INVESTMENT APPRAISAL

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INVESTMENT APPRAISAL

- **A means of assessing whether an investment project is worthwhile or not.**
- Investment appraisal is a collection of techniques used to identify the attractiveness of an investment.
- The purpose of investment appraisal is to assess the viability of project, programme and the value they generate.
- The primary objective of investment appraisal is to place a value on benefits so that the costs are justified.
- Investment project could be the purchase of a new PC for a small firm, a new piece of equipment in a manufacturing plant, a whole new factory, etc.

INVESTMENT APPRAISAL

- **Investment** is the purchase of productive capacity
  - Buy equipment/machinery or build new plant to: Increase capacity (amount that can be produced) which means: Demand can be met and this generates sales revenue
  - Increased efficiency and productivity
- **Depreciation and Residual Value**
  - Residual value - The amount a company expects to be able to sell a fixed asset for at the end of its useful life.

INVESTMENT APPRAISAL

- Investment therefore assumes that the investment will yield future income streams.
- Investment appraisal is all about assessing these income streams against the cost of the investment

A fork lift may be an important item but what does it contribute to overall sales? How long and how much work would it have to do to repay its initial cost?

EVALUATION METHODS

1. *Payback period*
2. *Accounting Rate of Return (ARR)*
3. *Discounted cash flow methods (DCF) / Net present value (NPV)*
4. *Internal rate of return (IRR)*

1. PAYBACK PERIOD

- Payback period is a simple technique for assessing an investment by the length of time it would take to repay it and is usually preferred by small businesses.
- Calculating the length of time it takes to recover the initial cost of an investment;
- **Firms can use this technique in one of two ways:**
  - Firstly, a firm could set an upper limit on the time allowed for payback, and any project which is not expected to payback within this period is rejected.
  - Secondly, when faced with a choice of projects, the payback method can be used to rank projects according to the speed at which they payback.

1. PAYBACK PERIOD CONT..

- **However, the payback method ignores the following two (2) important factors:**
  - The total return on the investment project (i.e. the earnings after payback).
  - Time value of money
- The payback method clearly discriminates against projects which produce a slow but substantial return, resulting in the danger that highly profitable projects will be rejected because of the delay in producing a return (yield).

1. PAYBACK PERIOD CONT..

- The formula is:

  Payback period = Original cost (initial cost)

  Ann. cash flows (annual operating savings)

  = X.X years

*Note: Annual cash flow can be a cost saving as well.

- Payback also provides more focus on the earlier cash flows arising from a project, as these are both more certain and more important if an organisation has liquidity concerns.

1. PAYBACK PERIOD CONT..

- *Advantages are*:
  - is simple to calculate and understand
  - has management appeal as a screening device in rapidly changing industries (often used as a first screening method for an investment)
  - rank projects
  - reject or accept projects
- Disadvantages are:
  - requires information on the revenue the investment generates
  - earnings after payback is ignored.
  - time value of money ignored

1. PAYBACK PERIOD - EXAMPLES

i. A manufacturing firm is considering investing $450,000 in new machinery. The equipment is expected increase the firm's cashflow by $150,000 per year. **How long is the payback period ?**

- After 1 year, the cashflow will be $150,000
- After 2 years, the cashflow will be $300,000
- After 3 years, the cashflow will be $450,000

Payback period = $450000/$150000 = 3

Therefore, the Payback period is 3 years.

1. PAYBACK PERIOD - EXAMPLES

i. A manufacturing firm is considering investing $500,000 in new machinery. The equipment is expected increase the firm's cashflow by $150,000 per year. **How long is the payback period ?**

Payback period = $500,000/$150,000 = 3 1/3 years

Therefore, the Payback period is 3 years & 4 months.

ii. A machine costs $600,000. It produces items that sell at $5 each and produces 60,000 units per year. What is the Payback period (years)?

1. PAYBACK PERIOD CONT..

What happens when the **net cash inflows differ** from year to year?

1. PAYBACK PERIOD – EXAMPLES

- Adam Company is evaluating a capital expenditure proposal that requires an initial investment of $50,000. Net cash inflows differ from year to year.

Year	Net Cash Inflow	Unrecovered Investment
0	$ 0	$50,000
1	15,000	
2	25,000	
3	40,000	

$10,000 is needed in Year 3 to complete the recovery.

