PROJECT APPRAISAL

What is the Investing?

Investing is where you use money to make more money.

There are so many methods that we can use to improve our money such as ,

1. Invest in the bank
2. Invest in the stock exchange market
3. Invest in a business etc

There is a risk when we invest. Risk should be minimized.

Example: some banks pay low interest, but they are having low risk.

Some banks give high interest, but they are high risk also.

How can you tell whether an investment is risky? Or which investment is more risky than others?

There are many ways to compare investments, but two of the most popular ways are:

1. Net Present Value
2. Internal Rate of Return

First let us learn what Present Value is?

Present Value (PV)

Money **now** is more valuable than money **later on**.

Why? Because you can use money to make more money!

You could run a business, or buy something now and sell it later for more, or invest the money in the bank to earn interest.

Example

(1.) You can get 10% interest per annum on your money.

So **Rs. 1,000 now** can earn Rs.1,000 x 10% = **Rs. 100** in a year.

Your Rs **1,000 now** can become Rs.**1,100 in a year's time**.

Present Value Formula

$$PV = FV\frac{1}{(1+r)^n}$$

$FV = Future\ Value$
$r = rate\ of\ return$
$n = number\ of\ periods$

Examples

(1) Arjuna promised you to pay Rs.2,000 in 4 years time. What is the Present Value (using at 10% rate of discount)?

- The Future Value (FV) is Rs.2,0**00**,
- The interest rate (r) is 10%, which is **0.10** as a decimal, and
- The number of years (n) is 4.

So the Present Value of Rs.2, 000 **in 4 years** is:

$PV = FV / (1+r)^n$
$PV = Rs.2, 000 / (1 + 0.10)^4$
$PV = Rs.2, 000 / 1.10^4$
PV = Rs.1,366.03

It is saying that value is Rs. 1,366.03 **now** for Rs.**2,000 in 4 years** (at 10%).

(2) If you will get Rs.3,000 in 3 years , what is the present Value (discounting rate is 10%)

The Future Value (FV) is Rs.**3,000**,

The interest rate (r) is 10%, which is **0.10** as a decimal, and

The number of years (n) is **3**.

So the Present Value of Rs.3,000 **in 3 years** is:

$PV = FV / (1+r)^n$
$PV = Rs.3,000 / (1 + 0.10)^3$
$PV = Rs.3,000 / 1.10^3$
PV = Rs.**2,253.95**

It is saying that value is Rs. **2,253.95 now** for Rs.**3,000 in 3 years** (at 10%).

(3) What is value now if you get Rs. 6,500 in next year at the rate of 10%?

$PV = Rs.\ 6,500 / (1+0.10)^1 = Rs.\ 6,500 / 1.10 =$ Rs. **5,909.09** (to nearest cent)

(4) What is the value now if you get Rs. 6,500 in next year the rate of 15%?

PV = Rs.6,500 / $(1+0.15)^1$ = Rs. 6,500/ 1.15 = Rs.**5,652.17** (to nearest cent)

Net Present Value

The NPV of a project or investment reflects the degree to which cash inflow, or revenue, equals or exceeds the amount of investment capital required to fund it.

STEPS TO CALCULATION NPV

1. Determine your initial investment
2. Determine a time period to analyze.
3. Estimate your cash flows for each time period
4. Determine the appropriate discount rate.
5. Discount your cash flows.

Examples

(1) Amal needs Rs. 1,000 now, and will pay you back Rs. 1,350 in a year. Is that a good investment when you can get at 10% per year?

Cash OutFlow: Rs. 1,000 now

You invested Rs 1,000 now, so PV = **-** Rs **1,000**

Cash InFow: Rs 1,350 next year

PV = Rs 1,350 / $(1+0.10)^1$ = Rs 1.350 / 1.10 = Rs **1,227.28** (to nearest cent)

The Net Amount is:

Net Present Value = Rs 1,227.28 – 1,000 = Rs **227.28**

If the Net Present Value (NPV) is **positive it is good** (and negative is bad).

(2) Invest Rs.20,000 now and receive 3 yearly payments of Rs.5,000 each, plus Rs.12,000 in the 3rd year. Use 10% discount Rate. Find NPV.

