

Risk and uncertainty

Chapter 6



Introduction

In financial and economic analysis, '**uncertainty**' is referred to as 'unreliability' of actual values vis-à-vis estimated values. The causes of unreliability may be due to errors in estimating due to insufficient information, inability to predict the future, etc.

'**Risk**' means volatility of expected returns. Volatility conveys the idea of change from anticipated (estimated) values, which may be due to unplanned causes.



Benefits of risk analysis

- The foremost benefit is a better understanding of the project situation leading to appropriate future planning in respect of time frame and costs.
- It also helps in efficient and effective management of the risk. This results in discouraging acceptance of financially unsound projects.
- Another use of risk analysis is a better understanding of the risk and, if necessary, the most suitable agency may be engaged to tackle it.
- Better understanding of the risk may also lead to the incorporation of appropriate clauses in the contract agreement for the project.
- Risk analysis should be properly documented since the resulting data may be useful for future projects.

Factors contributing to risk

- **Inaccuracy of the input data:** the level of reliability of the study depends largely on the accuracy of the information available, if the information is based on mere guesswork, a fair amount of uncertainty is likely to creep in.
- **Type of activity and the future trend of the economy:** While making capital investment in any enterprise, it is imperative to study in advance the nature and background of the enterprise as well as the projected future economic conditions (e.g., interest rates, inflation) and assess the risk involved in the process.
- **Type of plants and equipment:** Some plants have definite economic lives and resale value, while others may not have much resale value. This will have direct bearing on the anticipated income and expenditure. Multipurpose equipment may be very useful in the workshop, while equipment capable of only limited specialized job would naturally have restricted use.
- **Extent of the estimated study period:** If it is too long, it may not be possible to maintain the income/expenditure figures as per the initial estimation. Therefore, a long study period will increase the probability of uncertainty and risk in an investment.

Risk analysis

Analysis of risks is a systematic process for the assessment of identified risks in a project.

Two methods of risk analysis:

- **Qualitative method:** Probability and impact matrix
- **Quantitative method:** Sensitivity analysis

Quantitative analysis is effectively a continuation of the qualitative analysis. Once the risks are identified by qualitative analysis, a detailed quantitative analysis may be carried out. With this exercise, the impact of the risk may be quantified in respect of the three basic project success yardsticks, viz., cost, time and performance.

Risk analysis: Probability and impact matrix

This method is one of the common methods of qualitative risk assessment. The method is used to evaluate the importance and to prioritize each risk.

Risk can be ranked in respect of each of the project objectives. For the purpose of general ranking, the advantage among the several project rankings can be assessed without difficulty.

Actual technique of this method is to allot values for two items: Probability of occurrence of each risk; and Impact of the risks.

The risk grading is considered in descending order of risk, i.e., '1' is considered to be of highest risk and '5' is considered to be of lowest risk.

Probability and Impact Matrix of Risks

		Impact Severity		
		Low (Insignificant)	Medium (Reasonable)	High (Significant)
Probability of occurrence	Low (unlikely to occur)	5	4	3
	Medium (may occur)	4	3	2
	High (likely to occur)	3	2	1

Risk analysis: Sensitivity analysis

Sensitivity analysis involves changing the value of a few selected variables and calculating the resulting change in the net present value (NPV).

In practice, a number of variables are responsible for the economic viability of a project, viz., economic life of the project, change in the interest rate of the borrowed capital, selling price, etc. Any change in these basic parameters will automatically change the NPV of the project.

Sensitivity analysis shows the effect of such variations upon the expected return to be achieved in a project. For carrying out sensitivity analysis, the estimated values of the basic variables are considered, taking one factor at a time. The sum total of NPV of the project is then calculated. The effect of the NPV is plotted graphically for examination.

