

Decision Making Techniques

- A company expects the following proceeds from a project for an investment of £100,000. The company has a weighted cost of capital of 15%:

<u>Year</u>	<u>Cash inflow (£)</u>
1	20000
2	30000
3	50000
4	50000
5	50000

The asset will have no residual value.

- Calculate the:
 - a) Payback period
 - b) Accounting Rate of Return
 - c) Net Present Value
 - d) Internal Rate of Return

a) Payback



- How many years will it take to recover the initial outlay?

<u>Year</u>	<u>Cash Flow</u>	<u>Cumulative</u>
1	20000	20000
2	30000	50000
3	50000	100000

- $\therefore$ the investment will pay back within three years

b) Accounting Rate of Return

$$\frac{\text{Average annual profit from investment}}{\text{Original capital invested}} \times 100$$

*could also be average capital investment

- Remember that this is a measure based on accounting figures and is, $\therefore$, based on profit and not cash flow
- i.e. it will include accounting adjustments – not just cash movements ($\therefore$ allow for depreciation)

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• Total depreciation on asset over 5 years = £100000 – 0 = £100000
• ∴ total profit:

	£
Total Cash flows	200000
Less depreciation	<u>100000</u>
Total Profit	<u>100000</u>

• ∴ Average annual profit:
• $\frac{100000}{5} = £20000$

• ∴ ARR = $\frac{20000}{100000} \times 100$
• = 20%

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Net Present Value

- ◆ Involves discounting the expected future cash flows of a project to their present values
- ◆ Unlike other methods it takes the 'time value of money' into account

- by discounting the investment at the investors' required rate of return (i.e. the cost of capital)

- ◆ establish the discount factors:

Year 1 $\frac{1}{1 + r}$ 1.15 $\frac{1}{1.15}$ = 0.87

Year 2 $\frac{1}{(1 + r)^2}$ (1.15)² $\frac{1}{(1.15)^2}$ = 0.76

Year 3 $\frac{1}{(1 + r)^3}$ (1.15)³ $\frac{1}{(1.15)^3}$ = 0.66

etc.

Net Present Value (NPV)

$$NPV = \sum_{t=1}^T \frac{\text{Cash Flow}_t}{(1+i)^t} - \text{Initial Cash Investment}$$

t = Cash Flow Period
i = Interest Rate Assumption

Calculate NPV

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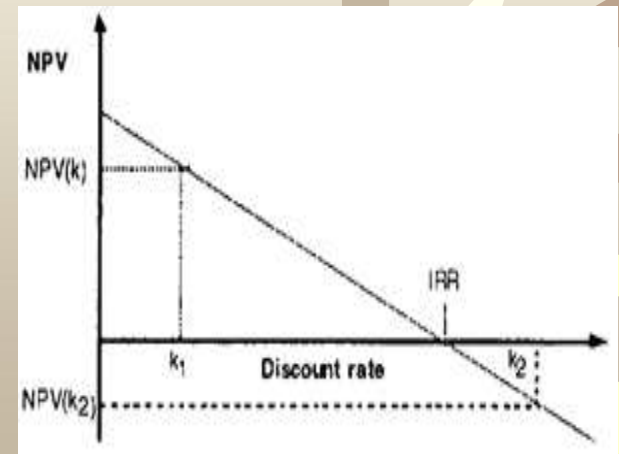
Year	Cash Flow	Discount Factor (15%)	Present Value
0	(100000)	1.00	(100000)
1	20000	0.87	17400
2	30000	0.76	22800
3	50000	0.66	33000
4	50000	0.57	28500
5	50000	0.50	<u>25000</u>
		NPV	<u>26700</u>

Internal Rate of Return

- ◆ 'the rate of interest that discounts the project cash flows to a net present value of zero'
- ◆ This can then be compared with the cost of capital or with other projects
- ◆ We know from the previous slide that the $IRR > 15$

How is the IRR calculated?