$10,000 of $40,000 is needed in Year 3 to complete the recovery of the initial investment => 0.25 (10,000 / 40,000) year
Thus, the payback period is 2.25 years.

1. PAYBACK PERIOD -EXAMPLES

Each of the three alternative projects below involve an initial cost of $ 1 million, and produce net cash flow as shown:

Project	Year 1	Year 2	Year 3	Year 4	Year 5
A	$ 0 m	$ 0.5 m	$ 0.5 m	$ 0.5 m	$ 0.5 m
B	$ 0.5 m	$ 0.5 m	$ 0.5 m	$ 0 m	$ 0 m
C	$ 0 m	$ 0 m	$ 0.5 m	$ 1 m	$ 1 m

- **Project A pays back in 3 years (£ 0 in year 1 + £ 0.5m in year 2 + £ 0.5m in year 3).**
- **Project B pays back in 2 years (£ 0.5m in year 1 + £ 0.5m in year 2).**
- **Project C pays back in 3 1/2 years (£ 0 in year 1 + £ 0 in year 2 + £ 0.5m in year 3 + half of the £ 1m in year 4).**
- Using **'The Pay-back Method'** to decide between these projects, project B would be selected. But if you looked at the total revenue over the full life of each project, project C actually brings more cash into the business and would be the better project to select.

2. ACCOUNTING RATE OF RETURN

A comparison of the profit generated by the investment with the cost of the investment. (The amount of profit, or return, an individual can expect based on an investment made.)

$$ARR = \frac{\text{average annual accounting profit*}}{\text{average capital invested / Initial Investment}}$$

Average investment = (book value at year 1+ book value at end of useful life) / 2

Average annual profit = total profit over investment period/number of years

*Average annual accounting profit is after incremental expenses (including depreciation).

2. ACCOUNTING RATE OF RETURN - EXAMPLES

An investment is expected to yield cash flows of £10,000 annually for the next 5 years. The initial cost of the investment is £20,000.

- Total profit therefore is: £30,000
- Annual profit = £30,000 / 5

  = £6,000
- ARR = 6,000/20,000 x 100

  = 30%
- A worthwhile return?

2. ACCOUNTING RATE OF RETURN - EXAMPLES

- Example: The **total** profit from a project over the past five years is $50,000. During this span, a **total** investment of $250,000 has been made. Calculate the ARR.

- Answer: The average annual profit is $10,000 ($50,000/5 years) and the average annual investment is $50,000 ($250,000/5 years). Therefore, the accounting rate of return is 20% ($10,000/$50,000).

2. ACCOUNTING RATE OF RETURN - EXAMPLES

- Example: An **initial** investment of $130,000 is expected to generate annual cash inflow of $32,000 for 6 years. Depreciation is allowed on the straight line basis. It is estimated that the project will generate scrap value of $10,500 at end of the 6th year. Calculate its accounting rate of return assuming that there are no other expenses on the project.

Solution

Annual Depreciation = (Initial Investment – Scrap Value) ÷ Useful Life in Years

Annual Depreciation = ($130,000 – $10,500) ÷ 6 ≈ $19,917

Average Accounting Income = $32,000 – $19,917 = $12,083

Average Investment = $(130,000+10500)/2 = $70250

Accounting Rate of Return = $12,083 ÷ $70250 ≈ 17.2%

2. ACCOUNTING RATE OF RETURN - EXAMPLES

- Example: XYZ Company is looking to invest in some new machinery to replace its current malfunctioning one. The new machine, which costs $420,000, would increase annual revenue by $200,000 and annual expenses by $50,000. The machine is estimated to have a useful life of 12 years and zero salvage value. Calculate ARR.

Solution

Calculate the depreciation expense per year: $420,000 / 12 = $35,000

Calculate the average annual profit: $200,000 – ($50,000 + $35,000) = $115,000

Use the formula: ARR = $115,000 / $420,000 = 27.4%

Therefore, this means that for every dollar invested, the investment will return a profit of about 27 cents.

