333-201 Business Finance

Dr Cesario MATEUS
PhD in Finance
Senior Lecturer in Finance and Banking
Room 219 A – Economics & Commerce Building
8344 – 8061
c.mateus@greenwich.ac.uk

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Lecture 15:
Capital Budgeting / Project Evaluation 2

Capital Budgeting II

- Compare the NPV and IRR methods and examine the incremental IRR method
- Examine the accounting rate of return method and its drawbacks
- Examine the payback period method and its drawbacks

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Comparing the IRR and NPV Methods

- Independent projects are projects that can be evaluated on their own and independently of each other
  - The decision to accept a project does not affect the decision to accept or reject other projects
  - Assumes that there are enough funds for all potential projects being considered
  - Examples: A development of two separate pieces of land, or expanding the Melbourne and London offices

- Decision rule for independent projects
  - Invest in all positive NPV projects

- Does the IRR rule work the same way here?

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Comparing the IRR and NPV Methods

Example: Consider two projects with the following pattern of net cash flows and a required rate of return of 10%. What decision would the firm make if the projects are independent?

Year	Project A	Project B
0	-$120,000	-$120,000
1	$100,000	$10,000
2	$50,000	$60,000
3	$15,000	$120,000
NPV	$23,501	$28,835
IRR	24.8%	19.8%

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Comparing the IRR and NPV Methods

- Mutually exclusive projects are projects where the acceptance of one project rules out the acceptance of other (competing) projects
  - Example: A piece of land is used to build a factory, which rules out an alternate project of building a warehouse on the same land

- Decision rule for mutually exclusive projects
  - Assuming the projects being considered are worth undertaking (that is, they are positive NPV projects).
  - Invest in the highest NPV project

Does the IRR rule work the same way here?

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Comparing the IRR and NPV Methods

Example: Consider two projects with the following pattern of net cash flows and a required rate of return of 10%. What decision would the firm make if the projects are mutually exclusive?

Year	Project A	Project B
0	-$120,000	-$120,000
1	$100,000	$10,000
2	$50,000	$60,000
3	$15,000	$120,000
NPV at 10%	$23,501	$28,835
IRR	24.8%	19.8%

