Corporate Finance

Lecture 6: Valuing Real Assets (updated)

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At the end of this lecture, we will…

- Know how to evaluate risk-less and risky real investment opportunities
- Be able to decide whether to invest
- Be familiar with the concepts of:
  - rate of return
  - opportunity cost of investment
  - net present value

Valuing risk-free real assets

- Should we invest?
  - For example, in buying a fridge or an office building
- First, how can we evaluate these “projects”?
  - Evaluate the cash flows generated by the asset
  - Net Present Value: value today net of investment costs
- Then, the answer is easy…
  - Positive → Undertake it!! Negative → Don’t!

Present and Future Value

- A pound today is worth more than one tomorrow! Why?
- If the interest is 5% a year…
  - investing 400,000 today gives 420,000 in a year
  - The future value (in a year) of 400,000 is 420,000
  - The present value of 420,000 in a year is 400,000 today
- Present Value: Value today of a future cash flow.
- Future Value: Amount to which an investment will grow after earning interest

Future Values

Future Value of $x = FV

$$FV = \$x \times (1+r)^t$$

Example - FV

What is the future value of $400,000 if interest is compounded annually at a rate of 5% for one year?

$$FV = \$400{,}000 \times (1+.05)^1 = \$420{,}000$$

Present Value

$$PV = \frac{1}{(1+r)^t} \times C_1$$

Discount Factor

Present value of a $1 future payment.

Discount Rate

Interest rate used to compute present values of future cash flows

Net Present Value

$$\text{NPV} = \text{PV} - \text{required investment}$$

$$\text{NPV} = C_0 + \frac{C_1}{1 + r}$$

Valuing an Office Building

Step 1: Forecast cash flows

Cost of building = C_0 = (-) 370

Sale price in Year 1 = C_1 = 420

Step 2: Estimate opportunity cost of capital

If equally risky investments in the capital market offer a return of 5%, then

Cost of capital = r = 5%

Valuing an Office Building

Step 3: Discount future cash flows

$$PV = \frac{C_1}{(1+r)} = \frac{420}{(1+.05)} = 400$$

Step 4: Go ahead if PV of payoff exceeds investment

$$NPV = 400 - 370 = 30$$

More generally…

- Cash flows:
  - Cash that a project generates over time
  - Inflow (+) or outflow (-)
  - Example: buying and selling a factory in the future, but also income from sales of products
- Net present value or “discounted cash flow”:

$$\mathrm{NPV} = \mathrm{C}_0 + \frac{C_1}{1+r_1} + \frac{C_2}{(1+r_2)^2} + \frac{C_3}{(1+r_3)^3} + \ldots + + \frac{C_T}{(1+r_3)^T}$$

Risk and Present Value

- A safe dollar is worth more than a risky one!
  - Higher risk projects require a higher rate of return
  - Higher required rates of return cause lower PVs

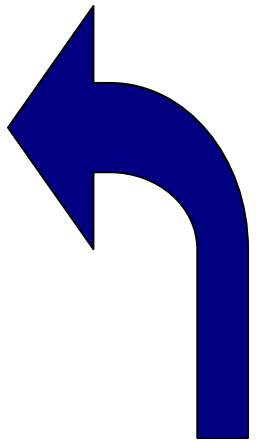
$$\text{PV of } C_1 = \$420 \text{ at } 5\%$$

$$\text{PV} = \frac{420}{1 + .05} = 400$$

Risk and Present Value

$$\text{PV of } C_1 = \$420 \text{ at } 12\%$$

$$\text{PV} = \frac{420}{1 + .12} = 375$$



$$\text{PV of } C_1 = \$420 \text{ at } 5\%$$

$$\text{PV} = \frac{420}{1 + .05} = 400$$

Project Selection

- If only one from a set of positive NPV projects can be selected, we should select that with the largest NPV
- When resources are limited, the profitability index (PI) helps selecting among various project combinations and alternatives:
  - PI = PV / -C_0 (typo corrected)
  - A set of limited resources and projects can yield various combinations
Project	C_0	C_1	C_2	$NPV\ @10\%$	PI
A	-1	$+22$	-12.1		
B	-5	$+44$	-24.2		