2. ACCOUNTING RATE OF RETURN - EXAMPLES

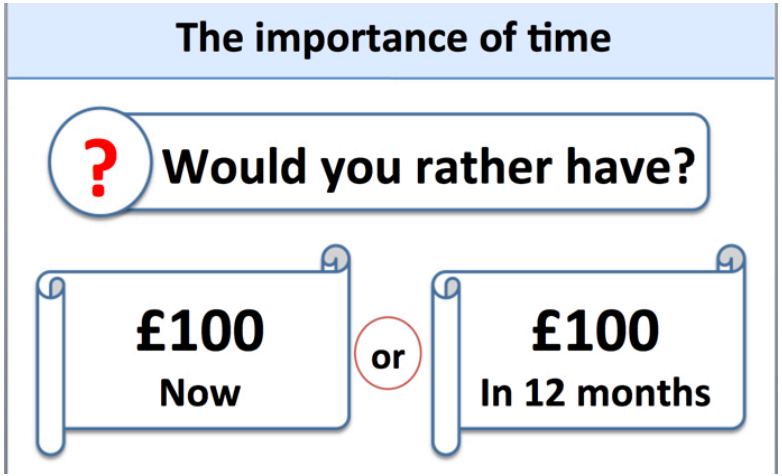
- Simple to calculate, easy to understand
- Time value of money is ignored
- Considered as a too simple measure
- E.g. If the ARR is equal to 5%, this means that the project is expected to earn five cents for every dollar invested per year.
- In terms of decision making, if the ARR is equal to or greater than the required rate of return, the project is acceptable because the company will earn at least the required rate of return.
- If the ARR is less than the required rate of return, the project should be rejected. Therefore, the higher the ARR, the more profitable the investment.

3. DISCOUNTED CASH FLOW (DCF) / NET PRESENT VALUE (NPV)

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

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

"**Net present value** is the present value of the cash flows at the required rate of return of your project compared to your initial investment"

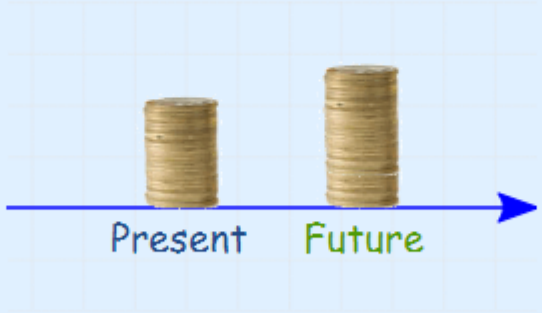


3. NET PRESENT VALUE (NPV) CONT..

Example: Let us say you can get 10% interest on your money.

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

Your **$1,000 now** becomes **$1,100 next year**.



So $1,000 now is the **same** as $1,100 next year (at 10% interest):

We say that $1,100 next year has a **Present Value** of **$1,000**.

Present Value *$1,000* — 10% — *Future Value* *$1,100*

Because $1,000 can become $1,100 in one year (at 10% interest).

3. NET PRESENT VALUE (NPV)

- Net present value is the difference between the present value of cash inflows and the present value of cash outflows that occur as a result of undertaking an investment project.
- Takes into account the fact that money values change with time.
- How much would you need to invest today to earn x amount in y years time?
- Value of money is affected by interest rates.
- NPV helps to take these factors into consideration.
- Shows you what your investment would have earned in an alternative investment regime.

3. NET PRESENT VALUE (NPV) CONT..

- **The principle:**
- How much would you have to invest now to earn £100 in one year's time if the interest rate was 5%?
- The amount invested would need to be: £95.24 (100/1.05)
- Allows comparison of an investment by valuing cash payments on the project and cash receipts expected to be earned over the lifetime of the investment at the same point in time, i.e the present.

3. NET PRESENT VALUE (NPV) CONT..

- **NPV can be either;**
- **Positive NPV:**
  - If present value of cash inflows is greater than the present value of the cash outflows, the net present value is said to be positive and the investment proposal is considered to be acceptable.
- **Zero NPV:**
  - If present value of cash inflow is equal to present value of cash outflow, the net present value is said to be zero and the investment proposal is considered to be acceptable.
- **Negative NPV:**
  - If present value of cash inflow is less than present value of cash outflow, the net present value is said to be negative and the investment proposal is rejected.

