

IFM: Lecture 2

An overview of investment appraisal methods

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Payback period

- Years to recover initial investment
- Example:

Year	Project A	Project B
0	(1000)	(1000)
1	400	600
2	400	400
3	400	200
4	400	nil
Payback	3.5 years	2 years

Payback period (Continued)

Advantages of payback period:

- Simple concept to understand
- Easy to calculate (provided future cash flows have been calculated)
- Uses cash, not accounting profit
- Takes risk into account (in the sense that earlier cash flows are more certain).

Payback period (Continued)

Disadvantages:

- Considers cash flows within the payback period only; says nothing about project as a whole
- Ignores size and timing of cash flows
- Ignores time value of money (although discounted payback can be used)
- It does not *really* take account of risk.

Return on capital employed

- ROCE can be defined as:
$$\frac{\text{average annual accounting profit} \times 100}{\text{average investment}}$$
- Where average investment is:
$$(\text{initial investment} + \text{scrap value})/2$$
- ROCE can also be defined as:
$$\frac{\text{average annual accounting profit} \times 100}{\text{initial investment}}$$
- ROCE is also known as accounting rate of return (ARR) and return on investment (ROI).

Return on capital employed (Continued)

- Average annual accounting profit can be calculated from project cash flows by taking off depreciation.
- Accounting profit is not cash flow.
- Simple decision rule: accept project if ROCE is equal to or greater than target value i.e. current company or division ROCE.
- If projects are mutually exclusive, select project with highest ROCE.

Return on capital employed (Continued)

Example:

- A machine costs £10 000
- Useful economic life is 5 years
- After 5 years, scrap value of £2000
- Net cash inflows from the machine would be £3000 per year
- Ignore taxation.

Return on capital employed (Continued)

Example:

- Depreciation: $(10\,000 - 2000)/5 = \text{£}1600$
- Average annual profit: $3000 - 1600 = \text{£}1400$
- Average investment: $(10\,000 + 2000)/2 = \text{£}6000$
- ROCE: $(1400/6000) \times 100 = 23\%$

Return on capital employed (Continued)

Advantages of return on capital employed:

- Gives value in familiar percentage terms
- Can be compared with primary accounting ratio, ROCE
- Relatively simple concept compared to DCF methods such as NPV and IRR
- Can compare mutually exclusive projects
- Considers whole of project, unlike payback.

Return on capital employed (Continued)

Disadvantages of return on capital employed

- Uses accounting profit rather than cash:
- Profit not directly linked to primary financial objective of shareholder wealth maximisation
- Uses average profits and hence ignore timing of profits
- Ignores time value of money
- Relative measure and so ignores size of initial investment.

Net present value

- Difference between PV of future benefits and present value of capital invested, discounted at company's cost of capital.
- NPV decision rule is to accept all projects with a positive net present value.
- With mutually exclusive projects, select project with highest NPV.
- Regarded as the best investment appraisal method by academics.

Net present value (Continued)

- NPV is given by:

$$-I_0 + \frac{C_1}{(1+r)} + \frac{C_2}{(1+r)^2} + \frac{C_3}{(1+r)^3} + \dots + \frac{C_n}{(1+r)^n}$$

Where:

- I_0 is the initial investment
- $C_1, C_2, \dots, C_n$ are the project cash flows occurring in years 1, 2, $\dots$ n
- r is the cost of capital or required rate of return.

Net present value (Continued)

Example:

- Project costing £1000 is expected to yield £500 per year for 2 years. What is the NPV?

Year	Cash flow	10% PVF	PV
0	(1000)	1.000	(1000)
1	500	0.909	455
2	500	0.826	<u>413</u>
NPV =			<u>(132)</u>

Would you accept the project? No.

Net present value (Continued)

Advantages:

- Takes account of time value of money
- Uses cash flow, not accounting profit
- Takes account of all relevant cash flows over life of project
- Can take account of conventional and non-conventional cash flows, as well as changes in discount rate during project
- Gives absolute measure of project value.

