



IIT ROORKEE



NPTEL ONLINE
CERTIFICATION COURSE

Project Management for Managers

Lec – 17

Capital Budgeting techniques- II

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Ex: Find DPBP ????, if discount factor is 10%

Year	Cash flow
0	-140
1	30
2	40
3	50
4	60
5	45

$$DPBP = Y_0 - (Cu.PV_0) / (CF_1),$$

Y_0 = is the year just before the pay back period is attained

$CuPV_0$ = cumulative present value of Y_0

CF_1 = cash flow of pay back year



Ex: FIND DPBP, if discount factor is 10%

Year	Cash flow	PVF	PV	CuPV
0	-140	1	-140	-140
1	30	$1/(1+0.10) = 0.90$	27	-113
2	40	$1/(1+0.10)^2 = 0.82$	33.04	-79.96
3	50	$1/(1+0.10)^3 = 0.75$	37.55	-42.41
4	60	$1/(1+0.10)^4 = 0.68$	40.98	-1.43
5	45	$1/(1+0.10)^5 = 0.62$	27.94	26.51

$$\text{DPBP} = 4 - (-1.43/27.94) = 4.05 \text{ yrs}$$



Ex: Find DPBP ????, if DF=10%

Year	Cash flow
0	-300
1	80
2	80
3	180
4	180
5	180



Ex: Find DPBP, if DF=10%

Year	Cash flow	PVF	PV	CuPV
0	-300	1	-300	-300
1	80	0.909	72.72	-227.28
2	80	0.826	66.08	-161.2
3	180	0.751	135.18	-26.02
4	180	0.683	122.94	96.92
5	180	0.621	111.78	208.7

$$\text{DPBP} = 3 - (-26.02/122.94) = 3.21\text{yrs}$$



Profitability index

Profitability index (PI) : PI is the ratio of sum of cash inflows to sum of cash outflow, a necessary condition for a project to be feasible is that PI should be more than 1.

$$PI = (\text{sum of cash inflows}) / (\text{sum of cash outflow})$$

$$\text{Net profitability index} = PI - 1$$



Net Present Value

NPV: NPV is the most common approach used in the field of financial investment analysis.

It is very **simple** to use and evaluate on the basis of **wealth maximization objective**.

It is defined as the difference b/w the present value of cash inflows and present value of cash outflows .



Advantages of NPV

1. Considers all cash flows.
2. Considers time value of money.
3. Computes contribution towards wealth creation.
4. Allows expected changes in cost of capital.

The limitation of NPV

1. Requires pre-determination of DF.
2. Does not consider risk factors.



Determine PI and NPV, assuming DF as 10%, should we accept this project??

Year	Cash flow
0	-160
1	30
2	40
3	50
4	60
5	100



Determine PI and NPV, assuming DF as 10%

Year	Cash flow	PVF (10%)	PV	
	-160	1	-160	
1	30	$1/(1+0.10) = 0.9091$	27.27	} 200.56
2	40	$1/(1+0.10)^2 = 0.826$	33.06	
3	0	$1/(1+0.10)^3 = 0.751$	37.57	
4	60	$1/(1+0.10)^4 = 0.683$	40.57	
5	100	$1/(1+0.10)^5 = 0.621$	62.09	
		Total	40.56	

$$PI = 200.56/160 = 1.25$$

$$NPV = 200.56 - 160 = 40.56,$$

We should accept project.



Ex: Determine PI and NPV, assuming DF as 10%

Year	Cash flow
0	-140
1	30
2	40
3	50
4	60
5	45

Should we accept this project????



Ex: Determine PI and NPV, assuming DF as 10%

Year	Cash flow	PVF	PV	
0	-140	1	-140	
1	30	$1/1.10 = 0.90$	27	166.51
2	40	$1/(1.10)^2 = 0.82$	33.04	
3	50	0.75	37.55	
4	60	0.68	40.98	
5	45	0.62	27.94	
Total			26.51	

$$PI = 166.51/140 = 1.189$$

NPV = 166.51 - 140 = 26.51. Should we accept project????



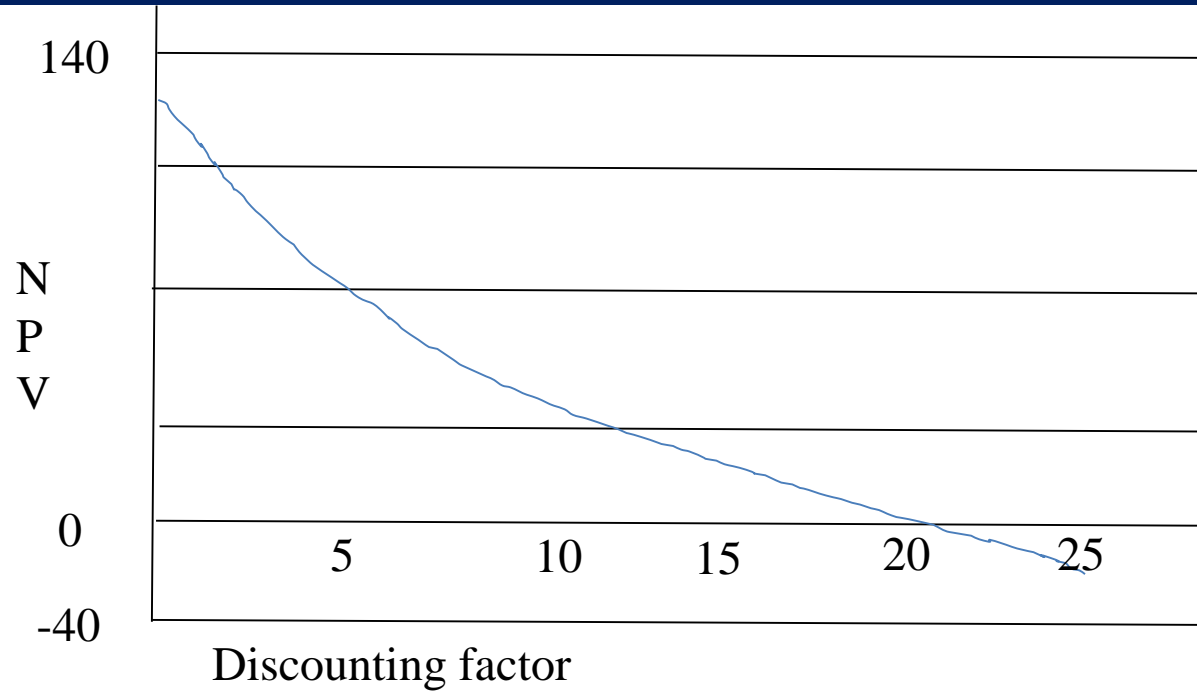
Internal Rate of Return (IRR): IRR is defined as the **discounting rate** which delivers a Net Present Value equal to zero.