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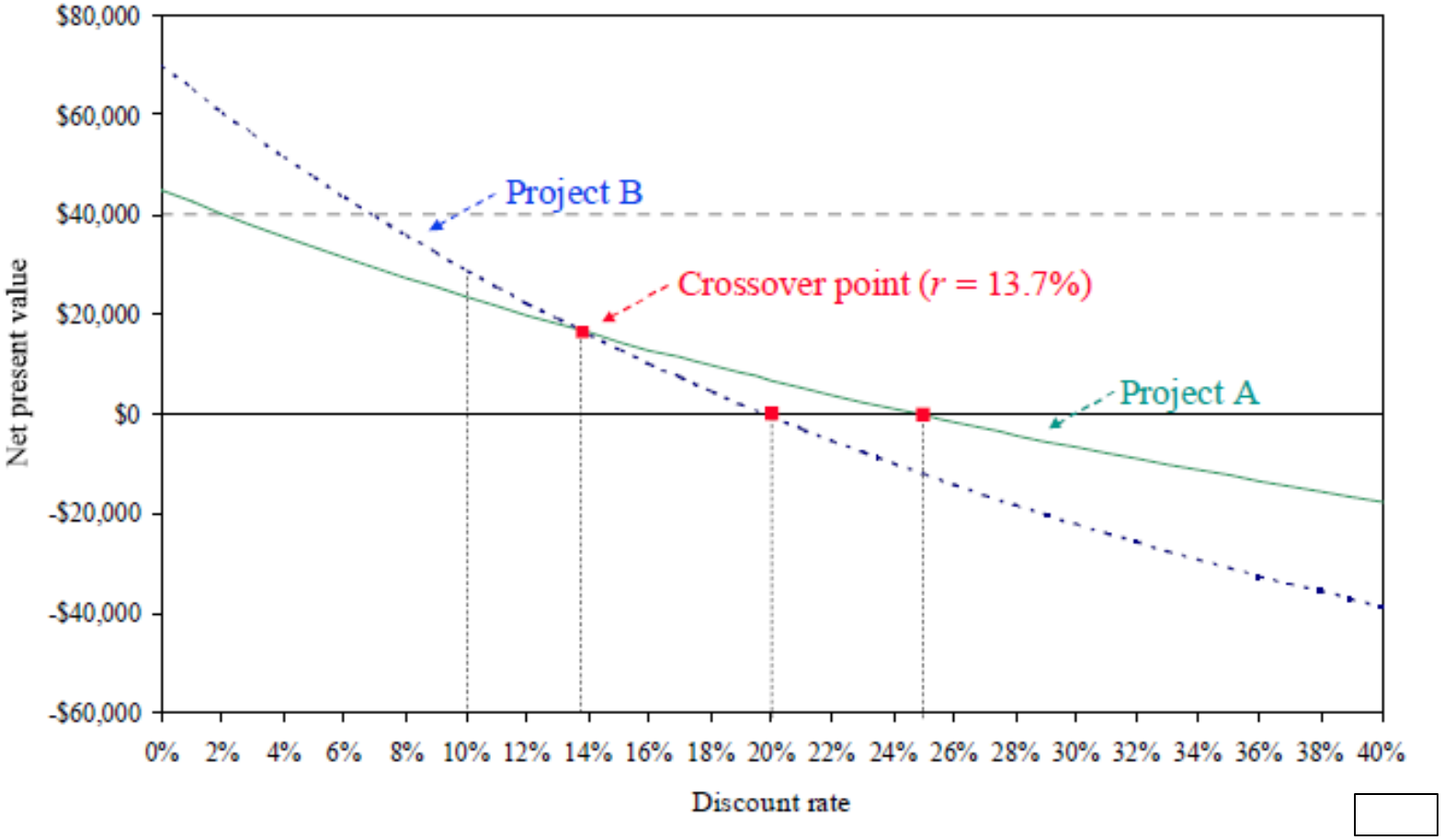
Comparing the IRR and NPV Methods



Comparing the IRR and NPV Methods

- For mutually exclusive projects the IRR and NPV methods can be made consistent by considering the incremental "projects" A - B or B – A.

- Look at the difference in net cash flows of the lower IRR project and the net cash flows of the higher IRR project

Year	Project A	Project B	"Project" B - A
0	-$120,000	-$120,000	$0
1	$100,000	$10,000	-$90,000
2	$50,000	$60,000	$10,000
3	$15,000	$120,000	$105,000
NPV	$23,501	$28,835	–
IRR	24.8%	19.8%	13.7%

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Comparing the IRR and NPV Methods

Is it worth investing in the lower IRR project B in preference to the higher IRR project A?

Year	Project A	Project B	"Project" B - A
0	-$120,000	-$120,000	$0
1	$100,000	$10,000	-$90,000
2	$50,000	$60,000	$10,000
3	$15,000	$120,000	$105,000
NPV	$23,501	$28,835	–
IRR	24.8%	19.8%	13.7%

- $NPV_{B\text{-}A} \equiv 0 = 10000/(1 + r_{B\text{-}A}) + 105000/(1 + r_{B\text{-}A})^2 - 90000$
- So, $r_{B\text{-}A} = 13.7\% > 10.0\%$
- Which method is preferable - *NPV* or incremental *IRR*?

