Cost-benefit evaluation techniques

Economic Assessment:

- Consider whether the project is the best among other options
- Prioritize the projects so that the resources can be allocated effectively if several projects are underway
- The economic assessment can be done by the following ways:
  - ✓ Cost-benefit analysis
  - ✓ Cash flow forecasting
  - ✓ Various cost-benefit evaluation techniques

We have already discussed about the cost benefit analysis and Cash flow forecasting. In this session, we are going to discuss about the various cost-benefit evaluation techniques.

Cost benefit evaluation techniques

It considers

- the timing of the costs and benefits
- the benefits relative to the size of the investment

Common method for comparing projects on the basic of their cash flow forecasting.

1) Net profit
2) Payback Period
3) Return on investment
4) Net present Value
5) Internal rate of return

Net profit

- ❖ Net profit is calculated by subtracting a company's total expenses from total income.
- ❖ Showing what the company has earned (or lost) in a given period of time (usually one year). **also called** net income or net earnings.

Net profit= total incomes - total costs

Example:

The following table illustrates cash flow forecasts for three projects. In each case it is assumed that that the cash flows take place at the end of each year. Here negative values represent expenditure and positive values represent income.

Year	Project1	Project2	project3
0	-100000	-1,000,000	-120000
1	10,000	2,00000	30,000
2	10,000	2,00000	30,000

3	10,000	2,00000	30,000
4	20,000	2,00000	30,000
5	100000	3,00000	75,000

Calculate net profit.(total cost or total investment)

Net profit= total incomes - total costs

- For project1, total income = 10,000+10,000+10,000+20,000+1,00000=1,50000
  Total cost = 1,00000
  Net profit = 1,50000-1,00000=Rs.50000
- For project2, total income = 2,00000+2,00000+2,00000+2,00000+3,00000=1,100,000
  Total cost = 1,000,000
  Net profit = 1,100,000-1,000,000=Rs.100000
- For project2, total income = 30,000+30,000+30,000+30,000+30,000+75,000=1,95000
  Total cost = 1,20000
  Net profit = 1,95000-1,20000=Rs.75,000

Year	Project1	Project2	project3
0	-100000	-1,000,000	-120000
1	10,000	2,00000	30,000
2	10,000	2,00000	30,000
3	10,000	2,00000	30,000
4	20,000	2,00000	30,000
5	100000	3,00000	75,000

Payback Period

- The payback period is the time taken to recover the initial investment or it is the length of time required for cumulative incoming returns to equal the cumulative costs of an investment

Advantages

- simple and easy to calculate.
- It is also a seriously flawed method of evaluating investments

Disadvantages

- It attaches no value to cash flows after the end of the payback period.
- It makes no adjustments for risk.
- It is not directly related to wealth maximization as NPV is.

- It ignores the time value of money.
- The "cut off" period is arbitrary.

Example:

The following table illustrates cash flow forecasts for three projects. In each case it is assumed that that the cash flows take place at the end of each year. Here negative values represent expenditure and positive values represent income.

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5	100000	3,00000	75,000

Calculate Payback Period

Project1 **=10,000+10,000+10,000+20,000+1,00,000**=1,50,000

Project 2= 2,00,000+2,00,000+2,00,000+2,00,000+3,00,000=11,000,00

Project 3= **30,000+30,000+30,000+30,000 +** 75,000 =1,95,000

It ignores any benefits that occur after the payback period and, therefore, does not measure profitability. And it ignores the time value of money.

RETURN ON INVESTMENT or ACCOUNTING RATE OF RETURN

- It provides a way of comparing the net profitability to the investment required

Or

- A performance measure used to evaluate the efficiency of an investment or to compare the efficiency of a number of different investments

Disadvantages

- It takes no account of the timing of the cash flows.
- Rate of returns bears no relationship to the interest rates offered or changed by Bank.

$$\text{ROI} = \frac{\text{average annual profit}}{\text{total investment}} * 100$$

$$\text{Average annual profit} = \frac{\text{net profit}}{\text{total no. of years}}$$

Example:

The following table illustrates cash flow forecasts for three projects. In each case it is assumed that that the cash flows take place at the end of each year. Here negative values represent expenditure and positive values represent income.

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5	100000	3,00000	75,000

- Calculate ROI for project 1.

Total investment =1,00,000

Net profit= 50,000 ‘

Total no. of year = 5

Average Annual Profit =

50000/5 = 10,000 Rs.