    ,000

Project Selection

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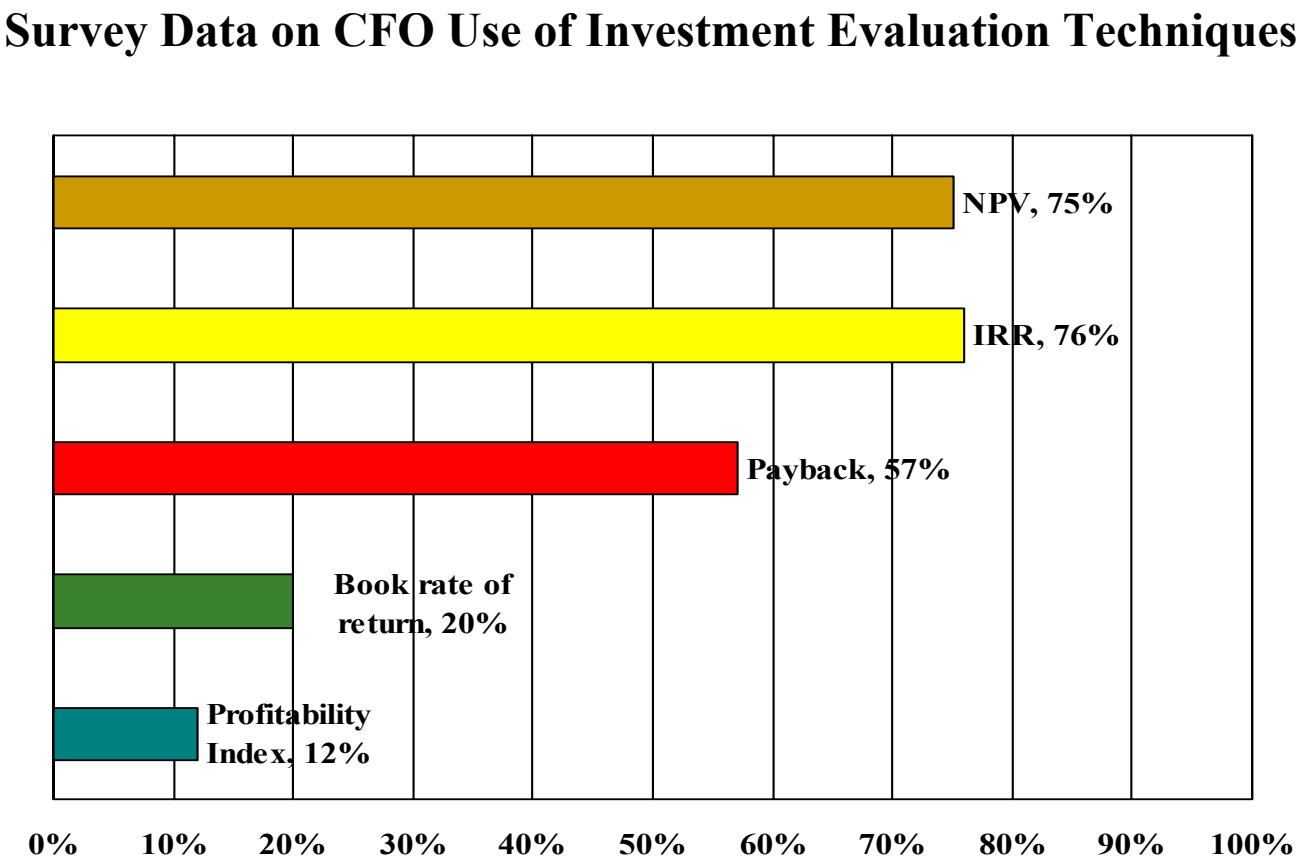
- When resources are limited, the profitability index (PI) helps selecting among various project combinations and alternatives:
  - PI = PV / $-C_0$ (typo corrected)
  - A set of limited resources and projects can yield various combinations
  - Example: Two scalable projects and GBP 10,000

Project	C_0	C_1	C_2	$NPV\ @10\%$	PI
A	-1	$+22$	-12.1	9	9
B	-5	$+44$	-24.2	15	3

Caution with NPV in practice

- Cash flow means pounds paid in (not earned!) less pounds paid out (not need to depreciate over time!)
- Compute them on after tax-basis
- Forget sunk costs
- Treat inflation consistently

But, are there other criteria?



SOURCE: Graham and Harvey, "The Theory and Practice of Finance: Evidence from the Field," Journal of Financial Economics 61 (2001), pp. 187-243.

Rate of Return Rule

- Accept investments that offer rates of return in excess of their opportunity cost of capital

Example

In the project listed below, the foregone investment opportunity is 12%. Should we do the project?

$$\text{Return} = \frac{\text{profit}}{\text{investment}} = \frac{420{,}000 - 370{,}000}{370{,}000} = .135 \text{ or } 13.5\%$$

More generally

- The rate of return of a cash flow stream is the interest rate y that makes the NPV of a project equal to 0:

$$0 = C_0 + \frac{C_1}{1+y} + \frac{C_2}{(1+y)^2} + \frac{C_3}{(1+y)^3} + \ldots + + \frac{C_T}{(1+y)^T}$$