- ◆ By linear interpolation



Calculate NPV with 25% discount factor

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Year	Cash Flow	Discount Factor (25%)	Present Value
0	(100000)	1.00	(100000)
1	20000	0.80	16000
2	30000	0.64	19200
3	50000	0.51	25500
4	50000	0.41	20500
5	50000	0.33	16500
		NPV	(2300)

- $$\text{IRR} = 15 + \left[\frac{26700}{26700 - -2300} \right] \times [25 - 15]$$
- $$\text{IRR} = 15 + \left[\frac{26700}{29000} \right] \times 10 = 24.2\%$$
- $\therefore$ accept project as $\text{IRR} > \text{cost of capital (i.e. } 24.2 > 15.0)$

Accounting Rate of Return

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Advantages

- ◆ Easy to calculate
- ◆ Easy to understand



Disadvantage

- ◆ Measures profit as a return – not cash
- ◆ Ignores the timing of the profits:



Two projects require the following investment and earn the indicated profits:

<u>Year</u>	<u>Project A</u>	<u>Project B</u>
0	(80,000)	(80,000)
1	20,000	45,000
2	15,000	10,000
3	25,000	5,000

What is the ARR for each project? Which do you think is the most preferable project?

- ◆ Ignores the lives of projects
- ◆ Ignores the size of the investment

Net Present Value

● Advantages

- ◆ Allows for the timing of cash flows
- ◆ Based on cash flows – not profit
- ◆ Considers all cash flows
- ◆ Gives an absolute measure of shareholder wealth

● Disadvantages

- ◆ Introduces extra uncertainty – cost of capital
- ◆ Assumes cash flow is on last day of year
- ◆ May be difficult to grasp

Internal Rate of Return

Advantages

- ◆ Provides a margin of error – as long as the cost of money is under the IRR a project is worthwhile
- ◆ Concept is understandable

