ASPEK KEUANGAN
Capital Budgeting

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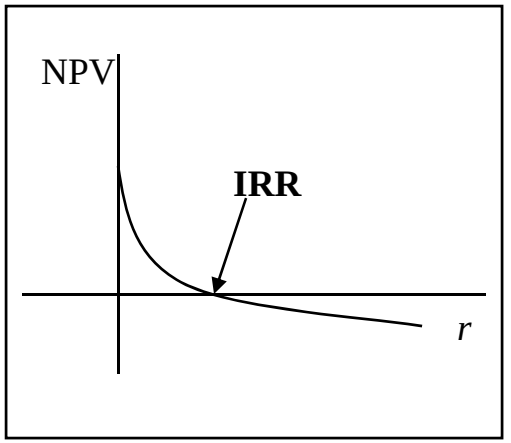
Investment decisions

- Objectives for this session :
- Review investment rules
  - NPV, IRR, Payback
- BOF Project
  - Free Cash Flow calculation
  - Sensitivity analysis, break even point
  - Inflation

Investment rules

- Net Present Value (NPV)
  - Discounted incremental free cash flows
  - Rule: invest if NPV>0
- Internal Rate of Return (IRR)
  - IRR: discount rate such that NPV=0
  - Rule: invest if IRR > Cost of capital
- Payback period
  - Numbers of year to recoup initial investment
  - No precise rule
- Profitability Index (PI)
  - PI = NPV / Investment
  - Useful to rank projects if capital spending is limited



Internal Rate of Return

- Alternative rule: compare the internal rate of return for the project to the opportunity cost of capital
- Definition of the Internal Rate of Return IRR : (1-period)

$$IRR = Profit / Investment = (C_1 - I)/I$$

- In our example: $IRR = (125 - 100)/100 = 25\%$

- **The Rate of Return Rule: Invest if IRR > r**

- In this simple setting, the NPV rule and the Rate of Return Rule lead to the same decision:

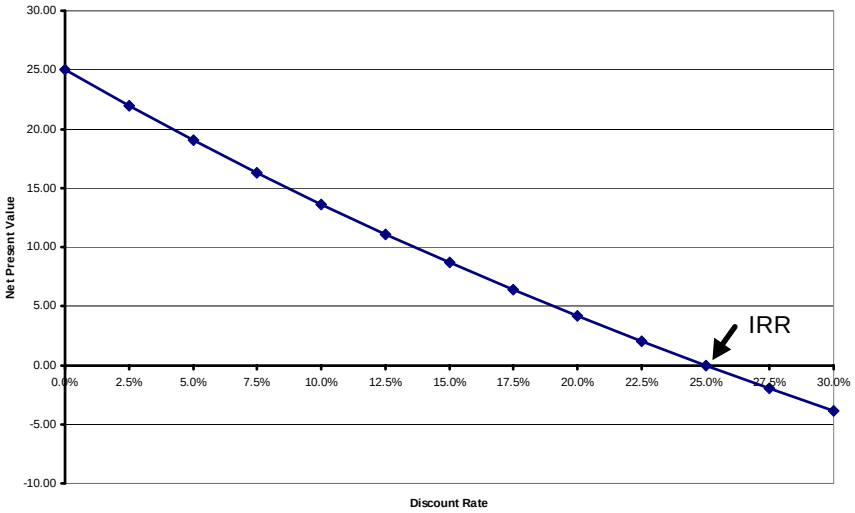
- $NPV = -I + C_1/(1+r) > 0 \Leftrightarrow C_1 > I(1+r) \Leftrightarrow (C_1 - I)/I > r \Leftrightarrow IRR > r$

IRR: a general definition

- The Internal Rate of Return is the discount rate such that the NPV is equal to zero.

- $-I + C_1/(1+IRR) \equiv 0$

- In our example:
- $-100 + 125/(1+IRR)=0$
- $\Rightarrow$ IRR=25%



Internal Rate of Return IRR

- Can be viewed as the "yield to maturity" of the project
  - Remember: the yield to maturity on a bond is the rate that set the present value of the expected cash flows equal to its price
- Consider the net investment as the price of the project
  - The IRR is the rate that sets the present value of the expected cash flows equal to the net investment
  - The IRR is the rate that sets the net present value equal to zero

What do CFOs Use?

