

# Capital Budgeting Techniques

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## Learning Objective:

1. Understand the concept of the capital budgeting.
2. Techniques of capita budgeting.
3. Non- discounting Technique: Payback period and accounting rate of return, Calculation and interpretation.
4. Discounting Technique: Net present value (NPV), Internal Rate of return (IRR), Profitability Index (PI), Calculation and , interpretation.
5. Comparing NPV and IRR techniques, conflict in rankings and strengths of each approach.

## Capital Budgeting an overview:

- **Capital budgeting** is the process of evaluating and selecting long-term investments projects that will ultimately maximize the firm's goal of maximizing owner wealth.
- **A capital expenditure** is an outlay of funds by the firm that is expected to generate benefits over a period of time which is more than one year.
- Capital expenditure is different from **operating expenditure** under this fund expenses made by the firm resulting benefits received in same accounting year.

# Capital Budgeting Process

The **capital budgeting process** consists of five steps:

1. **Proposal for projects:** Proposals for new investment projects are made at all levels within a business organization and are reviewed by finance personnel and key management body.
2. **Review and analysis of projects:** Financial managers including key management body perform formal review and analysis to assess the merits and de merits of investment proposals
3. **Decision making about proposals:** Firms typically delegate capital expenditure decision making on the basis of capital availability and limits.
4. **Selection and implementation:** Following approval and selection, expenditures are made and projects implemented.
5. **Follow-up and review process:** Results are monitored and actual costs and benefits are compared with those that were expected. Action may be required if actual outcomes differ from projected ones.

## **Types and Nature of Projects**

### **Independent versus Mutually Exclusive Projects**

- **Independent projects** are those whose cash flows are unrelated to (or independent of) one another; the acceptance or rejection of one does not eliminate the others from further consideration.
- **Mutually exclusive projects** are those that compete with one another, so that the acceptance of one eliminates further consideration all other projects that serve a similar function.

## **Basic concept :**

### Unlimited Funds versus Capital Rationing

- **Unlimited funds** is the situation in which a firm is able to accept all projects that provide an acceptable return.
- **Capital rationing** is the situation in which a firm has only a limited availability of fund for capital expenditures, and have numerous projects compete for investment.

## Calculation of Cash Outflow

Particulars	Amount (Rs.)
Cost of Machine/Assets	****
Transportation and installation charges	****
Working capital	****
Total cost of the project	<u>****</u>

## Calculation of Cash Inflow

Particulars	Amount (Rs.)
Sales	****
Less: Expenses	****
PBDT	****
Less: Depreciation	****
PBT	****
Less: Tax	****
Profit after tax	****
Add: Depreciation	****
Cash inflow per annum	<u>****</u>



## Basic of capital budgeting:

### Accept-Reject versus Ranking of projects:

- An **accept–reject approach** is the evaluation of capital expenditure proposals to determine whether they meet the firm's minimum acceptance criterion or not.
- A **ranking approach** is the process of ranking of capital expenditure projects on the basis of some predetermined measure, such as the rate of return.