ROI= (10,000/1,00,000) *100 = **10%**

- Calculate ROI for project 2.

Total investment =1,000,000

Net profit= 1,00,000

Total no. of year = 5

Average annual profit=1,00,000/5=20,000rs

ROI= (20,000/1,000,000) *100 = **2%**

- Calculate ROI for project 3.

Total investment =1,20,000

Net profit = 75,000

Total no. of year = 5

Average annual Profit=75,000/5

=15,000Rs.

ROI= (15,000/1,20,000) *100 = **12.5%**

Net present value and Internal rate of return

Net present value (NPV)

- It is the sum of the present values of all future amounts.
- *Present value* is the value which a future amount is worth at present
- It takes into account the profitability of a project and the timing of the cash flows
- **Discounted Cash Flow (DCF)** is a cash flow summary adjusted to reflect the time value of money. DCF can be an important factor when evaluating or comparing investments, proposed actions, or purchases. Other things being equal, the action or investment with the larger DCF is the better decision. When discounted cash flow events in a cash flow stream are added together, the result is called the **Net Present Value (NPV).**
- When the analysis concerns a series of cash inflows or outflows coming at different future times, the series is called a **cash flow stream**. Each future cash flow has its own value today (its own present value). The sum of these present values is the **Net Present Value** for the cash flow stream.
- The size of the discounting effect depends on two things: the amount of time between now and each future payment (the number of discounting periods) and an interest rate called the **Discount Rate.** *Discount rate* is the annual rate by which we discount future earning

$$\text{Discount factor} = \frac{1}{(1 + r\%)^t}$$

The example shows that:

- As the number of discounting periods between now and the cash arrival increases, the present value decreases.
- As the discount rate (interest rate) in the present value calculations increases, the present value decreases.

Discount Factor Table

DISCOUNT FACTOR (p.a.) FOR A RANGE OF DISCOUNT RATES

Present Value of $1 in the Future at Discount Rate r%

Year	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%
0	1	1	1	1	1	1	1	1	1	1	1	1	1
1	0.9709	0.9615	0.9524	0.9434	0.9346	0.9259	0.9174	0.9091	0.9009	0.8929	0.8850	0.8772	0.8696
2	0.9426	0.9246	0.9070	0.8900	0.8734	0.8573	0.8417	0.8264	0.8116	0.7972	0.7831	0.7695	0.7561
3	0.9151	0.8890	0.8638	0.8396	0.8163	0.7938	0.7722	0.7513	0.7312	0.7118	0.6931	0.6750	0.6575
4	0.8885	0.8548	0.8227	0.7921	0.7629	0.7350	0.7084	0.6830	0.6587	0.6355	0.6133	0.5921	0.5718
5	0.8626	0.8219	0.7835	0.7473	0.7130	0.6806	0.6499	0.6209	0.5935	0.5674	0.5428	0.5194	0.4972
6	0.8375	0.7903	0.7462	0.7050	0.6663	0.6302	0.5963	0.5645	0.5346	0.5066	0.4803	0.4556	0.4323
7	0.8131	0.7599	0.7107	0.6651	0.6227	0.5835	0.5470	0.5132	0.4817	0.4523	0.4251	0.3996	0.3759
8	0.7894	0.7307	0.6768	0.6274	0.5820	0.5403	0.5019	0.4665	0.4339	0.4039	0.3762	0.3506	0.3269
9	0.7664	0.7026	0.6446	0.5919	0.5439	0.5002	0.4604	0.4241	0.3909	0.3606	0.3329	0.3075	0.2843
10	0.7441	0.6756	0.6139	0.5584	0.5083	0.4632	0.4224	0.3855	0.3522	0.3220	0.2946	0.2697	0.2472
11	0.7224	0.6496	0.5847	0.5268	0.4751	0.4289	0.3875	0.3505	0.3173	0.2875	0.2607	0.2366	0.2149
12	0.7014	0.6246	0.5568	0.4970	0.4440	0.3971	0.3555	0.3186	0.2858	0.2567	0.2307	0.2076	0.1869
13	0.6810	0.6006	0.5303	0.4688	0.4150	0.3677	0.3262	0.2897	0.2575	0.2292	0.2042	0.1821	0.1625
14	0.6611	0.5775	0.5051	0.4423	0.3878	0.3405	0.2992	0.2633	0.2320	0.2046	0.1807	0.1597	0.1413
15	0.6419	0.5553	0.4810	0.4173	0.3624	0.3152	0.2745	0.2394	0.2090	0.1827	0.1599	0.1401	0.1229
16	0.6232	0.5339	0.4581	0.3936	0.3387	0.2919	0.2519	0.2176	0.1883	0.1631	0.1415	0.1229	0.1069