Initial investment = Rs. 20,000

Period = 3years

Discount rate = 10%

Method 1

Year	Cash Flow	DCF @ 10%	Present Value
0	(20,000.00)	1.00	(20,000.00)
1	5,000.00	0.9091	4,545.45
2	5,000.00	0.8264	4,132.23
3	5,000.00	0.7513	3,756.57
3	12,000.00	0.7513	9,015.78
	NPV		**1,450.04**

Method 2

- Now: PV = - Rs 20,000
- Year 1: PV = Rs 5,000 / 1.10 = Rs 4,545.45
- Year 2: PV = Rs 5,000 / 1.10^2 = Rs 4,132.23
- Year 3: PV = Rs 5,000 / 1.10^3 = Rs 3,756.57
- Year 3 (final payment): PV = Rs 12,000 / 1.10^3 = Rs 9,015.78

Adding those and get:

NPV = - Rs 20,000 + Rs 4,545.45+ Rs 4,132.23+ Rs 3,756.57+ Rs 9,015.78 = Rs **1,450.04**

This investment should be accepted.

(3) A project with a 3 year life and a cost of Rs. 100,000 generates revenue of Rs. 25,000 in year 1, Rs. 45,000 in year 2, and Rs. 65, 000 in year 3. If the discount rate is 8%, what is the NPV of the project?

Method 1

Year	Cash Flow	DCF @ 8%	Present Value
0	(100,000.00)	1.00	(100,000.00)
1	25,000.00	0.9259	23,148.15
2	45,000.00	0.8573	38,580.25
3	65,000.00	0.7938	51,599.10
	NPV		**13,327.49**

NPV is positive then project should be accepted.

Method 2

- Now: PV = **-** Rs **100,000**
- Year 1: PV = Rs 25,000 / 1.08 = Rs **23,148.15**
- Year 2: PV = Rs 45,000 / 1.08^2 = Rs **38,580.25**
- Year 3: PV = Rs 65,000 / 1.08^3 = Rs **51,599.10**

Adding those up gets:

NPV = - Rs 100,000 + Rs **23,148.15**+ Rs **38,580.25**+ Rs **51,599.10**= Rs **13,327.49**

(4) A project with a 4 year life and a cost of Rs. 225,000 generates revenue of Rs. 48,000 in year 1, Rs. 67,000 in year 2, Rs. 95, 000 in year 3 and Rs. 110,000 in year 4. If the discount rate is 15%, Can be accepted the project?

Year	**Cash Flow**	**DCF @ 15%**	**Present Value**
0	(225,000.00)	1.00	(225,000.00)
1	48,000.00	0.8696	41,739.13
2	67,000.00	0.7561	50,661.63
3	95,000.00	0.6575	62,464.04
4	110,000.00	0.5718	62,892.86
	NPV		**(7,242.34)**

Project cannot be accepted due to negative NPV.

Method 2

- Now: PV = **-** Rs **225,000**
- Year 1: PV = Rs 48,000 / 1.15 = Rs **41,739.13**
- Year 2: PV = Rs 67,000 / 1.15^2 = Rs **50,661.63**
- Year 3: PV = Rs 95,000 / 1.15^3 = Rs **62,464.04**
- Year 4: PV = Rs 110,000 / 1.15^4 = Rs **62,892.86**

Adding those and get:

NPV = - Rs 225,000 + Rs **41,739.13**+ Rs **50,661.63**+ Rs **62,464.04+Rs.** 62,892.86 = Rs **(7,242.34)**

Internal Rate of Return (IRR)

Internal Rate of Return is the interest rate that makes the ***Net Present Value Zero.***

And that "guess and check" method is the common way to find it (though in that simple case it could have been worked out directly).

STEPS OF CALCULATION OF IRR

Step 1: Select 2 discount rates for the calculation of NPVs

You can start by selecting any 2 discount rates on a random basis that will be used to calculate the net present values in Step 2.

It is important not to select discount rates that are ridiculously distant from the IRR (e.g. 10% and 90%) as it could undermine accuracy.

Step 2: Calculate NPVs of the investment using the 2 discount rates

You shall now calculate the net present values of the investment on the basis of each discount rate selected in Step 1.

Step 3: Calculate the IRR

Using the 2 discount rates from Step 1 and 2 calculate net present values . Then you shall calculate the IRR

Step 4: Interpretation

The decision rule for IRR is that an investment should only be selected where the cost of capital (WACC) is lower than the IRR.

The decision rule above will lead to the same conclusion as the NPV analysis where only one investment is being considered.

Examples

(1) Invest Rs. 9,000 now, receive 3 yearly payments of Rs. 2,500 each, plus Rs. 4,000 in the 3rd year. Find IRR.