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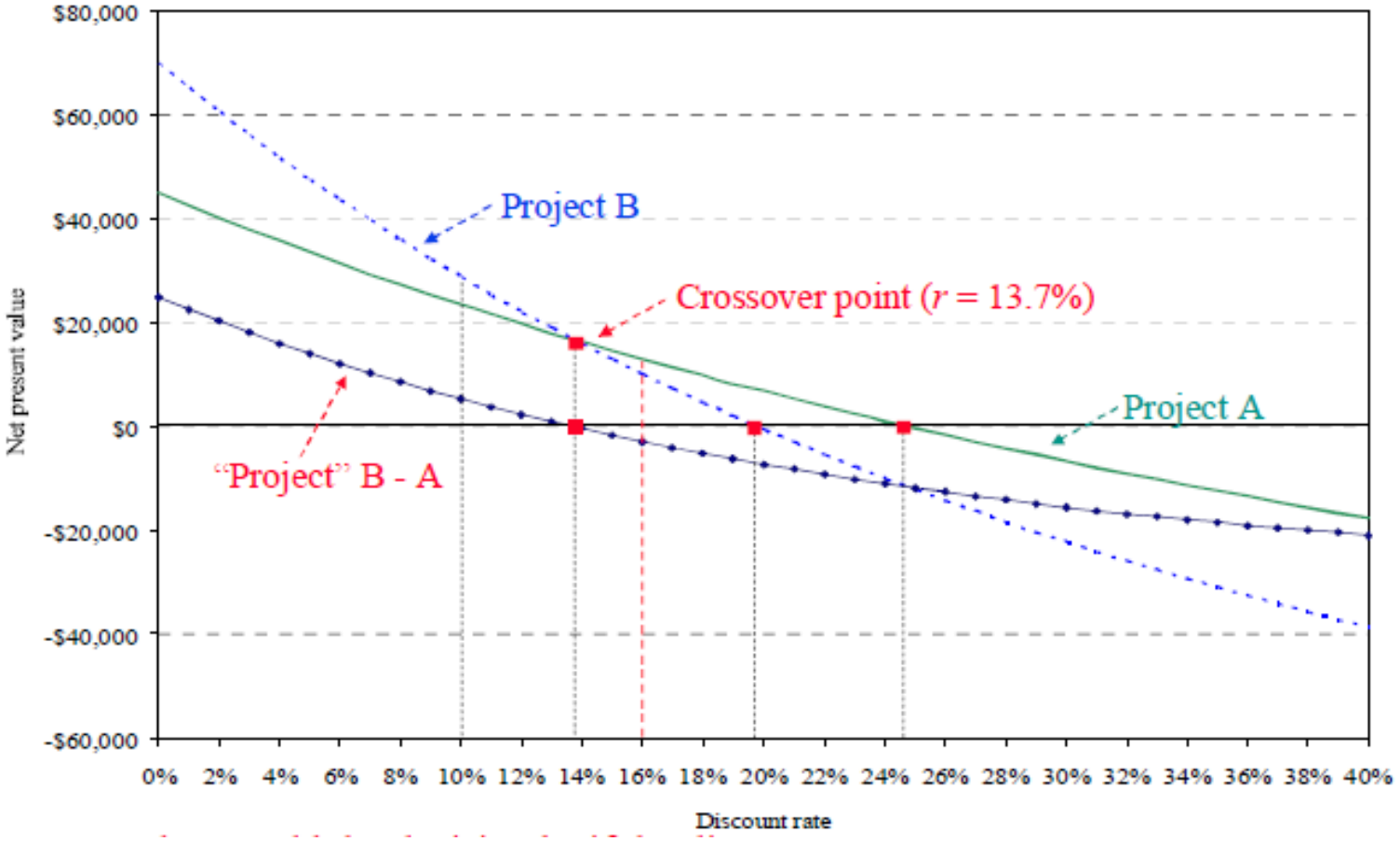
Comparing the IRR and NPV Methods



What would the decision be if the discount rate was 16%?

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Accounting Rate of Return

- A project's accounting rate of return (ARR) is the average earnings generated by the project, after deducting depreciation and taxes, expressed as a percentage of the investment outlay
- ARR can be based on either the initial investment or the average value of the capital invested over the project's life

- Decision rule
  - A project is acceptable if its ARR exceeds a prespecified minimum rate of return
  - For mutually exclusive projects the project with the highest ARR is preferred

Accounting Rate of Return

- *ARR* using the initial investment

$$ARR = \frac{Average\ Earnings}{Initial\ Investment} \times 100$$

- *ARR* using the average investment

$$ARR = \frac{Average\ Earnings}{Average\ Investment} \times 100$$

• Note that the average investment is defined as the average book value of the investment over the project's life

• You will be given information on which measure to use when evaluating projects

Accounting Rate of Return

Example: A firm is considering an investment that costs $1,000,000 and generates the following earnings over the next three years.