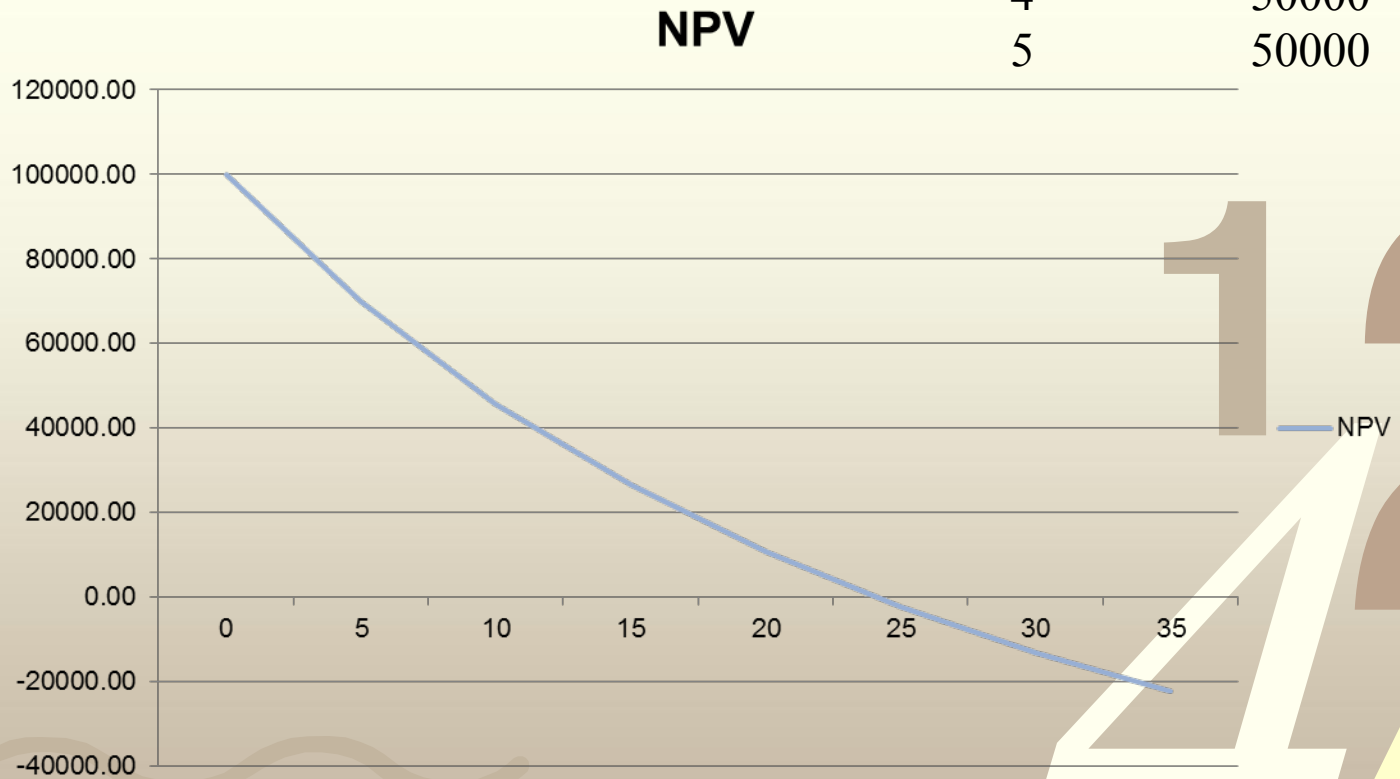
Disadvantages

- ◆ Interpolation is not strictly accurate (22)
- ◆ Cannot reliably compare mutually exclusive projects – time of cash flows (23)
- ◆ Reinvestment assumption (24)
- ◆ Possible to have more than one IRR (25)
- ◆ It is a relative measure

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Linear?

Year	£
0	-100000
1	20000
2	30000
3	50000
4	50000
5	50000



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IRR and Ranking Projects

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1		35		218
2		80		10
3		90		10
4		75		4
5		20		3
NPV (10%)		29.20		18.55
IRR		15.62%		18.71%
NPV (5%)		61.01		30.97
10%		29.20		18.55
15%		2.93		7.48
20%		-18.99		-2.47

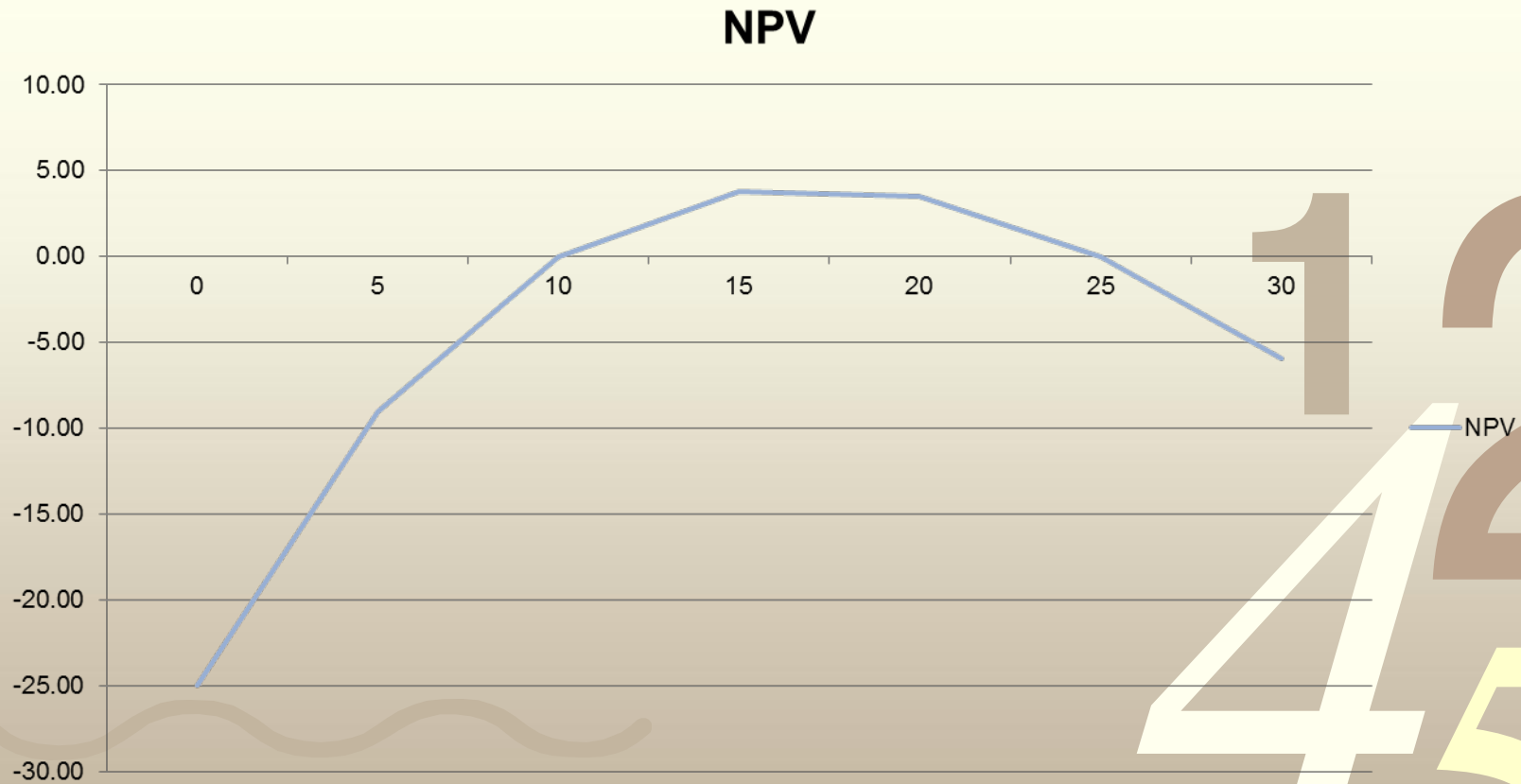
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Reinvestment assumption

