.
- C. The risk of a project, or the variability of the realizable NPV, is directly related to the degree of operating leverage of the project. The higher the fixed costs, the greater the variation in cash flows given a change from estimated sales.

	<u>Low Business Risk</u>			<u>High Business Risk</u>		
	<u>Bad</u>	<u>Normal</u>	<u>Good</u>	<u>Bad</u>	<u>Normal</u>	<u>Good</u>
Sales	1,250,000	5,000,000	8,750,000	1,250,000	5,000,000	8,750,000
Variable Cost	875,000	3,500,000	6,125,000	500,000	2,000,000	3,500,000
Fixed Cost	300,000	300,000	300,000	800,000	800,000	800,000
EBIT	75,000	1,200,000	2,325,000	-50,000	2,200,000	4,450,000

$$\text{DOL} = \frac{\% \Delta \text{EBIT}}{\% \Delta \text{Sales}} = \frac{\Delta \text{EBIT} / \text{EBIT}}{\Delta \text{Sales} / \text{Sales}}$$

Or ,

$$\text{DOL} = \frac{\text{S} - \text{V}}{\text{EBIT}}$$

Because,

$$\begin{aligned} \text{EBIT} &= \text{S} - \text{F} - \text{V} \\ \rightarrow \text{F} + \text{EBIT} &= \text{S} - \text{V} \end{aligned}$$

Therefore,

$$\text{DOL} = \frac{\text{S} - \text{V}}{\text{EBIT}} = \frac{\text{EBIT} + \text{F}}{\text{EBIT}} = 1 + \frac{\text{F}}{\text{EBIT}}$$