

CAPITAL BUDGETING - RISK ANALYSIS

QUESTIONS & ANSWERS

Question 1] Risk and uncertainty is quite inherent in capital budgeting. Comment.

CS (Professional) – June 2011 (5 Marks),

What are the risk and uncertainty in capital budgeting decisions?

CS (Professional) – Dec 2015 (4 Marks)

Ans.: Risk analysis gives management better information about the possible outcomes that may occur so that management can use their judgment and experience to accept an investment or reject it. Since risk analysis is costly, it should be used relatively in costly and important projects.

Risk and uncertainty are quite inherent in capital budgeting decisions. This is so because investment decisions and capital budgeting are actions of today which bear fruits in future which is unforeseen. Future is uncertain and involves risk. The projection of probability of cash inflows made today is not certain to be achieved in the course of future. Seasonal fluctuations and business cycles both deliver heavy impact upon the cash inflows and outflows projected for different project proposals. The cost of capital which offers cut-off rates may also be inflated or deflated under business cycle conditions. Inflation and deflation are bound to effect the investment decision in future period rendering the degree of uncertainty more severe and enhancing the scope of risk.

Technological developments are other factors that enhance the degree of risk and uncertainty by rendering the plants or equipments obsolete and the product out of date. Tie up in the procurement in quantity and/or the marketing of products may at times fail and frustrate a business unless possible alternative strategies are kept in view. All these circumstances combined together affect capital budgeting decisions.

It is therefore necessary to allow discounting factor to cover risk. One way to compare risk in alternative proposals is the use of Standard Deviation.

Lower standard deviation indicates lower risk.

However, wherever returns are expressed in revenue terms the co-efficient of variation gives better measurement for risk evaluation.

Question 2] There are number of statistical/mathematical techniques of risk evaluation in capital budgeting. Comment.

CS (Professional) – Dec 2014 (5 Marks)

Ans.: Following statistical/mathematical techniques of risk evaluation are used in capital budgeting:

- (a) Certainty Equivalent Approach
- (b) Probability Assignment
- (c) Expected Net Present Value

- (d) Standard Deviation
- (e) Coefficient of Variation
- (f) Sensitivity Analysis
- (g) Simulation
- (h) Probability Distribution Approach
- (i) Normal Probability Distribution
- (j) Linear Programming

Question 3] Write a short note on: Certainty Equivalent Approach

Ans.: Certainty Equivalent Factor (CEF) is the ratio of assured cash flows to uncertain cash flows. Under this approach, the cash flows expected in a project are converted into risk-less equivalent amount. The adjustment factor used is called CEF. This varies between 0 and 1. A co-efficient of 1 indicates that cash flows are certain. The greater the risk in cash flow, the smaller will be CEF 'for receipts', and larger will be the CEF 'for payments'. While employing this method, the decision maker estimates the sum he must be assured of receiving, in order that he is indifferent between an assured sum and expected value of a risky sum.

Method of Computation under CE approach:

Step 1: Convert uncertain cash flows to certain cash flows by multiplying it with the CEF.

Step 2: Discount the certain cash flows at the risk free rate to arrive at NPV.

Decision Rule: If the resultant NPV is positive project can be accepted.

Illustration: NZ Ltd. is considering to take a new project. The management of the company use Certainty Equivalent (CE) approach to evaluate such type of projects.

Following information is available for the project:

| Year | CFAT | CE |
|------|----------|------|
| 1 | 1,15,000 | 0.90 |
| 2 | 1,15,000 | 0.85 |
| 3 | 1,15,000 | 0.75 |
| 4 | 1,15,000 | 0.70 |
| 5 | 1,15,000 | 0.65 |

Projects requires initial investment of ₹ 3,00,000. The Company's cost of capital is 12% and risk free borrowing rate is 7%.

Advise the company whether it should take project or not?

Solution:

| Year | CFAT | CE | Adjusted CFAT | PV Factor 7% | PV |
|------------------------|----------|------|---------------|--------------|------------|
| 1 | 1,15,000 | 0.90 | 1,03,500 | 0.935 | 96,772 |
| 2 | 1,15,000 | 0.85 | 97,750 | 0.873 | 85,336 |
| 3 | 1,15,000 | 0.75 | 86,250 | 0.816 | 70,380 |
| 4 | 1,15,000 | 0.70 | 80,500 | 0.763 | 61,422 |
| 5 | 1,15,000 | 0.65 | 74,750 | 0.713 | 53,297 |
| Total Present Value | | | | | 3,67,207 |
| (-) Initial Investment | | | | | (3,00,000) |
| Net present value | | | | | 67,207 |

Since NPV is positive, project can be accepted.