3. NET PRESENT VALUE (NPV) CONT..

$$PV = \frac{\text{Future Value}}{(1 + i)^n}$$

- Where, i = interest rate/discount rate

  n = number of years
- The PV of £1 @ 10% in 1 years time is 0.9090
- If you invested 0.9090p today and the interest rate was 10% you would have £1 in a year's time.
- Discount rate is determined by the company.

3. NET PRESENT VALUE (NPV) CONT..

$$\mathrm{NPV} = \sum_{n=0}^{N} \frac{C_n}{(1+r)^n}$$

Present Value Tables

Formula: $PV = 1 / (1 + i)^n$

n / i	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%
1	0.9901	0.9804	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	0.9803	0.9612	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	0.9706	0.9423	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	0.9610	0.9238	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	0.9515	0.9057	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	0.9420	0.8880	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	0.9327	0.8706	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	0.9235	0.8535	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	0.9143	0.8368	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	0.9053	0.8203	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	0.8963	0.8043	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	0.8874	0.7885	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	0.8787	0.7730	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	0.8700	0.7579	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	0.8613	0.7430	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	0.8528	0.7284	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
17	0.8444	0.7142	0.6050	0.5134	0.4363	0.3714	0.3166	0.2703	0.2311	0.1978	0.1696	0.1456	0.1252	0.1078	0.0929
18	0.8360	0.7002	0.5874	0.4936	0.4155	0.3503	0.2959	0.2502	0.2120	0.1799	0.1528	0.1300	0.1108	0.0946	0.0808
19	0.8277	0.6864	0.5703	0.4746	0.3957	0.3305	0.2765	0.2317	0.1945	0.1635	0.1377	0.1161	0.0981	0.0829	0.0703
20	0.8195	0.6730	0.5537	0.4564	0.3769	0.3118	0.2584	0.2145	0.1784	0.1486	0.1240	0.1037	0.0868	0.0728	0.0611
21	0.8114	0.6598	0.5375	0.4388	0.3589	0.2942	0.2415	0.1987	0.1637	0.1351	0.1117	0.0926	0.0768	0.0638	0.0531
22	0.8034	0.6468	0.5219	0.4220	0.3418	0.2775	0.2257	0.1839	0.1502	0.1228	0.1007	0.0826	0.0680	0.0560	0.0462
23	0.7954	0.6342	0.5067	0.4057	0.3256	0.2618	0.2109	0.1703	0.1378	0.1117	0.0907	0.0738	0.0601	0.0491	0.0402
24	0.7876	0.6217	0.4919	0.3901	0.3101	0.2470	0.1971	0.1577	0.1264	0.1015	0.0817	0.0659	0.0532	0.0431	0.0349
25	0.7798	0.6095	0.4776	0.3751	0.2953	0.2330	0.1842	0.1460	0.1160	0.0923	0.0736	0.0588	0.0471	0.0378	0.0304
26	0.7720	0.5976	0.4637	0.3607	0.2812	0.2198	0.1722	0.1352	0.1064	0.0839	0.0663	0.0525	0.0417	0.0331	0.0264
27	0.7644	0.5859	0.4502	0.3468	0.2678	0.2074	0.1609	0.1252	0.0976	0.0763	0.0597	0.0469	0.0369	0.0291	0.0230
28	0.7568	0.5744	0.4371	0.3335	0.2551	0.1956	0.1504	0.1159	0.0895	0.0693	0.0538	0.0419	0.0326	0.0255	0.0200
29	0.7493	0.5631	0.4243	0.3207	0.2429	0.1846	0.1406	0.1073	0.0822	0.0630	0.0485	0.0374	0.0289	0.0224	0.0174
30	0.7419	0.5521	0.4120	0.3083	0.2314	0.1741	0.1314	0.0994	0.0754	0.0573	0.0437	0.0334	0.0256	0.0196	0.0151

3. NET PRESENT VALUE (NPV) CONT..

Advantages of using NPV

- Takes account of time value of money, placing emphasis on earlier cash flows
- Looks at all the cash flows involved through the life of the project
- Use of discounting reduces the impact of long-term, less likely cash flows
- Has a decision-making mechanism – reject projects with negative NPV

Disadvantages of using NPV

- More complicated method – users may find it hard to understand
- Difficult to select the most appropriate discount rate – may lead to good projects being rejected
- The NPV calculation is very sensitive to the initial investment cost
- Relies on the use of an appropriate discount factor

3. NET PRESENT VALUE (NPV) – EXAMPLE 01

The management of Fine Electronics Company is considering to purchase an equipment to be attached with the main manufacturing machine. The equipment will cost $6,000 and will increase annual cash inflow by $2,200. The useful life of the equipment is 6 years. After 6 years it will have no salvage value. The management wants a 10% (discount rate) return on all investments.