Risk analysis: Sensitivity analysis

NPV of a project is represented by:
$$NPV = \sum_{n=1}^n \frac{Q(P - V) - F}{(1 + i)^n} + \frac{S}{(1 + i)^n} - I$$

Where

n = expected project life in years

Q = number of units sold annually

P = selling price per unit

V = variable cost per unit

F = fixed costs, including taxes and liabilities

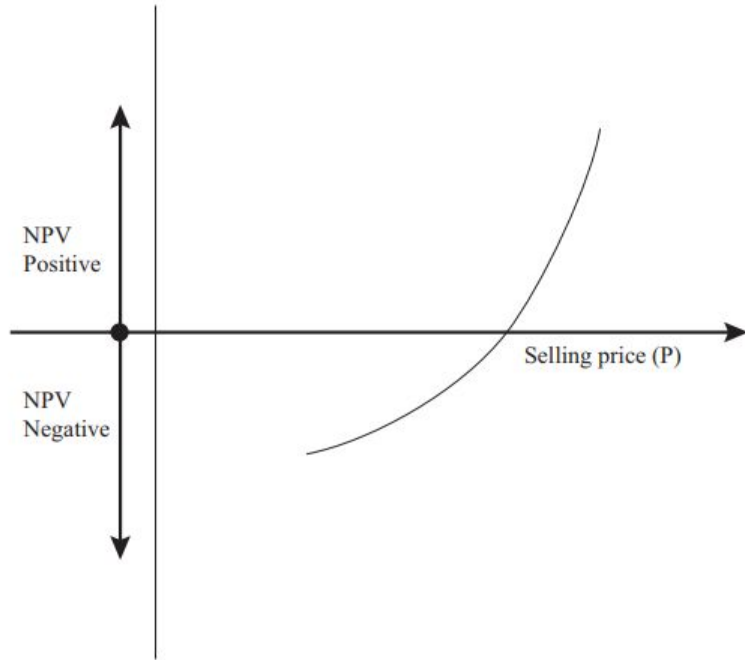
i = interest rate

S = salvage value (the amount that an asset is estimated to be worth at the end of its useful life, also known as scrap value or residual value)

I = initial investment

An idea in the change of NPV can be formed, when one of the variables is changed.

Risk analysis: Sensitivity analysis



Positive relation between NPV and selling price

A **higher selling price** boosts **revenue per unit**, increasing total cash inflows.

This leads to a **higher Net Present Value (NPV)**, making the project look **more financially attractive**.

A higher NPV means **greater value creation**.

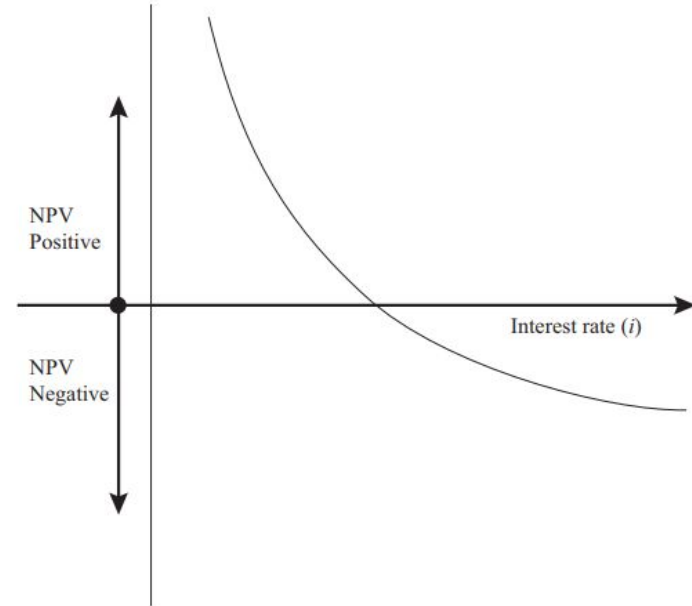
A higher selling price boosts NPV and improves project attractiveness, but risk analysis must test whether that price is realistic and sustainable under various conditions.

Risk analysis: Sensitivity analysis

When **interest rate increases**, the **discount rate increases**. Higher discount rates **reduce the present value of future cash flows**. So, **NPV goes down**.

Projects Become Less Attractive:

- A project that looked profitable at a lower interest rate might no longer be viable.
- If NPV becomes **negative**, the project **destroys value** rather than creates it.
- A high interest rate often reflects **greater uncertainty** or **economic instability**.
- High interest rates amplify project risk by lowering NPV, making it harder to justify investment and increasing sensitivity to uncertainty.



Negative relation between NPV and interest rate