	Year 1	Year 2	Year 3	Average
Earnings	$100,000	$50,000	$30,000	$60,000
Book values				
Jan 1	$1,000,000	$800,000	$600,000	(1000 + 400)/2 = $700,000
Dec 31	$800,000	$600,000	$400,000	

- Compute the accounting rates of return using the initial investment and average investment. If the prespecified cutoff rate is 5% p.a. what decision should the firm make?

Accounting Rate of Return

	Year 1	Year 2	Year 3	Average
Earnings	$100,000	$50,000	$30,000	$60,000
Book values				
Jan 1	$1,000,000	$800,000	$600,000	(1000 + 400)/2 = $700,000
Dec 31	$800,000	$600,000	$400,000	

- Based on the initial investment, $ARR = 60/1000 = 6.0\%$
- Based on the average investment, $ARR = 60/700 = 8.6\%$
- What decision should the firm make?

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Accounting Rate of Return

Example: Consider two projects which each require an initial outlay of $300,000, and which are fully depreciated over four years and generate the following patterns of annual earnings.

Evaluate the projects using the accounting rate of return

Project	Year 1	Year 2	Year 3	Year 4	Totals
A	$300,000	$50,000	$30,000	$20,000	$400,000
B	$10,000	$10,000	$10,000	$370,000	$400,000

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Accounting Rate of Return

ARR for both projects based on the initial investment is…

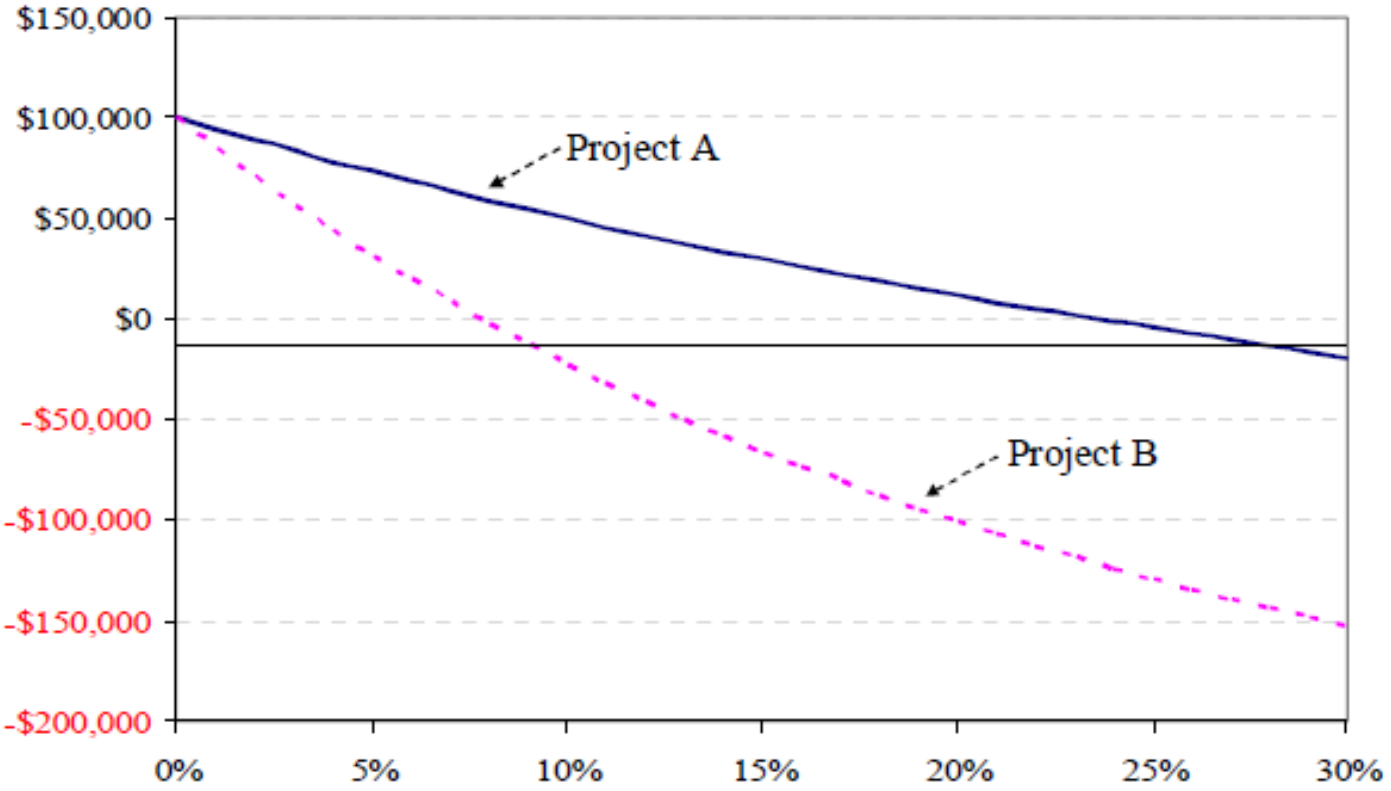
$$ARR = \frac{400000/4}{300000} \times 100 = 33.3\% \text{ p.a.}$$

