

## Techniques/Methods of capital budgeting

### 1. Traditional Methods

**Payback period:** Payback period is the time required to recover the net cash outflow (NCO) out of net cash inflow of the project.

$$\text{Payback period} = \frac{\text{Net cash outlay}}{\text{Annual cash inflow}}$$

$$\text{Or, Payback period} = A + \frac{NCO - C}{D}$$

Where, A= the year in which the cumulative net cash flow is near to NCO.

NCO= Net cash outlay.

C= Cumulative net cash flow of year A.

D= Net cash flow of the year following the year A.

**Decision Criteria:** □ If the payback period < maximum acceptable payback period ⇒ Accept.  
● If the payback period > maximum acceptable payback period ⇒ Reject.

#### Advantages of payback period

1. Adjusts for uncertainty of later cash flows
2. Biased towards liquidity since it is biased towards short-term projects
3. Long payback means capital tied up and high investment risk. The method also has the advantage that it involves a quick, simple calculation and an easily understood concept.

#### Limitation of Payback period

1. Under this method, time value of money is ignores.
2. Total cash flow throughout whole life of the project is also ignores.
2. Ignores cash flows occurring after the payback period.
3. It is unable to distinguish between projects with the same payback period.
4. It may lead to excessive investment in short-term projects.

**Average/Accounting Rate of Return (ARR) Method:** The ARR method (also called the return on capital employed (ROCE) or the return on investment (ROI) method) of appraising a capital project is to estimate the accounting rate of return that the project should yield. Note that net annual profit excludes depreciation.

$$ARR = \frac{\text{Average Annual Net Profit}}{NCO} \times 100$$

$$\text{Or, } ARR = \frac{\text{Average Annual Net Profit}}{\text{Average Capital}} \times 100$$

**Decision criteria:** If it exceeds a target rate of return, the project will be undertaken.

#### Advantages of ARR

1. It is very simple to understand and use.
2. Rate of return may readily be calculated with the help of accounting data.
3. It takes investments and the total earnings from the project during its life time.

#### Limitation of ARR

1. It ignores the time-value of money.
2. It considers only the rate of return and not the length of project lives.
3. The method ignores the fact that profits can be reinvested.
4. It implicitly assumes stable cash receipts over time.
5. It is based on accounting profits and not cash-inflows in appraising the projects.

## 2. Discounted Cash Flow Method

**Net Present Value:** Under NPV method present value of all net cash inflow is calculated by a discounting rate and compared with PV of net cash outflow. NPV is calculated by using the following equation-

$$NPV = \left[ \frac{A_1}{(1+r)^1} + \frac{A_2}{(1+r)^2} + \dots + \frac{A_n}{(1+r)^n} \right]$$

#### Decision criteria:

- If  $NPV > 0$  it means the investment would add value to the firm then the project may be accepted.
- If  $NPV < 0$  it means the investment would subtract value from the firm then the project should be rejected.
- If  $NPV = 0$  it means the investment would neither gain nor lose value for the firm. We should be indifferent in the decision whether to accept or reject the project. This project adds no monetary value. Decision should be based on other criteria, e.g. strategic positioning or other factors not explicitly included in the calculation.

**Internal rate of return (IRR):** Internal rate of return (IRR) is the discounting rate at which present value of cash inflow is equal to present value of cash outflow. So, we can write the following equation-

$$\frac{A_1}{(1+r)^1} + \frac{A_2}{(1+r)^2} + \dots + \frac{A_n}{(1+r)^n} = PV \text{ of outflow}$$

To calculate the actual IRR, using the following equation-

$$IRR = A + \frac{C}{D}(B - A)$$

Here, A= Lower Discounting Rate

B= Higher Discounting Rate

C= NPV at lower discounting rate

D= Difference between the NPV at lower & higher discounting.

**Decision criteria:**

- ☑ If the IRR is equal to or more than cost of capital the project should be accepted.
- If the IRR is less than cost of capital the project should be rejected.

**Advantage of IRR**

1. Can estimate IRR without knowing an appropriate discount rate.

**Disadvantages of IRR**

1. May lead to incorrect decisions in comparisons of mutually exclusive investments or if there are unconventional cash flows.

**PROFITABILITY INDEX (PI):** The profitability index, or PI, method compares the present value of future cash inflows with the initial investment on a relative basis. Therefore, the PI is the ratio of the present value of cash flows (PVCF) to the initial investment of the project. PI is also known as a benefit/cash ratio.

$$Profitability\ Index = \frac{PV\ of\ all\ cash\ inflow}{PV\ of\ NCO}$$

**Decision criteria:**

- ✓ In this method, a project with a PI greater than 1 is accepted.
- ✓ A project is rejected when its PI is less than 1.