- **Required:**
    i. Compute net present value (NPV) of this investment project.
    ii. Should the equipment be purchased according to NPV analysis?

3. NET PRESENT VALUE (NPV) – SOLUTION 01

i. **Computation of net present value:** Method 01

Year	Cashflow ($)	Discount Factor (DF) @ rate of 10%	Present Value (PV)
0	(6000)	1.000	(6000)
1	2200	0.909	1999.80
2	2200	0.826	1817.20
3	2200	0.751	1652.20
4	2200	0.683	1502.60
5	2200	0.621	1366.20
6	2200	0.564	1240.80
			3578.80 → NPV

3. NET PRESENT VALUE (NPV) – SOLUTION 01

i. **Computation of net present value:** Method 02

Year	Cashflow ($)	Discount Factor (DF) @ rate of 10%	Present Value (PV)
0	(6000)	1.000	(6000)
1 - 6	2200	4.355	9581
			3581 → NPV

3. NET PRESENT VALUE (NPV) – SOLUTION 01

ii. **Purchase decision:**

- Yes, the equipment should be purchased because the net present value is positive ($ 3581). Having a positive net present value means the project promises a rate of return that is higher than the minimum rate of return required by management (10% in the above example).
- In the above example, the minimum required rate of return is 10%. It means if the equipment is not purchased and the money is invested elsewhere, the company would be able to earn 10% return on its investment. The minimum required rate of return (10% in our example) is used to discount the cash inflow to its present value and is, therefore, also known as discount rate.

3. NET PRESENT VALUE (NPV) – EXAMPLE 02

- **"Cost reduction project"**
- Smart Manufacturing Company is planning to reduce its labor costs by automating a critical task that is currently performed manually. The automation requires the installation of a new machine. The cost to purchase and install a new machine is $15,000. The installation of machine can reduce annual labor cost by $4,200. The life of the machine is 15 years. The salvage value of the machine after fifteen years will be zero. The required rate of return of Smart Manufacturing Company is 12%.
- Should Smart Manufacturing Company purchase the machine?

3. NET PRESENT VALUE (NPV) – SOLUTION 02

- According to net present value method, Smart Manufacturing Company should purchase the machine because the present value of the **cost savings** is greater than the present value of the **initial cost** to purchase and install the machine.

Year	Cashflow ($)	Discount Factor (DF) @ rate of 12%	Present Value (PV)
0	(15000)	1.000	(15000)
1 - 15	4200	6.811	28606.2
			13606.2 → NPV

3. NET PRESENT VALUE (NPV) – EXAMPLE 03

- **"Uneven cash flow projects"**
- A project requires an initial investment of $225,000 and is expected to generate the following net cash inflows:
  - **Year 1:** $95,000
  - **Year 2:** $80,000
  - **Year 3:** $60,000
  - **Year 4:** $55,000
- **Required:** Compute net present value of the project if the minimum desired rate of return is 12%.

3. NET PRESENT VALUE (NPV) – SOLUTION 03

- The cash inflow generated by the project is uneven. Therefore, the present value would be computed for each year separately:

Year	Present value of $1 at 12%	Cash flow	Present value of cash flow
1	0.893*	$95,000	$ 84,835
2	0.797	80,000	63,760
3	0.712	60,000	42,720
4	0.636	55,000	34,980
Total			$ 226,295
Initial investment			(225,000)
Net present value			$ 1,295

* The project seems attractive because its net present value is positive.