Let us try 10% discount rate:

Year	Cash Flow	DCF @ 10%	Present Value
0	(9,000.00)	1.00	(9,000.00)
1	2,500.00	0.9091	2,272.73
2	2,500.00	0.8264	2,066.12
3	2,500.00	0.7513	1,878.29
3	4,000.00	0.7513	3,005.26
	NPV		**222.39**

Let us try 12% discount rate:

Year	Cash Flow	DCF @ 12%	Present Value
0	(9,000.00)	1.00	(9,000.00)
1	2,500.00	0.8929	2,232.14
2	2,500.00	0.7972	1,992.98
3	2,500.00	0.7118	1,779.45
3	4,000.00	0.7118	2,847.12
	NPV		**(148.30)**

So close. Maybe 11.2%

Year	Cash Flow	DCF @ 11.2%	Present Value
0	(9,000.00)	1.00	(9,000.00)
1	2,500.00	0.8993	2,249
2	2,500.00	0.8088	2,022
3	2,500.00	0.7273	1,819
3	4,000.00	0.7273	2,910
	NPV		**0**

Then IRR is **11.2 %**

Method 2

Let us try 10%

Now: PV = **-Rs. 9,000**

- Year 1: PV = Rs. 2,500 / 1.10 = Rs. 2,272.73
- Year 2: PV = = Rs. 2,500 / 1.10^2 = Rs. 2,066.12
- Year 3: PV = = Rs. 2,500 / 1.10^3 = Rs. 1,878.29
- Year 3 (final payment): PV = Rs. 4,000 / 1.10^3 = Rs. 3,005.26
- Adding those up gets: **NPV** = Rs **222.39**

Let us try at 12% discount rate:

- Now: PV = **-Rs. 9,000**
- Year 1: PV = Rs. 2,500 / 1.12 = Rs. 2,232.14
- Year 2: PV = = Rs. 2,500 / 1.12^2 = Rs. 1,992.98
- Year 3: PV = = Rs. 2,500 / 1.12^3 = Rs. 1,779.45
- Year 3 (final payment): PV = Rs. 4,000 / 1.12^3 = Rs. 2,847.12
- Adding those up gets: **NPV** = Rs **(148.30)**

So close. Maybe 11.2%

- Now: PV = **-Rs. 9,000**
- Year 1: PV = Rs. 2,500 / 1.112 = Rs. 2,249
- Year 2: PV = = Rs. 2,500 / 1.112^2 = Rs. 2,022
- Year 3: PV = = Rs. 2,500 / 1.112^3 = Rs. 1,819
- Year 3 (final payment): PV = Rs. 4,000 / 1.112^3 = Rs. 2,910
- Adding those up gets: **NPV** = Rs. 0

Then IRR is 11.2 %

(2) Find the IRR of an investment having initial cash outflow of Rs. 280,000. The cash inflows at first, second, third and fourth years are expected to be Rs. 72,000, Rs. 97,000, Rs.105,000 and Rs, 110,000 respectively.

Year	Cash Flow	DCF @ 10%	Present Value
0	(280,000.00)	1.00	(280,000.00)
1	72,000.00	0.9091	65,454.55
2	97,000.00	0.8264	80,165.29
3	105,000.00	0.7513	78,888.05
4	110,000.00	0.6830	75,131.48
	NPV		**19,639.37**

Let us try at 13%

Year	Cash Flow	DCF @ 13%	Present Value
0	(280,000.00)	1.00	(280,000.00)
1	72,000.00	0.8850	63,716.81
2	97,000.00	0.7831	75,965.23
3	105,000.00	0.6931	72,770.27
4	110,000.00	0.6133	67,465.06
	NPV		**(82.63)**

Assume that r is 10%.
NPV at 10% discount rate = Rs. 19,639.37

Since NPV is greater than zero we have to increase discount rate, thus
NPV at 13% discount rate = Rs. **(82.63)**

Since NPV is fairly close to zero at 13% value of r, therefore
IRR ≈ 13%

Formula

$$\textbf{Internal Rate of Return} = R1 + \frac{NPV1 \times (R2 - R1)}{(NPV1 - NPV2)}$$

Where:

R1 = Lower discount rate

R2 = Higher discount rate

NPV1 = Higher Net Present Value (derived from R1)

NPV2 = Lower Net Present Value (derived from R2)

(3) Mr. Amila is considering to invest Rs. 350,000 in a Hardware business. The cash inflows during the first, second and third years are expected to be Rs. 125,000, Rs. 150,000 and Rs, 170,000 respectively.

Cost of capital is 11%

Calculate the IRR for the proposed investment and interpret your answer.