Question 4] Write a short note on: Risk adjusted discount rate

Ans.: Risk-adjusted discount rate is the rate used in the calculation of the present value of a risky investment. It is calculated as follows:

Formula:

$$R_f + \beta (R_m - R_f)$$

The risk-adjusted discount rate is the total of the risk-free rate, *i.e.* the required return on risk-free investments, and the market premium, *i.e.* the required return of the market. Financial analysts use the risk-adjusted discount rate to discount a firm's cash flows to their present value and determine the risk that investor should accept for a particular investment.

Question 5] How expected cash flow are calculated by assigning probabilities to estimated cash flows in capital budgeting?

Ans.: The concept of probability is fundamental to the use of the risk analysis techniques. It may be defined as the likelihood of occurrence of an event. If an event is certain to occur, the probability of its occurrence is one but if an event is certain not to occur, the probability of its occurrence is zero. Thus, probability of all events to occur lies between zero and one.

Probability distribution can be used to compute expected values. For this purpose following procedure is adopted:

Step 1: Establish probability distribution

Step 2: Multiply values with probability of each outcome

Step 3: Aggregate the result of Step 2

Illustration: X Ltd. is considering to start a new project for which it has gathered following data:

| <i>Cash flow</i> | <i>Probability</i> |
|------------------|--------------------|
| 30,000 | 0.1 |
| 60,000 | 0.4 |
| 1,20,000 | 0.4 |
| 1,50,000 | 0.1 |

Calculate the expected cash flow.

Solution:

| Cash flow | Probability | Expected Cash flow |
|-----------|-------------|-------------------------|
| 3,000 | 0.1 | 300 |
| 6,000 | 0.4 | 2,400 |
| 12,000 | 0.4 | 4,800 |
| 15,000 | 0.1 | 1,500 |
| | | $\overline{CF} = 9,000$ |

Question 6] How standard deviation (i.e. risk) and coefficient of variance of project is calculated in capital budgeting?

Ans.: Standard deviation is a statistical measure of dispersion. It measures the deviation from a central number *i.e.* mean. By calculating standard deviation in capital budgeting, we can measure in each case the extent of variation. Higher the standard deviation, higher is the risk associated with the project.

However, wherever returns are expressed in revenue terms the co-efficient of variation gives better measurement for risk evaluation.

Coefficient of variation is calculated as follows:

$$\text{Coefficient of variation} = \frac{\sigma}{\text{NPV}}$$

Procedure to calculate standard deviation can be explained with the help of following illustration:

Illustration 1: X Ltd. is considering to start a new project for which it has gathered following data:

| NPV | Probability |
|----------|-------------|
| 80,000 | 0.3 |
| 1,10,000 | 0.3 |
| 1,42,500 | 0.2 |

Compute the risk associated with the project *i.e.* standard deviation.

Solution:

| NPV | Probability | Expected NPV |
|---------------------------|-------------|--------------|
| 80,000 | 0.3 | 24,000 |
| 1,10,000 | 0.3 | 33,000 |
| 1,42,500 | 0.2 | 28,500 |
| $\overline{\text{NPV}} =$ | | 85,500 |

Calculation of standard deviation of Project A:

| NPV | D | D ² | P | PD ² |
|--------------|---------|----------------|-----|-----------------|
| 80,000 | - 5,500 | 3,02,50,000 | 0.3 | 90,75,000 |
| 1,10,000 | 24,500 | 60,02,50,000 | 0.3 | 18,00,75,000 |
| 1,42,500 | 57,000 | 3,24,90,00,000 | 0.2 | 64,98,00,000 |
| $\sigma^2 =$ | | | | 83,89,50,000 |
| $\sigma =$ | | | | 28,965 |

$$\text{Coefficient of variation} = \frac{\sigma}{\text{NPV}} = \frac{28,965}{85,500} = 0.34$$

Illustration 2: A company is considering Projects X and Y with following information:

| Project | Expected NPV (₹) | Standard deviation |
|---------|-------------------|--------------------|
| X | 18,000 | 6,500 |
| Y | 22,000 | 7,200 |

Which project will you recommend?

Solution:

On the basis of information about standard deviation of Project X & Y, the Project X is better as it has lower standard deviation (*i.e.* risk). However, the coefficient of variation for these projects may be found as follows:

$$\text{Coefficient of variation} = \frac{\sigma}{\text{NPV}}$$

$$\text{Project X} = \frac{6,500}{18,000} = 0.361$$

$$\text{Project Y} = \frac{7,200}{22,000} = 0.327$$

Project Y is better as its CV is lesser than Project X.