A simple criterion can be stated to **accept a project if its rate of return exceeds the cost of capital and rejected if this IRR is less than cost of capital.**

IRR may result in number of complexities: Neglects the **size** of the project and **assumes** that cash flows are **reinvested at constant rate.**



The relationship b/w discounting rates and NPV is not a linear, and for calculation of exact IRR, this should be linear, can be assumes linear, if we take small piece.



Calculating IRR is a **tedious process**. It should be done with the help of **trial and error method**.

Continue **increasing “r”** to **decrease NPV till it reaches negative**.
And then interpolate b/w the consecutive “r” values where it is positive and negative, respectively.

The interpolation formula:

$IRR = r_0 + (NPV_0) / (NPV_1 - NPV_0)$, Where

r_0 = is the rate at which NPV is just positive,

NPV_0 = is just positive NPV,

NPV_1 = is just negative NPV

Calculate IRR??

Year	Cash flow
0	-160
1	30
2	40
3	50
4	60
5	100

Let us try at 18% and then 17% , at 18% NPV is just negative.



Year	Cash flow	18%		17 %	
		PVF	PV	PVF	PV
0	-160	1	-160	1	-160
1	30	$1/1.18=.847$	25.42	.855	25.64
2	40	$1/(1.18)^2 = .718$	28.73	.731	29.22
3	50	.609	30.43	.624	31.22
4	60	.516	30.95	.534	32.02
5	100	.437	43.71	.456	45.61
Total			-0.76		3.71

$$IRR = r_o + (NPV_o) / (NPV_1 - NPV_o),$$

$$IRR = 17 + 3.71 / (3.71 - (-0.76)) = 17.83\%$$



Discount rate 8%

Year	Cash Flow	PVF	PV
0	-1,000,000	1	-1,000,000
1	450,000	$1/(1+0.08)=0.92$	414000
2	400,000	$1/(1+0.08)^2=0.85$	340000
3	350,000	$1/(1+0.08)^3=0.79$	276500
4	300,000	$1/(1+0.08)^4=0.73$	219000
5	250,000	$1/(1+0.08)^5=0.68$	170000
NPV			419500

In the above example if you replace the 8% with a 25% the NPV will become zero, and that's your IRR. **Hence, the statement that IRR is the discount rate at which the NPV of a project becomes zero is true.**



Discount rate 25%

Cash flow			PVF	PV
-10,00,000	1	1	1	-1000000
4,50,000	1	1.25	0.8	360000
4,00,000	1	1.5625	0.64	256000
3,50,000	1	1.953125	0.512	179200
3,00,000	1	2.44140625	0.4096	122880
2,50,000	1	3.051757813	0.32768	81920
NPV				0



Selection of capital budgeting technique (NPV vs IRR) :
In capital budgeting , there are number of **different approaches** that can be used to **evaluate** any given project, and each approach has its own distinct **advantages and disadvantages** as discussed earlier.

All other things being equal, using IRR and NPV measurements to evaluate projects often results in the **same findings**.



- Over time, discounted cash flow methods have gained importance and internal rate of return is one of the most popular evaluation methods.
- Firms typically use multiple evaluation methods.
- Accounting rate of return and payback period are widely employed as supplementary evaluation methods.



However, there are number of projects for which **using IRR is not as effective as using NPV** to discount cash flows.

While **ranking** the various techniques, **NPV stands on top priority**, followed by IRR.

Why IRR is not as good as NPV is?

-IRR presumes that the same rate of return is available in other projects as well.

-If cash flows are not normal, IRR may arrive at multiple solutions.



Assessment of Basic Evaluation Methods

	<i>Net present value</i>	<i>IRR</i>	<i>Payback period</i>	<i>Accounting rate of return</i>
<i>Theoretical considerations</i>				
1. Does the method consider all cash flows	Yes	Yes	No	?
2. Does the method discount cash flows at the opportunity cost of funds ?	Yes	No	No	No
3. Does the method satisfy the principle of value additivity ?	Yes	No	?	?
4. From a set of mutually exclusive projects, does the method choose the project which maximize shareholder wealth ?	Yes	No	?	?



Assessment of Basic Evaluation Methods

	<i>Net present value</i>	<i>Internal rate of return</i>	<i>Payback period</i>	<i>Accounting rate of return</i>
<i>Practical considerations</i>				
1. Is the method simple ?	Yes	Yes	Yes	Yes
2. Can the method be used with limited information ?	No	No	Perhaps	Yes
3. Does the method give a relative measure ?	No	Yes	No	Yes



Survey: Evaluation Techniques in India

- **Internal rate of return**
- **Payback period**
- **Net present value**
- **Break-even analysis**
- **Profitability Index**



Financing of Projects