	% Always or Almost Always
Internal Rate of Return	75.6%
Net Present Value	74.9%
Payback period	56.7%
Discounted payback period	29.5%
Accounting rate of return	30.3%
Profitability index	11.9%

- Based on a survey of 392 CFOs

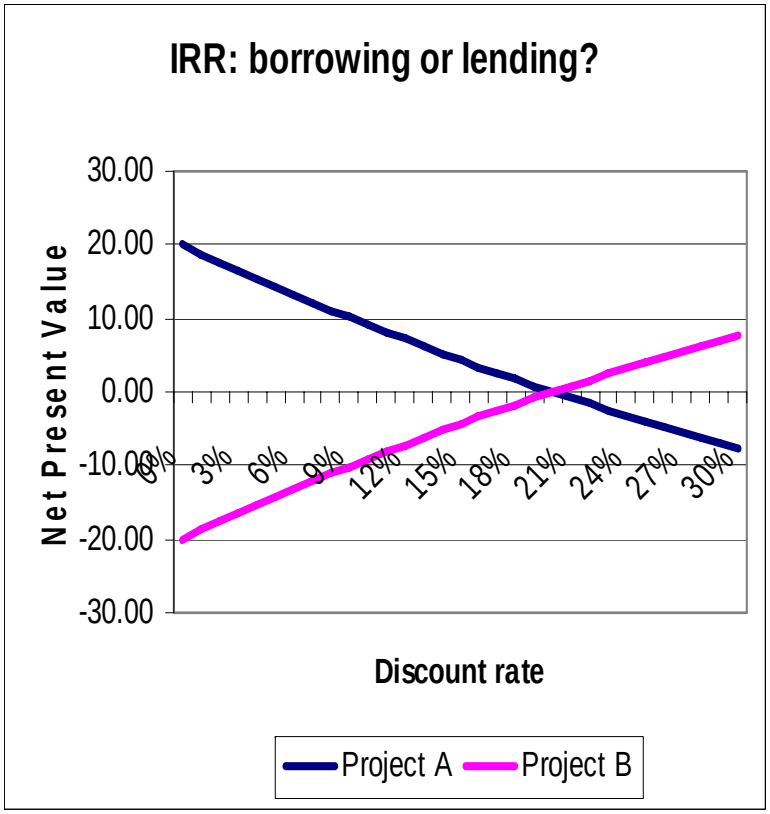
Source: Graham, John R. and Harvey R. Campbell, "The Theory and Practice of Corporate Finance: Evidence from the Field", *Journal of Financial Economics* 2001

IRR Pitfall 1: Lending or borrowing?

- Consider following projects:

	0	1	IRR	NPV(10%)
A	-100	+120	20%	9.09
B	+100	-120	20%	-9.09

- A: lending Rule IRR>*r*
- B: borrowing Rule IRR<*r*



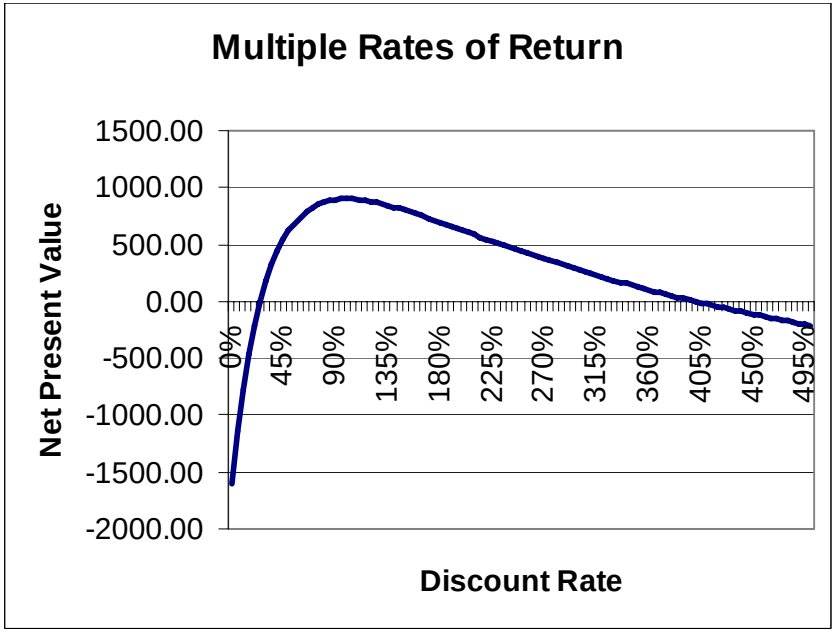
IRR Pitfall 2 Multiple Rates of Return

- Consider the following project
- Year 0 1 2
- CF -1,600 10,000 -10,000

- 2 "IRRs" : +25% & +400%

- This happens if more than one change in sign of cash flows

- To overcome problem, use modified IRR method
  - Reinvest all intermediate cash flows at the cost of capital till end of project
  - Calculate IRR using the initial investment and the future value of intermediate cash flows