Net present value (Continued)

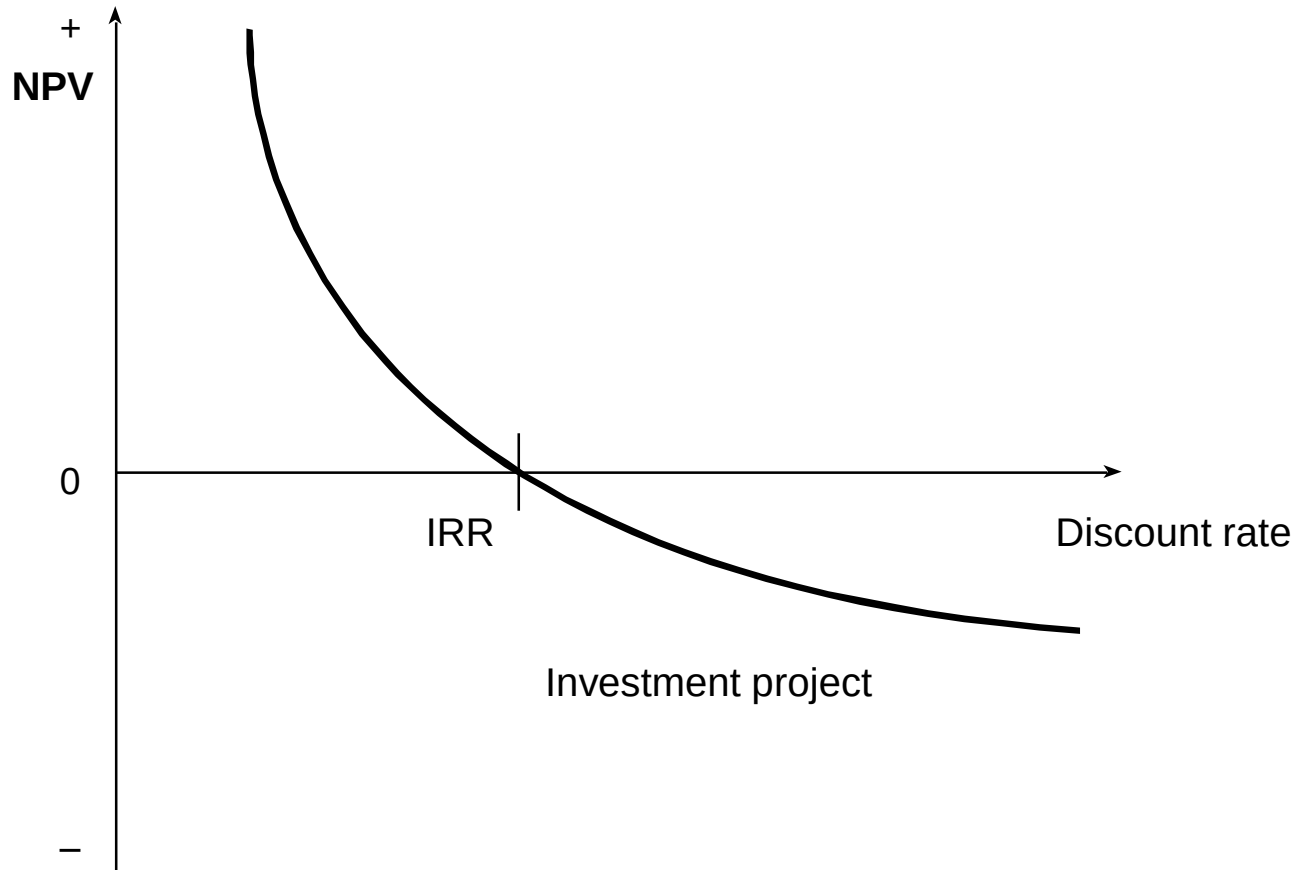
Disadvantages:

- Project cash flows may be difficult to estimate (but applies to all methods)
- Accepting all projects with positive NPV only possible in a perfect capital market
- Cost of capital may be difficult to find
- Cost of capital may change over project life, rather than being constant.