3. NET PRESENT VALUE (NPV) CONT..

- **"Choosing among several alternative investment proposals"**
- If limited funds but several alternative proposals.
- If each alternative requires the same amount of investment, the one with the highest net present value is preferred.
- But if each proposal requires a different amount of investment, then proposals are ranked using an index called **present value index (**or **profitability index)**.
- The proposal with the highest present value index is considered the best.
- Present value index is computed using the following *formula*:

$$\text{Present value/profitability index} = \frac{\text{Present value of cash inflows}}{\text{Investment required}}$$

3. NET PRESENT VALUE (NPV) – EXAMPLE 04

- Choose the most desirable investment proposal from the following alternatives using profitability index method:

	Proposal X	Proposal Y	Proposal Z
Present value of cash inflow	$ 212,000	$ 171,800	$ 185,200
Investment required	(200,000)	(160,000)	(180,000)
Net present value	$ 12,000	$ 11,800	$ 5,200

3. NET PRESENT VALUE (NPV) – SOLUTION 04

- Because each investment proposal requires a different amount of investment, the most desirable investment can be found using present value index. Present value index of all three proposals is computed below:
  - **Proposal X:** 212,000/200,000 = 1.06
  - **Proposal Y:** 171,800/160,000 = 1.07
  - **Proposal Z:** 185,200/180,000 = 1.03
- Proposal X has the highest net present value but is not the most desirable investment.
- The present value indexes show proposal Y as the most desirable investment because it promises to generate 1.07 present value for each dollar invested, which is the highest among three alternatives.

3. NET PRESENT VALUE (NPV) CONT..

Example

- A firm is deciding on investing in an energy efficiency system. Two possible systems are under investigation.
- A yields **quicker results** in terms of energy savings than the B, but the B may be **more efficient later**.
- Which should the firm invest in?

3. NET PRESENT VALUE (NPV) CONT..

Answer

- **System A represents the better investment.**
- System B yields the same return after six years but the returns of System A occur faster and are worth more to the firm than returns occurring in future years even though those returns are greater.
- The net present value is higher if the income amounts are larger, or if they come sooner, or if the discount rate is lower.
- The net present value is lower if the income amounts are smaller, or if they come later, or if the discount rate is higher.

3. NET PRESENT VALUE (NPV) CONT..

Answer Cont…

System A

Year	Cash Flow (£)	Discount Factor (4.75%)	Present Value (£) (CF x DF)
0	- 600,000	1.00	-600,000
1	+75,000	0.9546539	71,599.04
2	+100,000	0.9113641	91,136.41
3	+150,000	0.8700374	130,505.61
4	+200,000	0.8305846	166,116.92
5	+210,000	0.7929209	166,513.39
6	+150,000	0.7569650	113,544.75
Total	**285,000**		NPV **=139,416**

1/(1.0475)^2

NPV is high

3. NET PRESENT VALUE (NPV) CONT..

Answer Cont… **System B**

Year	Cash Flow (£)	Discount Factor (4.75%)	Present Value (£) (CF x DF)
0	- 600,000	1.00	-600,000
1	+25,000	0.9546539	23,866.35
2	+75,000	0.9113641	68,352.31
3	+85,000	0.8700374	73,953.18
4	+100,000	0.8305846	83,058.46
5	+150,000	0.7929209	118,938.10
6	+450,000	0.7569650	340,634.30
Total	**285,000**		**NPV =108,802.70**

NPV is low

CONVERTING FUTURE CASH INFLOWS TO THEIR EQUIVALENT PRESENT VALUES

Present Value Table for Single-Amount Cash Inflows

Period	Present Value Factor for $1		
	10%	12%	14%
1	0.909091	0.892857	0.877193
2	0.826446	0.797194	0.769468
3	0.751315	0.711780	0.674972
4	0.683013	0.635518	0.592080
5	0.620921	0.567427	0.519369

Investing $607,470 today at a 12% return is equivalent to receiving $200,000 each year for the next four years.

PV of $200,000 Cash Inflows Received for 4 Years

Period	FV		Factor		Amount
1	$ 200,000	×	0.892857	=	$ 178,571
2	200,000	×	0.797194	=	159,439
3	200,000	×	0.711780	=	142,356
4	200,000	×	0.635518	=	127,104
					$ 607,470

4. INTERNAL RATE OF RETURN [IRR]

- The internal rate of return is the rate at which the present value of cash inflows equals cash outflows.
- The rate that will produce a zero NPV.