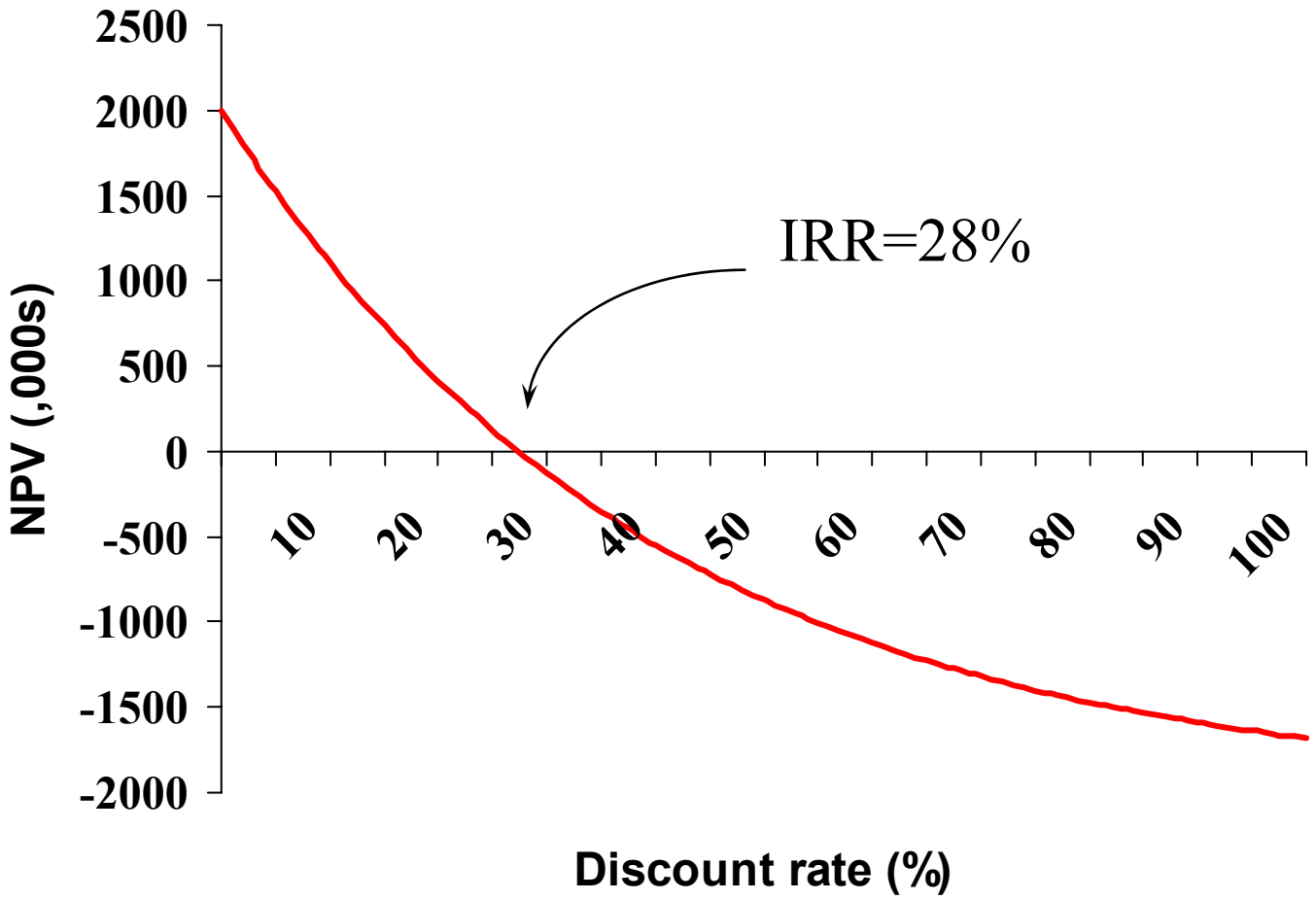
- ***Example***

  You can purchase a turbo powered machine tool gadget for $4,000. The investment will generate $2,000 and $4,000 in cash flows for two years, respectively. What is the IRR on this investment?

$$NPV = -4{,}000 + \frac{2{,}000}{(1+IRR)^1} + \frac{4{,}000}{(1+IRR)^2} = 0$$

$$IRR = 28.08\%$$

Internal Rate of Return



IRR and NPV

- Same criteria if NPV is decreasing wrt discount rate
- However, the IRR has some pitfalls:
  - If NPV increases (lending money instead of borrowing), we should therefore ask for an IRR lower than the opportunity cost of capital
  - There might be several IRRs or none
  - Ignores magnitude and cannot select among different projects
  - Even more problematic if we discount rates are not stable over time (with which one do we compare?)

Book Rate of Return

Book Rate of Return - Average income divided by average book value over project life. Also called *accounting rate of return*.

$$\text{Book rate of return} = \frac{\text{book income}}{\text{book assets}}$$

Managers rarely use this measurement to make decisions. The components reflect tax and accounting figures, not market values or cash flows.

Payback

- The payback period of a project is the number of years it takes before the cumulative forecasted cash flow equals the initial outlay.
- The payback rule says only accept projects that “payback” in the desired time frame.
- This method is flawed, primarily because it ignores later year cash flows and the the present value of future cash flows.

Payback

Example

Examine the three projects and note the mistake we would make if we insisted on only taking projects with a payback period of 2 years or less.

Project	C_0	C_1	C_2	C_3	Payback Period	NPV@10%
A	-2000	500	500	5000	3	+2,624
B	-2000	500	1800	0	2	-58
C	-2000	1800	500	0	2	+50