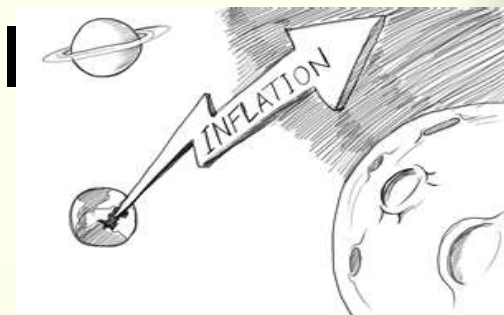
Year	£	IRR assumes:	
0	-1000	Year 2	1000
1	1000	Year 1 = $1000 (1.618)$	<u>1618</u>
2	1000		2618
		Year 0 = $-1000((1.618)^2)$	<u>2618</u>
NPV (15%)	625.71		0
IRR	61.80%		
		NPV assumes:	
		Year 2	1000
		Year 1 = $1000(1.15)$	<u>1150</u>
			2150
		Year 0 = $-1000(1.15)^2$	<u>-1322.5</u>
			827.5
		827.5 discounted at 15% for 2 years = NPV	
		$827.5/1.15^2 =$	625.71

More than 1 IRR?

Year	£
0	-1000
1	2350
2	-1375



Particular issues with NPV cal



1. Inflation

- If cash flows are in *real* values use the *real* discount rate.
- If cash flows have been inflated use the *money* (*nominal*) discount rate (this scenario is more likely where multiple inflation rates are used – i.e. inflate the cash flows and then apply the *money* discount rate)
- The relationship is as follows:
- $1 + m = (1 + r)(1 + i)$ or, $1 + r = \frac{(1 + m)}{(1 + i)}$

Inflation example

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- A company can invest £10,000 and receive the following annual returns at current values:
- Year 1 5,000
- Year 2 8,000
- Year 3 6,000
- Inflation is 5% p.a. and the nominal cost of capital is 15.5%
- What is the NPV of the project?

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2. Working capital

- Will often appear as part of the initial investment at time 0
- It is released at the end of a project and appears as a cash inflow (i.e. money tied up in debtors and stock is released)
- If inflation exists there may be an annual incremental increase in working capital in line with the inflation on material costs

3. Taxation

- ◆ Capital allowances on fixed assets
- ◆ Taxation on profits / cash flows
- ◆ Make sure that the effect on cash flow is in the correct year