INTERNAL RATE OF RETURN [IRR]

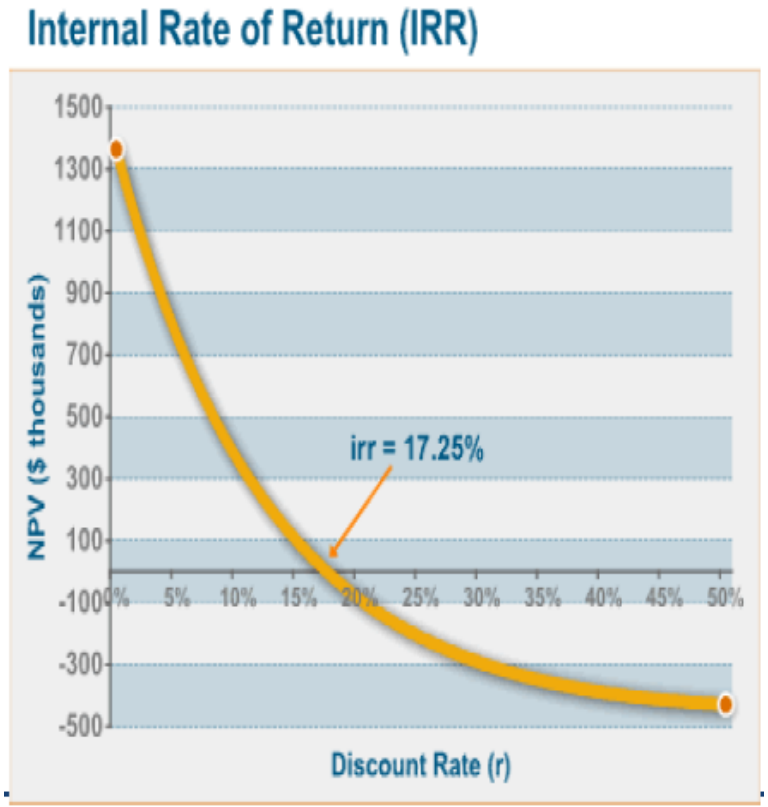
- Also called the **time-adjusted rate of return.**
- It is the minimum rate that could be paid for the money invested in a project without losing money.
- It is also described as the discount rate that results in a project's net present value equalling zero.

INTERNAL RATE OF RETURN [IRR]

- Allows the risk associated with an investment project to be assessed
  - Helps measure the worth of an investment
  - Allows the firm to assess whether an investment in the machine, etc. would yield a better return based on internal standards of return
  - Allows comparison of projects with different initial outlays
  - Software or simple graphing allows the IRR to be found

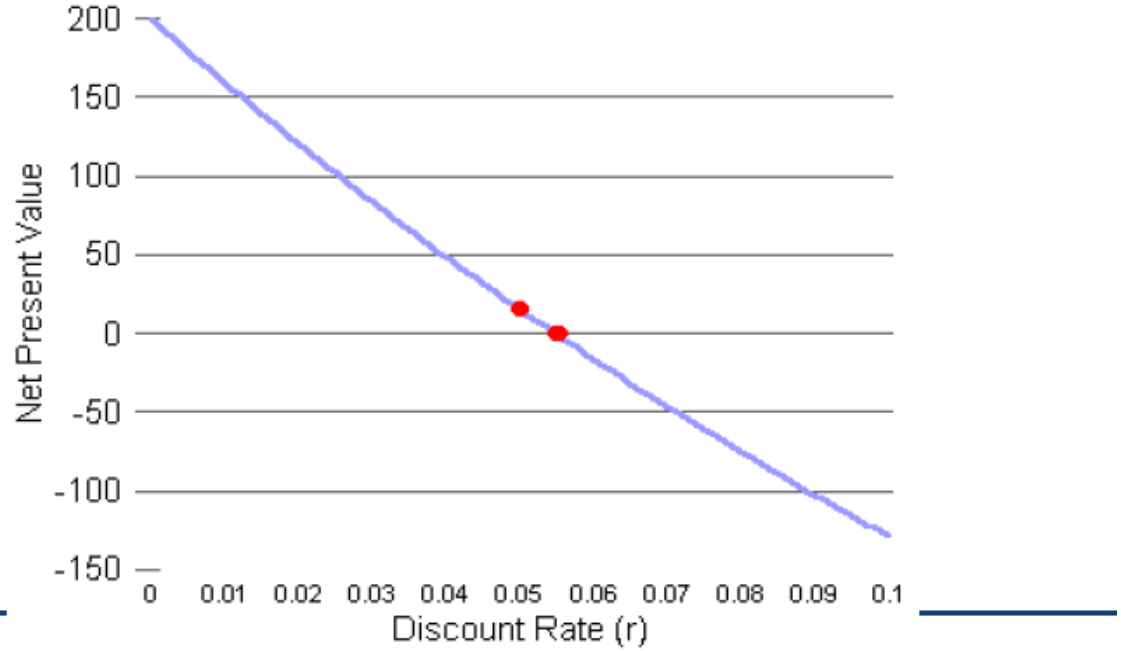
INTERNAL RATE OF RETURN [IRR]