Internal rate of return

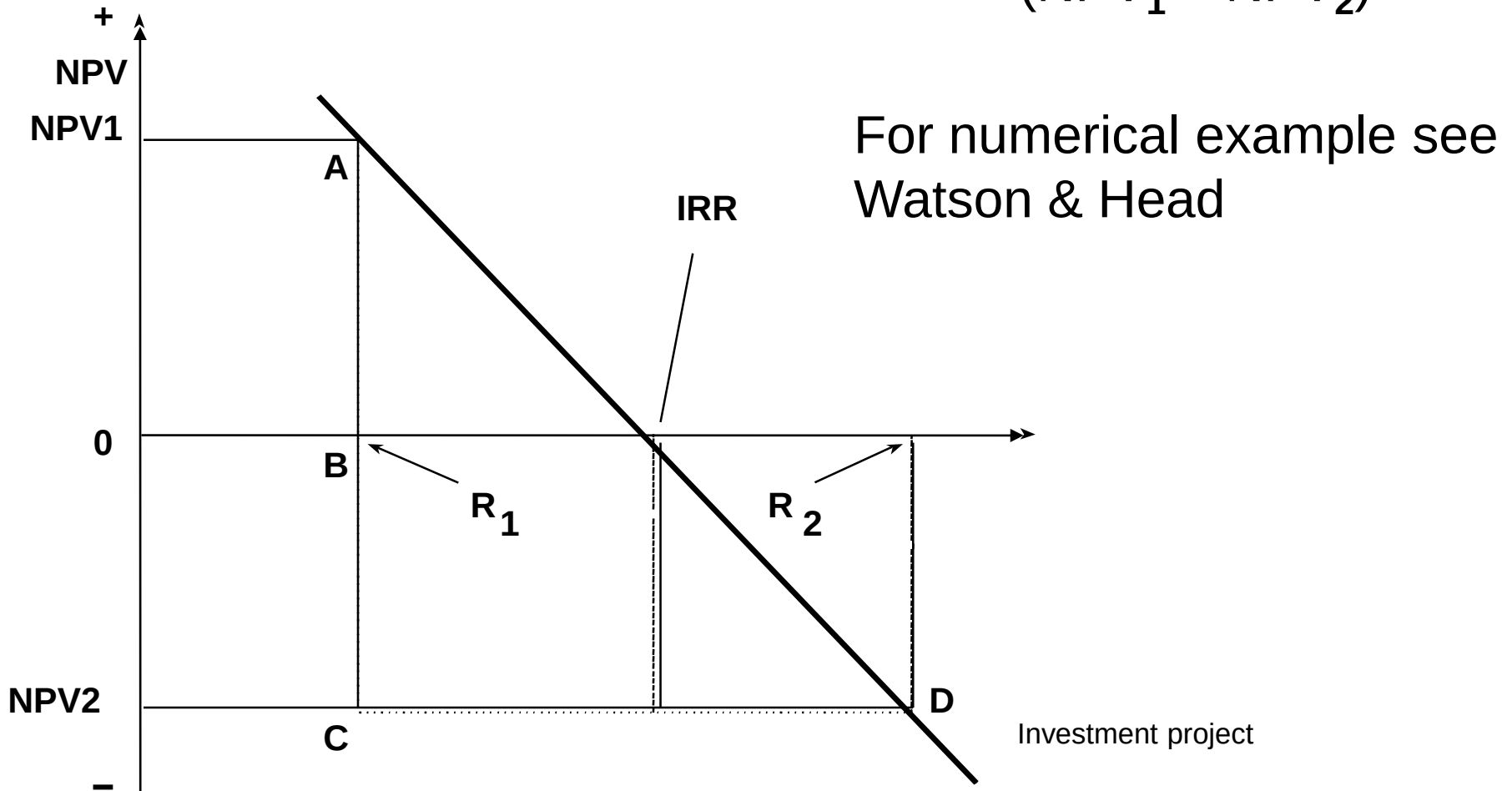
- IRR is discount rate which gives zero NPV for project.
- Decision rule is to accept all projects with an IRR greater than company's cost of capital or target rate of return.
- Linear interpolation or extrapolation gives an approximate value of IRR.

Internal rate of return (Continued)