IRR Pitfall 3 - Mutually Exclusive Projects

- **Scale Problem**

	C_0	C_1	$NPV_{10\%}$	IRR
Small	-10	+20	8.2	100%
Large	-50	+80	22.7	60%

- To choose, look at incremental cash flows

	C_0	C_1	$NPV_{10\%}$	IRR
L-S	-40	+60	14.5	50%

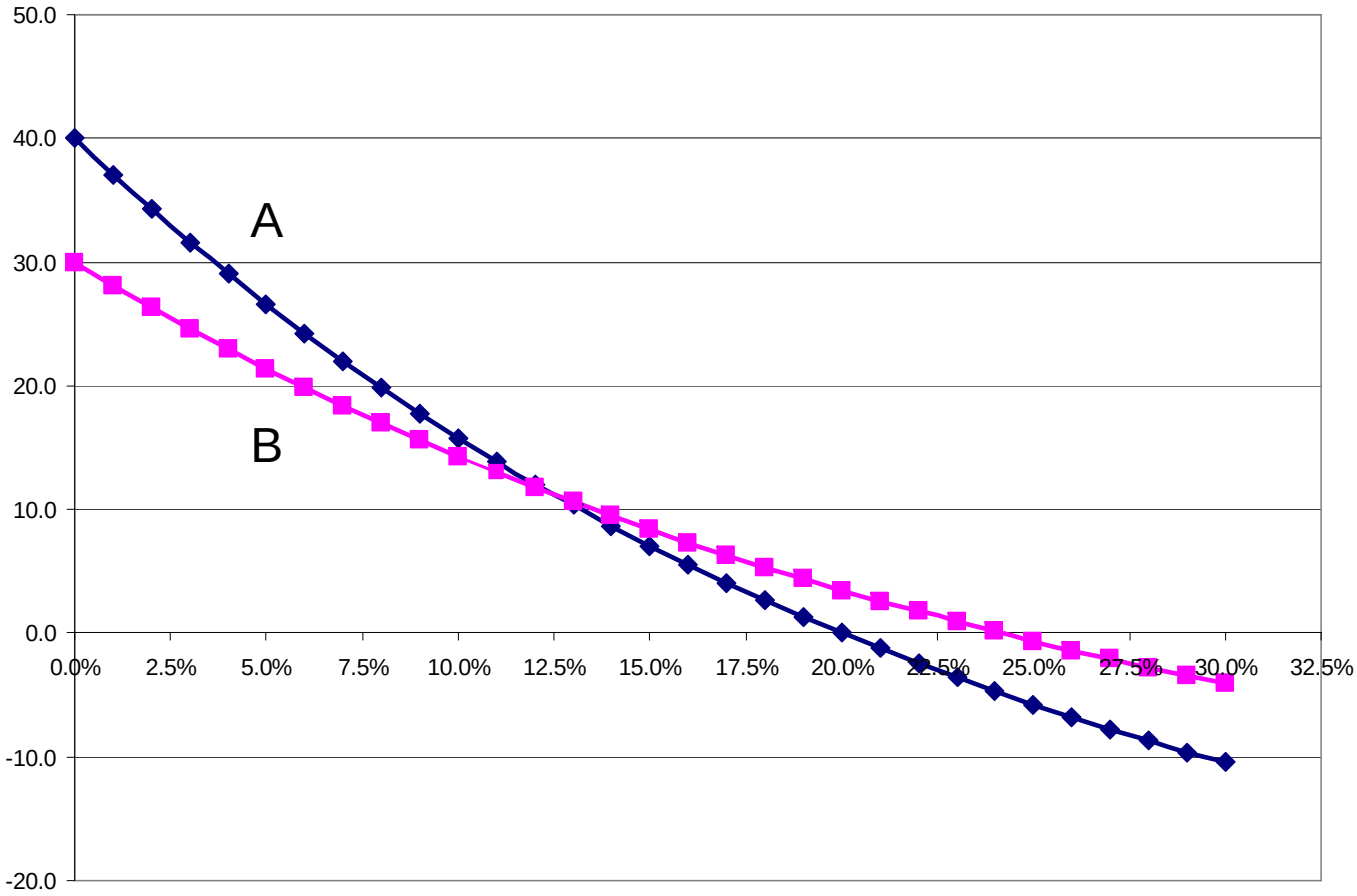
- **Timing Problem**

	C_0	C_1	C_2	$NPV_{8\%}$	IRR
A	-100	+20	+120	19.8	20%
B	-100	+100	+30	17.0	24.2%

- Look at incremental cash flows

	C_0	C_1	C_2	$NPV_{8\%}$	IRR
A-B	0	-80	+90	2.9	12.5%

Mutually Exclusive Project - Illustration



Payback

- The payback period is the number of years it takes before the cumulative forcasted cash flows equals the initial investment.
- Example:

Year	0	1	2	3	Payback	NPV $r=10\%$
A	-1,000	500	500	1,000	2	619
B	-1,000	0	1,000	0	2	-174
C	-1,000	500	500	0	2	-132

- A very flawed method, widely used
  - Ignores time value of money
  - Ignores cash flows after cutoff date

Profitability Index

- Profitability Index = PV(Future Cash Flows) / Initial Investment

- A useful tool for selecting among projects when capital budget limited.
- The highest weighted average PI

NPV - Review

- NPV: measure change in market value of company if project accepted
- As market value of company V = PV(Future Free Cash Flows)

$$NPV = \Delta V = \sum_t \frac{\Delta FCF_t}{(1+r)^t}$$

- $\Delta V = V_{\text{with project}} - V_{\text{without project}}$
- Cash flows to consider:
  - cash flows (not accounting numbers)
    - do not forget depreciation and changes in WCR
  - incremental (with project - without project)
    - forget sunk costs
    - include opportunity costs
    - include all incidental effects
    - beware of allocated overhead costs

Inflation

- Be consistent in how you handle inflation
  - Discount nominal cash flows at nominal rate
  - Discount real cash flows at real rate
  - Both approaches lead to the same result.

- Example: Real cash flow in year 3 = 100 (based on price level at time 0)
  - Inflation rate = 5%
  - Real discount rate = 10%

Discount real cash flow using real rate	Discount nominal cash flow using nominal rate
PV = $100 / (1.10)^3 = 75.13$	Nominal cash flow = $100 (1.05)^3 = 115.76$ Nominal discount rate = (1.10)(1.05)-1 = 15.5% PV = $115.76 / (1.155)^3 = 75.13$

Interest rates and inflation: real interest rate

	Date 0	Date 1
Nominal interest rate = 10%		
Individual invests	$ 1,000	
Individual receives		$ 1,100
Hamburger sells for	$1	$1.06
Inflation rate = 6%		
Purchasing power (# hamburgers)	H1,000	H1,038

- *Real* interest rate = 3.8%

(1+Nominal interest rate)=(1+Real interest rate)×(1+Inflation rate)

- Approximation:

Real interest rate ≈ Nominal interest rate - Inflation rate

Investment Project Analysis: BOF

Big Oversea Firm is considering the project

Year	0	1	2	3
Initial Investment	60			
Resale value				20
Sales		100	100	
Cost of sales		50	50	

Corporate tax rate = 40%
Working Capital Requirement = 25% Sales
Discount rate = 10%

BOF: Free Cash Flow Calculation

Year	0	1	2	3
Sales		100	100	
Cost of sales		50	50	
EBITDA		50	50	
Depreciation		30	30	
EBIT		20	20	
Taxes		8	8	8
Net income		12	12	-8
Net income		12	12	-8
Depreciation		30	30	0
DWCR		25	0	-25
CFInvestment	-60			20
Free Cash Flow	**-60**	**17**	**42**	**37**

BOF: go ahead?

- NPV calculation:

$$NPV = -60 + \frac{17}{1.10} + \frac{42}{(1.10)^2} + \frac{37}{(1.10)^3} = 17.96$$

- Internal Rate of Return = 24%

- Payback period = 2 years

BOF: checking the numbers

- Sensitivity analysis
  - What if expected sales below expected value?

Sales	60	70	80	90	100
NPV	-1.28	3.53	8.34	13.15	17.97

- Break-even point
  - What is the level of sales required to break even?
  - Break even sales = 62.7

BOF Project with inflation rate = 100%

Nominal free cash flows

Year	0	1	2	3
Sales		200	400	
Cost of sales		100	200	
EBITDA		100	200	
Depreciation		30	30	
EBIT		70	170	
Taxes		28	68	64
Net income		42	102	-64
Net income		42	102	-64
Depreciation		30	30	0
ΔWCR		50	50	-100
CFInvestment	-60			160
Free Cash Flow	**-60**	**22**	**82**	**196**

Nominal discount rate = (1+10%)(1+100%)-1 = 120%

NPV = -14.65 IRR = 94%

REFERENSI

- Solvay Business School
- Université Libre de Bruxelles
- Fall 2007