Step 1 : Select 2 discount rates

R1 = 10% and R2 = 15%

Step 1 : Find NPVs of the investment using 2 discount rates

at 10%

Year	Cash Flow	DCF @ 10%	Present Value
0	(350,000.00)	1.00	(350,000.00)
1	125,000.00	0.9091	113,636.36
2	150,000.00	0.8264	123,966.94
3	170,000.00	0.7513	127,723.52
	NPV1		**15,326.82**

at 15%

Year	Cash Flow	DCF @ 15%	Present Value
0	(350,000.00)	1.00	(350,000.00)
1	125,000.00	0.8696	108,695.65
2	150,000.00	0.7561	113,421.55
3	170,000.00	0.6575	111,777.76
	NPV2		**(16,105.04)**

Step 3 : Calculate the IRR

$$\textbf{Internal Rate of Return} = R1\% + \frac{NPV1 \times (R2 - R1)\%}{(NPV1 - NPV2)}$$

$$= 10\% + \frac{\textbf{15,326.82} \times (15 - 10)\%}{(\textbf{15,326.82} - (\textbf{-16,105.04}))}$$

$$= 10\% + \frac{\textbf{15,326.82} \times 5\%}{(\textbf{15,326.82} + \textbf{16,105.04})}$$

$$= 10\% + 2.44\%$$

IRR = **12.44%**

Step 4 : Interpretation
The investment should be accepted by Amila because the cost of capital (i.e 11 %) is lower than the IRR of 12.44%

IRR Calculation

The calculation of IRR is a bit complex. We know that at IRR, Net Present Value (NPV) is zero, thus:

NPV = 0; or

PV of future cash flows − Initial Investment = 0; or

$$\left[\frac{CF_1}{(1+r)^1} + \frac{CF_2}{(1+r)^2} + \frac{CF_3}{(1+r)^3} + \ldots\right] - \text{Initial Investment} = 0$$

Where,

r is the internal rate of return;
CF_1 is the period one net cash inflow;
CF_2 is the period two net cash inflow,
CF_3 is the period three net cash inflow, and so on ...

But the problem is, we cannot isolate the variable **r** (=internal rate of return) on one side of the above equation. However, there are alternative procedures which can be followed to find IRR. The simplest of them is described below:

1. Guess the value of r and calculate the NPV of the project at that value.
2. If NPV is close to zero then IRR is equal to r.
3. If NPV is greater than 0 then increase r
4. If NPV is smaller than 0 then decrease r.
5. Recalculate NPV using the new value of r and go back to step 2.

Example

Find the IRR of an investment having initial cash outflow of Rs. 250,000. The cash inflows during the first, second, third and fourth years are expected to be Rs. 66,000, Rs. 78,000, Rs. 92,000 and Rs. 105,000 respectively.

Year	Cash Flow	DCF @ 10%	Present Value
0	(250,000.00)	1.00	(250,000.00)
1	66,000.00	0.9091	60,000.00
2	78,000.00	0.8264	64,462.81
3	92,000.00	0.7513	69,120.96
4	105,000.00	0.6830	71,716.41
	NPV		**15,300.18**

NPV at 10% is = Rs. 15,300.18

Since NPV is greater than zero we have to increase discount rate,

When DCF 12%

Year	Cash Flow	DCF @ 12%	Present Value
0	(250,000.00)	1.00	(250,000.00)
1	66,000.00	0.8929	58,928.57
2	78,000.00	0.7972	62,181.12
3	92,000.00	0.7118	65,483.78
4	105,000.00	0.6355	66,729.40
	NPV		**3,322.87**

NPV at 12% is = Rs. 3,322.87

But it is still greater than zero we have to further increase the discount rate,

When DCF 13%

Year	Cash Flow	DCF @ 13%	Present Value
0	(250,000.00)	1.00	(250,000.00)
1	66,000.00	0.8850	58,407.08
2	78,000.00	0.7831	61,085.44
3	92,000.00	0.6931	63,760.61
4	105,000.00	0.6133	64,398.47
	NPV		**(2,348.40)**

NPV at 13% is = Rs. (2,348.40)

When DCF 12.5%

Year	Cash Flow	DCF @ 12.5%	Present Value
0	(250,000.00)	1.00	(250,000.00)
1	66,000.00	0.8889	58,666.67
2	78,000.00	0.7901	61,629.63
3	92,000.00	0.7023	64,614.54
4	105,000.00	0.6243	65,550.98
	NPV		**461.82**

NPV at 12.5% is = Rs. 461.82

Since NPV is fairly close to zero at 12.5%

$$\textbf{Internal Rate of Return} = R1\% + \frac{NPV1 \times (R2 - R1)\%}{(NPV1 - NPV2)}$$

$$= 10\% + \frac{\mathbf{15{,}300.18} \times (13 - 10)\%}{(\mathbf{15{,}300.18} - (\mathbf{-2348.40}))}$$

$$= 10\% + \frac{\mathbf{15{,}300.18} \times 5\%}{\mathbf{(15{,}326.82 + 2348.4)}}$$

$$= 10\% + 2.6\%$$

IRR = **12.6%**

Note that in an exam situation a candidate could choose any discount rate to start. In choosing the discount rates, try to get one positive rate and one negative rate. Then apply IRR formula.