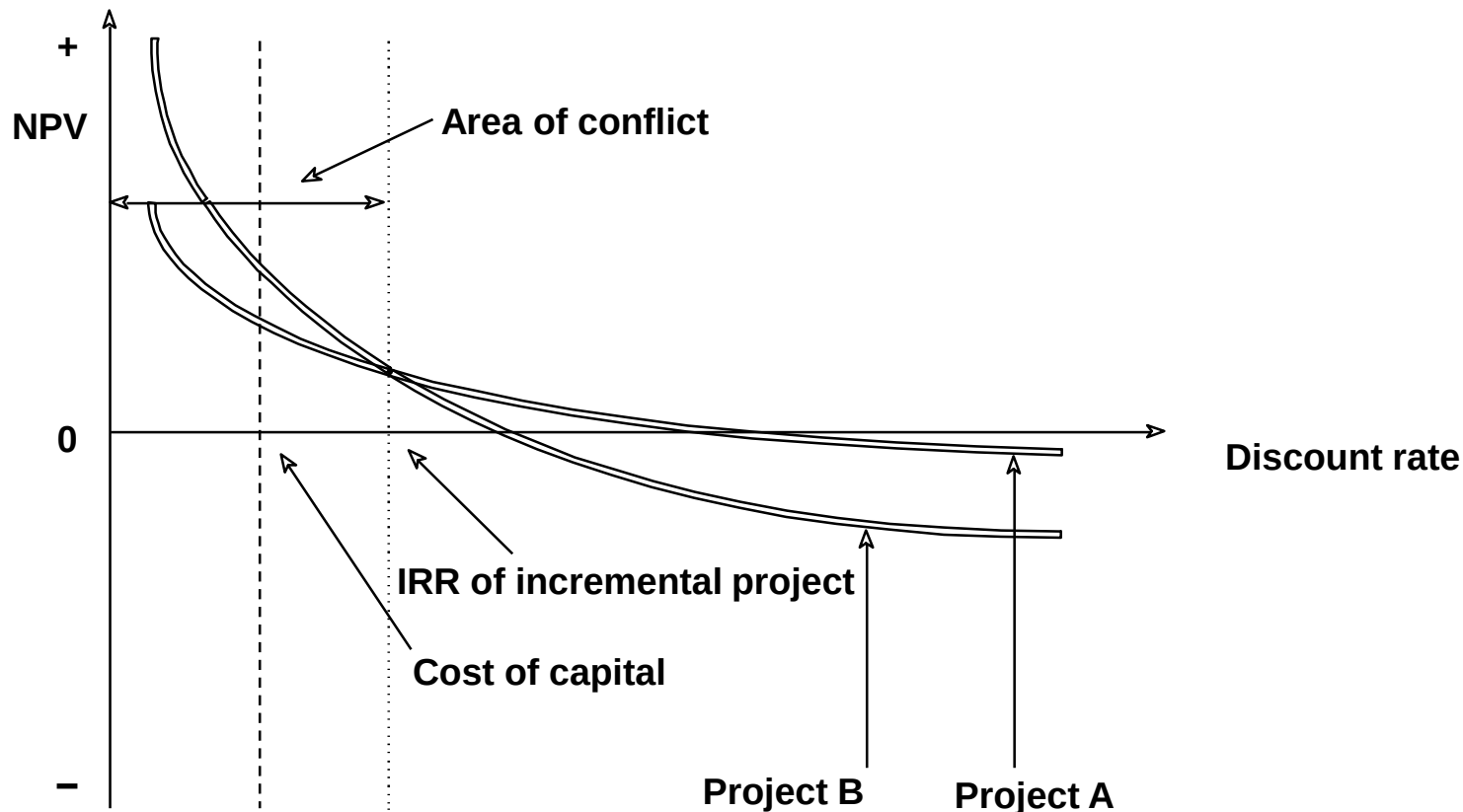
Internal rate of return (Continued)

$$IRR = R_1 + \frac{NPV_1 \times (R_2 - R_1)}{(NPV_1 - NPV_2)}$$



IRR versus NPV

- If IRR is used to compare mutually exclusive projects, wrong project may be selected: NPV always gives correct selection advice.



IRR versus NPV (Continued)

- A problem if applying IRR to projects with non-conventional cash flows is that multiple IRRs may be found: again, NPV gives correct selection advice.
- NPV can accommodate changes in discount rate during project, but IRR ignores them.
- NPV method assumes that cash flows can be reinvested at a rate equal to the cost of capital: IRR method assumes that cash flows can be reinvested at rate equal to IRR.

Conclusion

- NPV is academically preferred as an investment appraisal method – it has no major defects and is consistent with SHWM.
- IRR comes a close second and can prove to be a useful alternative.
- ARR and payback are flawed as investment appraisal methods but payback is often used as an initial screening method.

Capital rationing

- Arises if firm has insufficient funds to invest in all projects with positive NPV.
- Hard capital rationing arises when limitations are externally imposed.
- Soft capital rationing arises when limitations are internally imposed.
- Soft capital rationing is more common.

Hard capital rationing

Causes:

- Capital markets may be depressed.
- Investors may consider the company to be too risky to invest in.
- Issue costs may make a small issue of finance expensive.

Soft capital rationing

Arises if managers:

- want to avoid dilution of control (equity)
- want to avoid dilution of EPS (equity)
- wish to avoid fixed interest payments (debt)
- wish to follow policy of steady growth
- believe restricting available funds will encourage better investment projects (internal market for investment funds).

Single period rationing

- Firm must choose combination of projects to maximise total NPV.
- Ranking divisible projects by NPV will not lead to correct decision.
- Divisible projects must be ranked using the profitability index (PI).
- $PI = \frac{\text{PV of Future Cash Flows}}{\text{Investment}}$
- (Alternatively, $PI = NPV/\text{Investment}$).

Single period rationing (Continued)

- For indivisible projects, selection must be made by looking at total NPVs of possible combinations of projects.
- Combination with highest NPV which does not exceed capital rationing limit will be optimal investment schedule.
- Investment of surplus funds is not relevant to the investment decision.

Multi-period rationing

- Profitability index and NPV evaluation of project combinations do not help.
- Linear programming must be used to determine optimum combination.
- Simple problems can be solved by hand, complex problems by computer.