Question 7] Write a short note on: Decision tree technique in capital budgeting

Ans.: Decision tree technique is a method to evaluate risky proposals. A decision tree shows the sequential outcome of a risky decision. The decision tree approach gets its name because of resemblance with a

tree having number of branches. A capital budgeting decision tree shows the cash flows and net present value of the project under differing possible circumstances.

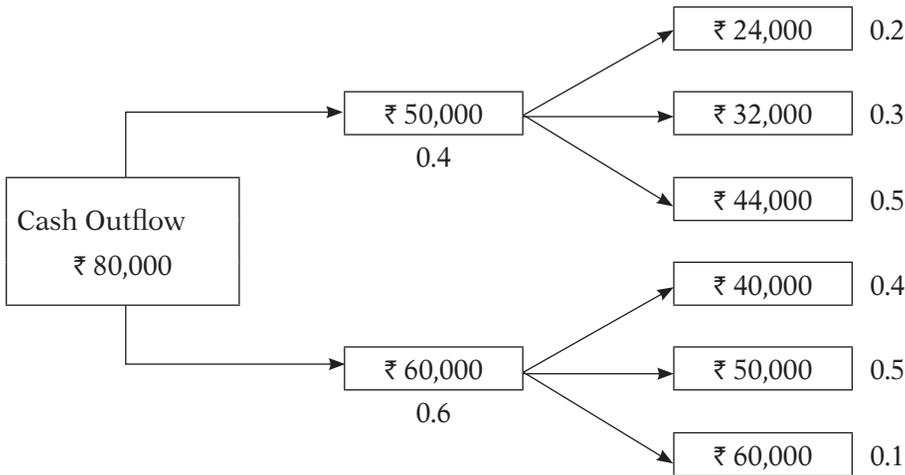
Illustration: A company has made following estimates if the CFAT of the proposed project. The company use decision tree analysis to get clear picture of project's cash inflow. The project cost ₹ 80,000 and the expected life of the project is 2 years. The net cash inflows are:

In Year 1, there is 0.4 probability that CFAT will be ₹ 50,000 and 0.6 probability that CFAT will be ₹ 60,000. The probabilities assigned to CFAT for the Year 2 are as follows:

| If CFAT = ₹ 50,000 | | If CFAT = ₹ 60,000 | |
|--------------------|-------------|--------------------|-------------|
| ₹ | Probability | ₹ | Probability |
| 24,000 | 0.2 | 40,000 | 0.4 |
| 32,000 | 0.3 | 50,000 | 0.5 |
| 44,000 | 0.5 | 60,000 | 0.1 |

The firm uses 10% discount rate for this type of investments.

Solution: *Decision Tree:*



Net present value of cash flows:

| Combination | CFAT ₁ | PV Factor | PV ₁ | CFAT ₂ | PV Factor | PV ₂ |
|-------------|-------------------|-----------|-----------------|-------------------|-----------|-----------------|
| A | 50,000 | 0.909 | 45,450 | 24,000 | 0.826 | 19,824 |
| B | 50,000 | 0.909 | 45,450 | 32,000 | 0.826 | 26,432 |
| C | 50,000 | 0.909 | 45,450 | 44,000 | 0.826 | 36,344 |
| D | 60,000 | 0.909 | 54,540 | 40,000 | 0.826 | 33,040 |
| E | 60,000 | 0.909 | 54,540 | 50,000 | 0.826 | 41,300 |
| F | 60,000 | 0.909 | 54,540 | 60,000 | 0.826 | 49,560 |

Table continued...

| Combination | Total PV (PV ₁ + PV ₂) | Initial investment | NPV | Joint Probabilities | Expected NPV |
|-------------|---|--------------------|----------|---------------------|--------------|
| A | 65,274 | 80,000 | - 14,276 | 0.08 | - 1,178 |
| B | 71,882 | 80,000 | - 8,118 | 0.12 | - 974 |
| C | 81,794 | 80,000 | 1,794 | 0.20 | 358 |
| D | 87,850 | 80,000 | 7,580 | 0.24 | 1,819 |
| E | 95,840 | 80,000 | 15,840 | 0.30 | 4,752 |
| F | 1,04,100 | 80,000 | 24,100 | 0.06 | 1,446 |
| | | | | | 6,223 |