ARR for both projects based on the average investment is…

$$ARR = \frac{(400000/4)}{[(300000+0)/2]} \times 100 = 66.7\% \text{ p.a.}$$

Since the ARRs for the two projects are equal should the firm be indifferent between the two projects?

Accounting Rate of Return



Note: The NPV profiles assume that the net cash flows are the same as the earnings

Problems With Accounting Rate of Return

- Earnings are not net cash flows
  - Earnings numbers are subject to the vagaries of the accounting choices made by managers
- Time value of money ignored
  - A dollar of earnings tomorrow is regarded as equivalent to a dollar of earnings today
- ARR tends to favor projects with shorter lives
  - Earnings received in earlier years would increase the numerator and hence the ARR

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Payback Period

- A project's payback period is the time it takes for the initial cash outlay on a project to be recovered from the net after-tax cash flows
  - Note that in computing the payback period we assume that the cash flows are distributed *evenly over the year (rather than at the* end of each year)

- *Decision rule*
  - A project is acceptable if its payback period is less than a prespecified maximum payback period
  - For mutually exclusive projects, the project with the shortest payback period is preferred (assuming they all meet the maximum payback period threshold)

Payback Period

Example: A firm is considering three mutually exclusive projects that require an initial outlay of $100,000 and that generate the following pattern of cash flows. The firm typically accepts projects with a payback period less than 2 years

Project	Year 1	Year 2	Year 3	Year 4	Payback
C	$100,000	-	-	$10,000	1 year
D	$50,000	$50,000	$50,000	$50,000	2 years
E	$50,000	$30,000	$30,000	$90,000	2.7 years
F	$50,000	-$30,000	$60,000	$40,000	3.5 years

- Payback for project E = 2 + 20/30 = 2.7 years
- Payback for project F = 3 + 20/40 = 3.5 years

Decision?

Problems With Payback Period

- Fails to take account of the cash flows that occur after the payback period cutoff date
- Biased against projects that have longer development periods
  - Examples: Mining and exploration projects
- Ignores the time value of money
- Is there any use for the payback period and accounting rate of return methods?
- What method(s) should a company use?

Key Concepts

- The NPV method is recommended for investment evaluation
- NPV is consistent with maximization of shareholder wealth
- NPV is also simple to use and gives rise to fewer problems than the IRR method
- In practice, other valuation methods such as the accounting rate of return and payback period are used in conjunction with NPV, despite their inferiority

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Key Relationships/Formula Sheet

Accounting rate of return using the initial investment

$$ARR = \frac{Average\ Earnings}{Initial\ Investment} \times 100$$

Accounting rate of return using the average investment

$$ARR = \frac{Average\ Earnings}{Average\ Investment} \times 100$$