## Capital Budgeting Techniques

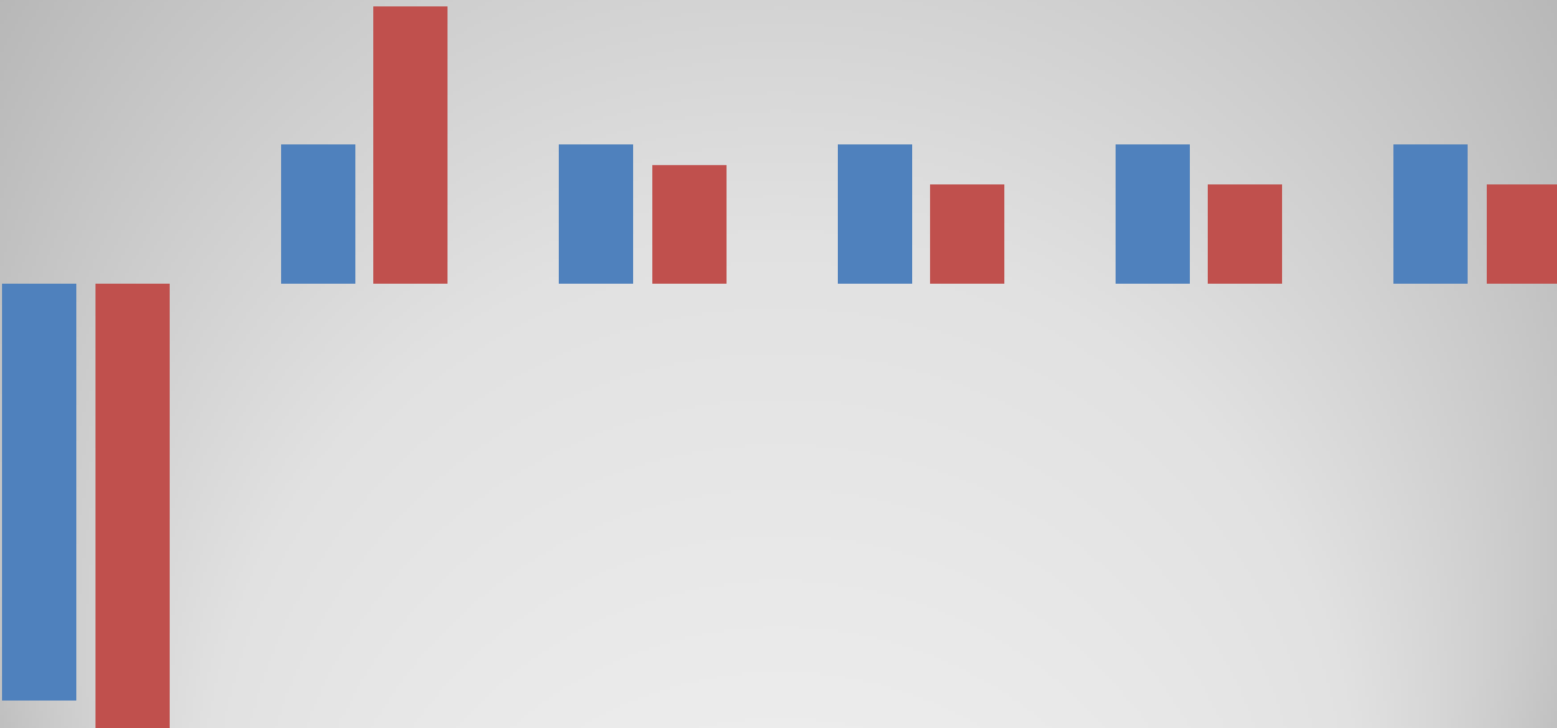
ABC Ltd. is a medium sized metal fabricator that is currently contemplating two projects: Project A requires an initial investment of Rs. 42,000, project B an initial investment of Rs. 45,000. The relevant operating cash flows for the two projects are presented in Table 1 and depicted on the time lines in Figure 1.

# Table 1 Capital Expenditure Data for ABC Ltd.

Table 1: Capital Expenditure of ABC Ltd.		
	Project A	Project B
Initial investment (outflow of cash)	Rs. 42,000	Rs. 45,000
Year	Operating cash inflows	
1	Rs. 14,000	Rs. 28,000
2	Rs. 14,000	Rs. 12,000
3	Rs. 14,000	Rs. 10,000
4	Rs. 14,000	Rs. 10,000
5	Rs. 14,000	Rs. 10,000

# Figure 1 ABC Ltd. Projects A and B Cash inflow

■ Cash inflow Project A     ■ Cash inflow Project B



# Payback Period

The **payback method** is the amount of time required for a firm to recover its initial investment in a project, as calculated from cash inflows.

Decision criteria:

- Determination of the length of the maximum acceptable payback period.
- If the calculated payback period of a project is less than the maximum acceptable payback period, accept the project.
- If the payback period of the project is greater than the maximum acceptable payback period, reject the project.

## Payback Period (cont.)

We can calculate the payback period for ABC Ltd. projects A and B using the data in Table 1.

- For project A, which is an annuity, the payback period is 3.0 years (Rs.42,000 initial investment  $\div$  Rs.14,000 annual cash inflow).
- Because project B generates a unequal stream of cash inflows, the calculation of its payback period is not as clear-cut as of project A.
  - In year 1, the firm will recover Rs.28,000 of its Rs.45,000 initial investment.
  - By the end of year 2, Rs.40,000 (Rs.28,000 from year 1 + Rs.12,000 from year 2) will have been recovered.
  - At the end of year 3, Rs.50,000 will have been recovered.
  - Only 50% of the year-3 cash inflow of Rs.10,000 is needed to complete the payback of the initial Rs.45,000.
- The payback period for project B is therefore 2.5 years (2 years + 50% of year 3).