- As in the example above, a project that has a **discount rate less than the IRR will yield a positive NPV**. The higher the discount rate the more the cash flows will be reduced, resulting in a lower NPV of the project.
- The IRR is therefore the maximum allowable discount rate that would yield value considering the cost of capital and risk of the project. For this reason, the IRR is sometimes referred to as a break-even rate of return.



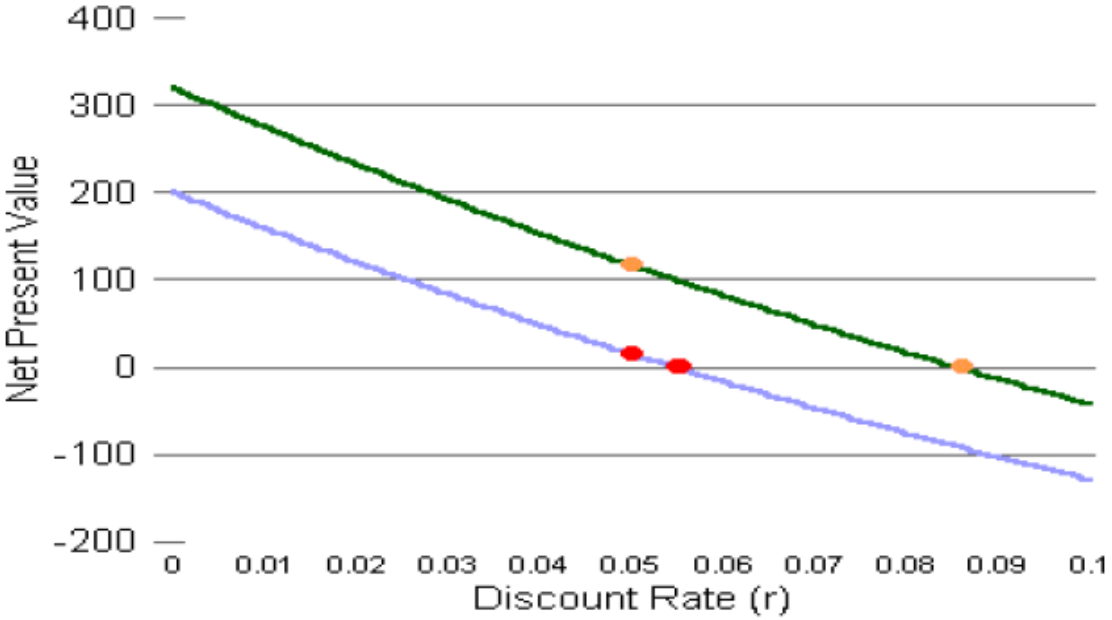
INVESTMENT A

$$NPV = -1000 + \frac{200}{1+r} + \frac{200}{(1+r)^2} + \frac{200}{(1+r)^3} + \frac{200}{(1+r)^4} + \frac{200}{(1+r)^5} + \frac{200}{(1+r)^6}$$



INVESTMENT B

$$NPV = -1000 + \frac{220}{1+r} + \frac{220}{(1+r)^2} + \frac{220}{(1+r)^3} + \frac{220}{(1+r)^4} + \frac{220}{(1+r)^5} + \frac{220}{(1+r)^6}$$



WHAT DOES THE GRAPHS SAY?

- Investment B is better than A?

- Investment A is better than B?
- If discount rate is less than 5.47%, both NPV curves are positive