Issues in NPV

- Choosing an appropriate discount rate is difficult
- Ensuring that the rankings of projects are not sensitive to small changes in discount rate

Guidelines:

- Use the standard rate prescribed by the organization
- Use interest rate + premium rate
- Use a target rate of return
- Rank the projects using various discount rates

Applying discount factors

NPV is the sum of the discounted cash flows for all the years of the 'project' (note that in NPV terms the lifetime of the completed application is included in the 'project')

The figure of RM618 means that RM618 more would be made than if the money were simply invested at 10%. An NPV of RM0 would be the same amount of profit would be generated as investing at 10%.

Year	Cash-flow	Discount factor(discount rate 10%)	Discounted cash flow

0	-100,000	1.0000	-100,000
1	10,000	0.9091	9,091
2	10,000	0.8264	8,264
3	10,000	0.7513	7,513
4	20,000	0.6830	13,660
5	100,000	0.6209	62,090
		NPV	**618**

The figure of RM618 means that RM618 more would be made than if the money were simply invested at 10%. An NPV of RM0 would be the same amount of profit would be generated as investing at 10%.

Example: Comparing Competing Investments with NPV.

Consider two competing investments in computer equipment. Each calls for an initial cash outlay of $100, and each returns a total a $200 over the next 5 years making net gain of $100. But the timing of the returns is different, as shown in the table below (Case A and Case B), and therefore the present value of each years return is different. The sum of each investments present values is called the Discounted Cash flow (DCF) or Net Present Value (NPV). Using a **10%** discount rate

Timing	Discount Rate(10%)	**CASE A**		**CASE B**	
		Net Cash Flow	**Present Value**	**Net Cash Flow**	**Present Value**
Now 0	**1**	– $100.00	– $100.00	– $100.00	– $100.00
Year 1	**0.9091**	$60.00	$54.54	$20.00	$18.18
Year 2	**0.8264**	$60.00	$49.59	$20.00	$16.52
Year 3	**0.7513**	$40.00	$30.05	$40.00	$30.05
Year 4	**0.6830**	$20.00	$13.70	$60.00	$41.10

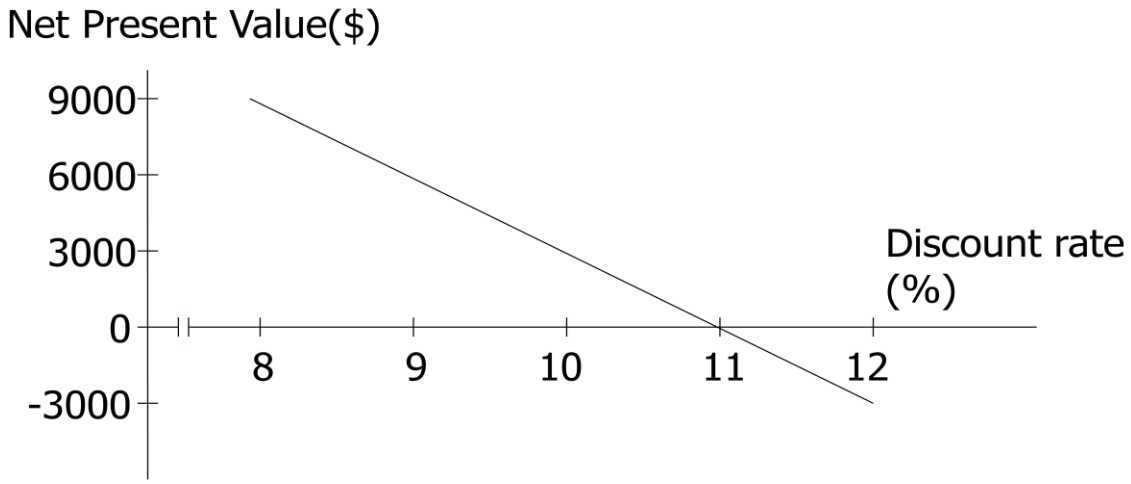
Year 5	**0.6209**	$20.00	$12.42	$60.00	$37.27
Total		**Net CF_A = $100.00**	**NPV_A = $60.30**	**Net CF_B = $100.00**	**NPV_B = $43.12**

Disadvantages

- May not be directly comparable with earnings from other investments or the costs of borrowing capital

Internal Rate of Return (IRR)

- The percentage discount rate that would produce a NPV of zero
- A relative measure. Use Excel to demonstrate the calculation of NPV and IRR
- The IRR being a relative measure does not indicate the absolute size of the return.