## Payback Period: Pros and Cons of Payback Analysis

- The payback method is widely used by firms to evaluate most of the projects.
- Its popularity due to its computational simplicity and intuitive appeal.
- By measuring how much time required by the firm to recovers its initial investment, the payback period also gives implicit consideration to the timing of cash flows and therefore to the time value of money.

It can be widely viewed as a measure of risk exposure, many firms use the payback period as a decision criterion or as a supplement to other decision techniques of capital budgeting.

## **Payback Period: Pros and Cons of Payback Analysis (cont.)**

- The major drawback of the payback period is that the appropriate payback period is merely a subjective determined number.
  - It cannot one to be specified in light of the wealth maximization goal of the firm because it is not based on discounting cash flows to determine whether they add to the firm's value or deteriorated.
- A second weakness is that this approach completely ignore the time factor in the value of money.
- A third weakness of payback is its failure to recognize cash flows that occur after the payback period.



## Limits on Payback Analysis

- Though it has some drawbacks but easy to compute and easy to understand, the payback period simplicity brings it in the center of capital budgeting techniques.
- Whatever the weaknesses of the payback period method of evaluating capital projects, the simplicity of the method does allow it to be used in conjunction with other, more sophisticated measures.
- In our view, if the payback period method is used in conjunction with the NPV method, should it be more appealing for the analyst.

## Table 2 Relevant Cash Flows and Payback Periods for DY Enterprises' Projects

**Table 2 Relevance of cash flows and Payback period for DY Enterprises's Projects**

	Project Gold	Project Silver
Initial Investment	Rs. 50,000	Rs. 50,000
Year	Operating cash inflows	
1	Rs. 5,000	Rs. 40,000
2	Rs. 5,000	Rs. 2,000
3	Rs. 40,000	Rs. 8,000
4	Rs. 10,000	Rs. 10,000
5	Rs. 10,000	Rs. 10,000
Payback period	3 year	3 year

## Table 3 Calculation of the Payback Period for R Company's Two Alternative Investment Projects

### Table 3 Calculation of the payback period for R company's two alternative investment projects

	Project X	Project y
Initial investment	Rs. 10,000	Rs. 10,000
Year	Operating cash inflows	
1	Rs. 5,000	Rs. 3,000
2	Rs. 5,000	Rs. 4,000
3	Rs. 1,000	Rs. 3,000
4	Rs. 100	Rs. 4,000
5	Rs. 100	Rs. 3,000
Payback period	2 year	3 year

## Conclusion for payback period:

Table 2 and 3 both are showing the payback time period for respective projects for their companies. In table 2 payback period is same but cash flow in various year is different put a question mark in the selection of the project. As per the cash flow of in table 2, silver project is better than the gold project because it provide earliest recovery of cash that affect the time value of money. In table 3 project x has earliest recovery of cash but after 2 year its cash inflow drastically reduced give edge to project y. Therefore under this method instead of numerical value manager rationality is important for the selection of the project.

## Accounting Rate of Return method

IT considers the earnings of the project of the economic life. This method is based on conventional accounting concepts. The rate of return is expressed as percentage of the earnings of the investment in a particular project. This method has been introduced to overcome the disadvantage of pay back period. The profits under this method is calculated as profit after depreciation and tax of the entire life of the project.

The formula is as:

$$\text{ARR} = \text{Average Profits after tax} / \text{Net investment} \times 100$$

This method of ARR is not commonly accepted in assessing the profitability of capital expenditure. Because the method does to consider the heavy cash inflow during the project period as the earnings will be averaged. The cash flow advantage derived by adopting different kinds of depreciation is also not considered in this method.

### **Accept or Reject Criterion:**

Under the method, all project, having Accounting Rate of return higher than the minimum rate establishment by management will be considered and those having ARR less than the pre-determined rate. This method ranks a Project as number one, if it has highest ARR, and lowest rank is assigned to the project with the lowest ARR.

### **Merits**

- It is very simple to understand and use.
- This method takes into account saving over the entire economic life of the project.
- Therefore, it provides a better means of comparison of project than the pay back period. This method through the concept of "net earnings" ensures a compensation of expected profitability of the projects and It can readily be calculated by using the accounting data.