Note that the PI method is closely related to the NPV approach. In fact, if the net present value of a project is positive, the PI will be greater than 1. On the other hand, if the net present value is negative, the project will have a PI of less than 1.

**Modified IRR (MIRR):** The MIRR is similar to the IRR, but is theoretically superior in that it overcomes two weaknesses of the IRR. The MIRR correctly assumes reinvestment at the project's cost of capital and avoids the problem of multiple IRRs. However, please note that the MIRR is not used as widely as the IRR in practice.

There are 3 basic steps of the MIRR:

- (1) Estimate all cash flows as in IRR.
- (2) Calculate the future value of all cash inflows at the last year of the project's life.
- (3) Determine the discount rate that causes the future value of all cash inflows determined in step 2, to be equal to the firm's investment at time zero. This discount rate is known as the MIRR.

$$\text{PV costs} = \frac{\text{TV}}{(1 + \text{MIRR})^n}$$

MIRR is better than IRR because

1. MIRR correctly assumes reinvestment at project's cost of capital.
2. MIRR avoids the problem of multiple IRRs.

### Difference between IRR and MIRR

The points given below are substantial so far as the difference between IRR and MIRR is concerned:

Basis for distinguish	IRR	MIRR
Definition	It is the rate at which NPV is equal to zero.	It is the rate at which NPV of terminal inflows is equal to the outflow, i.e. initial investment.
Considerable factor	IRR is a method of computing the rate of return considering internal factors, i.e. excluding cost of capital and inflation.	MIRR is a method of capital budgeting, which calculates the rate of return taking into account cost of capital.
Assumption	Project cash flows are reinvested at the project's own IRR.	Project cash flows are reinvested at the cost of capital.
Accuracy	The accuracy of MIRR is more than IRR.	MIRR measures the true rate of return.

### Difference between NPV and IRR

Basis for Comparison	NPV	IRR
Meaning	The total of all the present values of cash flows (both positive and negative) of a project is known as Net Present Value or NPV.	IRR is described as a rate at which the sum of discounted cash inflows equates discounted cash outflows.
Expressed in	Absolute terms	Percentage terms
What it represents?	Surplus from the project	Point of no profit no loss (Break-even point)
Decision Making	It makes decision making easy.	It does not help in decision making
Rate for reinvestment of intermediate cash flows	Cost of capital rate	Internal rate of return
Variation in the cash outflow timing	Will not affect NPV	Will show negative or multiple IRR

#### There are three main reasons why NPV is usually the best choice for measuring project value.

1. NPV assumes that project cash flows are reinvested at the company's required rate of return; the IRR assumes that they are reinvested at the IRR. Since IRR is higher than the required rate of return, in order for the IRR to be accurate, the company would have to keep finding projects that would reinvest the cash flow at this higher rate. It would be difficult for a company to keep this up forever, thus NPV is more accurate.
2. NPV measures project value more directly than IRR. This is because NPV actually calculates the project's value. If there is more than one project lined up, the manager can simply add the values together to get a total.
3. Often times, during the life of a project, cash flows must be reinvested to cover depreciation. This will give a negative cash flow for that period, thus leading to more than one IRR. If there is more than one IRR, then calculating only 1 IRR for the project is not reliable. NPV must be used for this type of project.

**Capital Rationing:** Capital rationing is the financial situation in which a firm has only a fixed number of dollars for allocating among competing capital expenditure.

**Recent variations of these methods include:**

- The Adjusted Present Value (APV) Method is a flexible DCF method that takes into account interest related tax shields; it is designed for firms with active debt and a consistent market value leverage ratio;
- The Profitability Index (PI) Method, which is modeled after the NPV Method, is measured as the total present value of future net cash inflows divided by the initial investment; this method tends to favor smaller projects and is best used by firms with limited resources and high costs of capital;
- The Bailout Payback Method, which is a variation of the Payback Method, includes the salvage value of any equipment purchased in its calculations;
- The Real Options Approach allows for flexibility, encourages constant reassessment based on the riskiness of the project's cash flows and is based on the concept of creating a list of value-maximizing options to choose projects from; management can, and is encouraged, to react to changes that might affect the assumptions that were made about each project being considered prior to its commencement, including postponing the project if necessary; it is noteworthy that there is not a lot of support for this method among financial managers at this time.