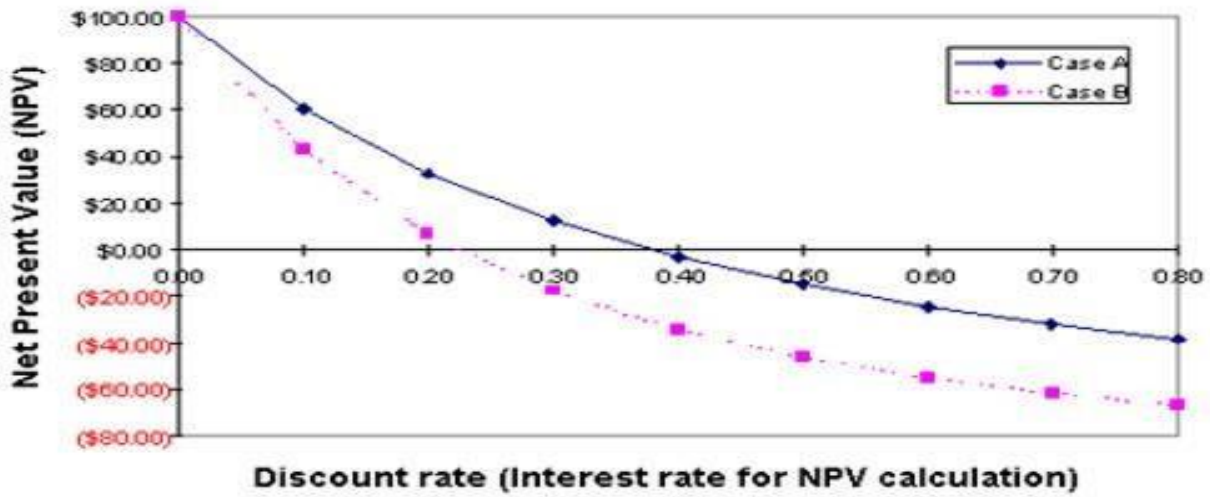


The IRR compares returns to costs by asking: **"What is the discount rate that would give the cash flow stream a net present value of 0?"**

		CASE A		**CASE B**	
Timing	Discount Rate(10%)	**Net Cash Flow**	**Present Value**	**Net Cash Flow**	**Present Value**
Now 0	**1**	– $100.00	– $100.00	– $100.00	– $100.00

Year 1	**0.9091**	$60.00	$54.54	$20.00	$18.18
Year 2	**0.8264**	$60.00	$49.59	$20.00	$16.52
Year 3	**0.7513**	$40.00	$30.05	$40.00	$30.05
Year 4	**0.6830**	$20.00	$13.70	$60.00	$41.10
Year 5	**0.6209**	$20.00	$12.42	$60.00	$37.27
			NPVA =		
Total		Net CFA = $100.00	$60.30	Net CFB = $100.00	NPVB = $43.12

IRR asks a different question of the same two cash flow streams. Instead of proposing a discount rate and finding the NPV of each stream (as with NPV), IRR starts with the net cash flow streams and ***finds*** the interest rate (discount rate) that produces an NPV of zero for each. The easiest way to see how this solution is found is with a graphical summary.



- These curves are based on the Case A and Case B cash flow figures in the table above. Here, however, we have used nine different interest rates, including 0.0 and 0.10, on up through 0.80.
- As you would expect, as the interest rate used for calculating NPV of the cash flow stream increases, the resulting NPV decreases.
- For Case A, an interest rate of 0.38 produces NPV = 0, whereas
- Case B NPV arrives at 0 with an interest rate of 0.22.

- Case A therefore has an IRR of 38%, Case B an IRR of 22%.
- IRR as the decision criterion, the one with the **higher IRR is the better choice.**