## Demerits

1. It ignores time value of money.
2. It does not consider the length of life of the projects.
3. It is not consistent with the firm's objective of maximizing the market value of shares.
4. It ignores the fact that the profits earned can be reinvested. -

# Net Present Value (NPV)

**Net present value (NPV)** is a modern capital budgeting technique used by project managers in their analysis; found by subtracting a project's initial investment from the present value of its cash inflows discounted at a rate equal to the firm's cost of capital or required rate of return or hurdle rate which one is preferred by the project manager. Formula is as;

NPV = Present value of cash inflows – Initial investment

$$\text{NPV} = \sum_{t=1}^n \frac{CF_t}{(1+r)^t} - CF_0$$



# Net Present Value (NPV) (cont.)

Decision criteria:

- If the NPV is greater than Rs. 0 (Zero), accept the project.
- If the NPV is less than Rs. 0 (Zero), reject the project.

If the NPV is greater than Rs.0, the firm will earn a return greater than its cost of capital or required rate of return or hurdle rate which one is preferred by the project manager. Such action should increase the market value of the firm, and therefore the wealth of its owners by an amount equal to the NPV.

## Project A and Project B Using NPV Techniques

Year	0	1	2	3	4	5
<b>Cash Flow Project A</b>	-42,000	14,000	14,000	14,000	14,000	14,000
<b>Present Value Factor at 10%</b>	1	0.909091	0.826446	0.751315	0.683013	0.620921
<b>Present Value of Cash flow</b>	-42000	12727.27	11570.25	10518.41	9562.188	8692.899
<b>Total Present Value of Cash Inflow</b>	53071.01					
<b>NPV</b>	11071.01					
<b>Year</b>	0	1	2	3	4	5
<b>Cash Flow Project B</b>	-45000	28,000	12,000	10,000	10,000	10,000
<b>Present Value Factor at 10%</b>	1	0.909091	0.826446	0.751315	0.683013	0.620921
<b>Present Value of Cash flow</b>	-45000	25454.55	9917.355	7513.148	6830.135	6209.213
<b>Total Present Value of Cash Inflow</b>	55924.4					
<b>NPV</b>	10924.4					

Under the Choice of the project, Project A has more NPV than the Project B show Project A will be selected

## **Net Present Value (NPV): NPV and the Profitability Index**

For a project that has an initial cash outflow followed by a series of cash inflows, the profitability index (PI) is simply equal to the present value of cash inflows divided by the present value of initial cash outflow:

$$PI = \frac{\sum_{t=1}^n \frac{CF_t}{(1+r)^t}}{CF_0}$$

When companies evaluate investment opportunities using the PI, the decision rule they follow is to invest in the project when the index is greater or equal to 1.

# Net Present Value (NPV): NPV and the Profitability Index (cont.)

We can refer back to NPV method, which shows the present value of cash inflows for projects A and B, to calculate the PI for each of ABC Ltd. options:

$$PI_A = \text{Rs. } 53,071 \div \text{Rs. } 42,000 = 1.26$$

$$PI_B = \text{Rs. } 55,924 \div \text{Rs. } 45,000 = 1.24$$

Under the Choice of the project, Project A has PI index more than the Project B show Project A will be selected.

Therefore we found that under NPV and PI method results are same so there is no choice over other. Though we can say that PI method is next level of NPV method.

## Net Present Value (NPV): NPV and Economic Value Added

- Economic Value Added (or EVA), a registered trademark of the consulting firm, Stern Stewart & Co., is another close cousin of the NPV method.
- The EVA method begins the same way that NPV does—by calculating a project's net cash flows.
- However, the EVA approach subtracts from those cash flows a charge that is designed to capture the return that the firm's investors demand on the project.
- EVA determines whether a project earns a **pure economic profit**—a profit above and beyond the normal competitive rate of return in a line of business.

## Net Present Value (NPV): NPV and Economic Value Added

Suppose a certain project costs Rs.1,000,000 up front, but after that it will generate net cash inflows each year (in perpetuity) of Rs.120,000. If the firm's cost of capital is 10%, then the project's NPV and EVA are:

$$\text{NPV} = -\text{Rs.}1,000,000 + (\text{Rs.}120,000 \div 0.10) =$$

$$\text{Rs.}200,000 \quad \text{EVA} = \text{Rs.}120,000 - \$100,000 =$$

$$\text{Rs.}20,000$$

## Internal Rate of Return (IRR)

The **Internal Rate of Return (IRR)** is a sophisticated capital budgeting technique; the discount rate that equates the NPV of an investment opportunity with Rs.0 (Zero) (because the present value of cash inflows equals the initial investment); it is the rate of return that the firm will earn if it invests in the project and receives the given cash inflows.

$$\$0 = \sum_{t=1}^n \frac{CF_t}{(1 + IRR)^t} - CF_0$$

$$\sum_{t=1}^n \frac{CF_t}{(1 + IRR)^t} = CF_0$$

# Internal Rate of Return (IRR)

## Decision criteria:

- If the IRR is greater than the cost of capital or required rate of return, accept the project.
- If the IRR is less than the cost of capital or required rate of return, reject the project.

This criteria guarantee that the firm will earn at least its required return. Such an outcome should increase the market value of the firm and, therefore, the wealth of its owners.



## Project A and Project B Using IRR Techniques

Year	0	1	2	3	4	5
<b>Cash Flow Project A</b>	-42,000	14,000	14,000	14,000	14,000	14,000
<b>IRR of the Project A</b>	19.90%					
<b>PV facto at 19.9%</b>	1	0.834028	0.695603	0.580153	0.483864	0.403556
<b>Present value of cash inflow</b>	-42000	11676.4	9738.446	8122.14	6774.095	5649.788
<b>Net Present Value</b>	-39.1336 Approx.					
<b>Year</b>	0	1	2	3	4	5
<b>Cash Flow Project B</b>	-45000	28,000	12,000	10,000	10,000	10,000
<b>IRR of the Project B</b>	21.70%					
<b>Pv facto at 21.7%</b>	1	0.821693	0.675179	0.55479	0.455867	0.374582
<b>Present value of cash inflow</b>	-45000	23007.4	8102.146	5547.895	4558.665	3745.822
<b>Net Present Value</b>	-38.076 Approx.					

## Internal Rate of Return (IRR): Calculating the IRR (cont.)

- To find the IRR using the excel sheet results are shown in previous ppt for both the projects.
- To find the IRR manually first calculate the present using two discounting rates from one you get present value of inflow more and from other it is less. After this you use
- $$IRR = \text{Lower discount rate} + (\text{Higher discount rate} - \text{lower discount rate}) \left( \frac{\text{Pv at lower rate} - \text{cash outflow}}{\text{Pv at lower rate} - \text{present value at higher rate}} \right)$$
- Comparing the IRRs of projects A and B given ABC ltd. 10% cost of capital, we can see that both projects are acceptable because
  - $IRRA = 19.9\% > 10.0\%$  cost of capital
  - $IRRB = 21.7\% > 10.0\%$  cost of capital
- Comparing the two projects' IRRs, we would prefer project B over project A because  $IRRB = 21.7\% > IRRA = 19.9\%$ .

## **Internal Rate of Return (IRR): Calculating the IRR (cont.)**

- It is interesting to note in the preceding example that the IRR suggests that project B, which has an IRR of 21.7%, is preferable to project A, which has an IRR of 19.9%.
- This conflicts with the NPV rankings obtained in an earlier example.
- Such conflicts are not unusual.
- There is no guarantee that NPV and IRR will rank projects in the same order. However, both methods should reach the same conclusion about the acceptability or nonacceptability of projects.

## Personal Finance Example

Mr. X is evaluating an investment opportunity. He feels that this investment must earn a minimum compound annual after-tax return of 9% in order to be acceptable. Mr. X initial investment would be Rs.7,500, and he expects to receive annual after-tax cash flows of Rs.500 per year in each of the first 4 years, followed by Rs.700 per year at the end of years 5 through 8. He plans to sell the investment at the end of year 8 and net Rs.9,000, after taxes.

- Mr. X finds the investment's IRR of 9.54%.
- Given that the expected IRR of 9.54% exceeds Mr. X required minimum IRR of 9%, the investment is acceptable.

# Comparing NPV and IRR Techniques: Net Present Value Profiles

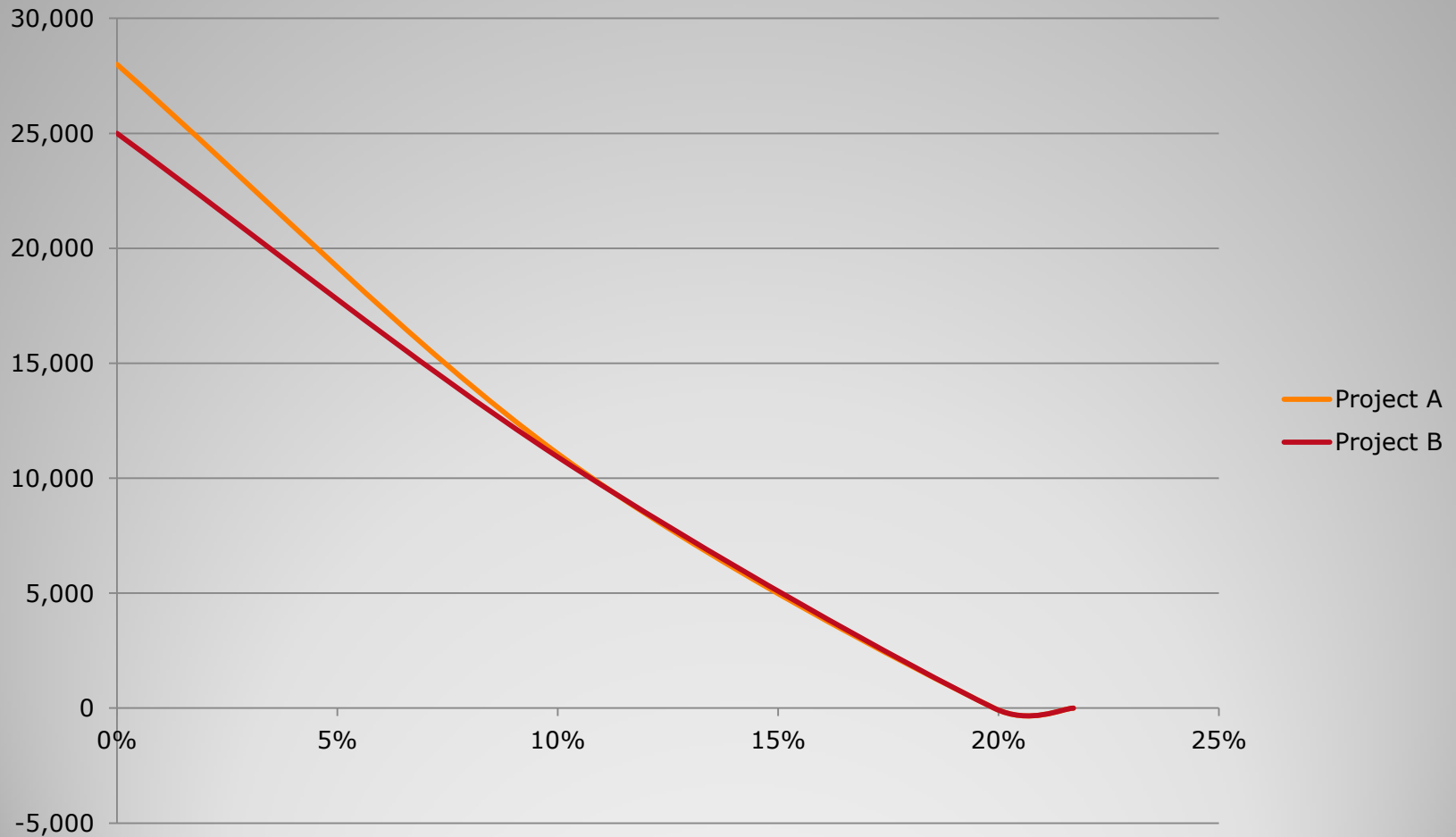
**Net present value profiles** are graphs that depict a project's NPVs for various discount rates.

To prepare NPV profiles for ABC Ltd. projects A and B, the first step is to develop a number of discount rate- NPV coordinates and then graph them as shown in the following table and figure.

# Discount Rate–NPV Coordinates for Projects A and B

Discount Rate–NPV Coordinates for Projects A and B		
	Net Present Value	
Discount rate	Project A	Project B
0%	28,000	25,000
10%	11,071	10,924
19.9%	0	---
21.7%	---	0

# NPV Profiles using 0%, 10%, 10.9% and 21.7% rate of discounting



## Comparing NPV and IRR Techniques: Conflicting Rankings

- **Conflicting rankings** are conflicts in the ranking given a project by NPV and IRR, resulting from differences in the magnitude and timing of cash flows.
- One underlying cause of conflicting rankings is the implicit assumption concerning the reinvestment of **intermediate cash inflows**—cash inflows received prior to the termination of the project.
- NPV assumes intermediate cash flows are reinvested at the cost of capital, while IRR assumes that they are reinvested at the IRR.



## **Comparing NPV and IRR Techniques: Conflicting Rankings (cont.)**

A project requiring a Rs.170,000 initial investment is expected to provide cash inflows of Rs.52,000, Rs.78,000 and Rs.100,000.

The NPV of the project at 10% is Rs.16,867 and it's IRR is 15%. Table on the following slide demonstrates the calculation of the project's future value at the end of it's 3-year life, assuming both a 10% (cost of capital) and 15% (IRR) interest rate.

**Table: Reinvestment Rate Comparisons for a Project**

Year	Opening cash inflows	Number of year earning interest	Reinvestment rate	
			Future value	Future value
1	52,000	2	62,920	68,770
2	78,000	1	85,800	89,700
3	100,000	0	100,00	100,000
	Future value end of year 3		248,720	258,470

NPV at 10%=16,847

IRR=15%

## **Comparing NPV and IRR Techniques: Conflicting Rankings (cont.)**

If the future value in each case in Table were viewed as the return received 3 years from today from the Rs.170,000 investment, then the cash flows would be those given in next Table on the following slide.

## Table: Project cash flows after reinvestment

	Investment rate	
	10%	15%
Initial investment	Rs. 170,000	
Year	Operating cash inflows	
1	00	00
2	00	00
3	148,720	258,470
NPV at 10%	16,867	24,418
IRR	13.5%	15%

## Comparing NPV and IRR Techniques: Timing of the Cash Flow

Another reason why the IRR and NPV methods may provide different rankings for investment options due to differences in the timing of cash flows.

- When much of a project's cash flows arrive early in its life, the project's NPV will not be more sensitive to the discount rate.
- On the other hand, the NPV of projects with cash flows that arrive later will more sensitive to the discount rate changes.
- The differences in the timing of cash flows between the two projects does not affect the ranking provided by the IRR method.

## Comparing NPV and IRR Techniques: Magnitude of the Initial Investment

The scale problem occurs when two projects are very different in terms of amount of money required to invest in each project.

- In these cases, the IRR and NPV methods may rank projects differently.
- The IRR approach (and the PI method) may favor small projects with high returns as Rs. 2 investment yield Rs.3.
- The NPV approach favors the investment that makes the investor the most money (like the Rs1,000 investment that yields Rs.1,100 in one day).

# Comparing NPV and IRR Techniques: Which Approach is Better?

On a purely theoretical basis, NPV is the better approach because:

- NPV measures how much wealth a project creates (or loses if the NPV is negative) for its shareholders.
- Certain mathematical properties may provide a project to have **multiple IRRs**—more than one IRR resulting from a capital budgeting project with a nonconventional cash flow pattern; the maximum number of IRRs for a project is equal to the number of sign changes in its cash flows.

Though NPV method is theoretically superior to IRR method, however, financial managers prefer to use the IRR approach as often as the NPV method because of the preference to know the rates of return.

## Focus on Ethics

### Nonfinancial Considerations in Project Selection

- For most companies ethical considerations are primarily concerned with the reduction of potential risks associated with a project.
- However, The Kuwait Fund was established as the first institution in the Middle East that took an active role in international development efforts. The fund finances development projects and their feasibility studies in developing countries.
- One of the major objectives of the Kuwait Fund is to build a solid bridge of friendship and solidarity between the state of Kuwait and the developing nations.
- The success of the Kuwait Fund in achieving this objective helped the state of Kuwait to get the necessary votes in the United Nations and the U.N. Security Council for the war against Iraq to liberate Kuwait in 1991.
- The Kuwait Fund offers many forms of assistance, including direct loans or the provision of guarantees, and grants-in-aid to finance technical, economic, and financial studies.
- What are the potential benefits to the state of Kuwait of the ethical behavior of the Kuwait Fund?



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