

# The Cost of Capital

March 15, 2004

# Sources of capital

- Debt
  - Bank loans
  - Bond issues
  - Convertible bonds
  - Delaying payment on accounts payable
- Preferred equity
- Common equity
  - Common stock issues
  - Retained earnings

# Effect of taxes on the cost of capital

- Interest payments are a deductible expense, but returns to stockholders (i.e., dividends, retained earnings) are not.
- $\Rightarrow$  For every dollar of return paid on equity, the firm must earn  $1/(1-\tau)$  dollars of income before taxes; for every dollar of interest paid, the firm need only only earn one dollar of income before taxes.
- The effective ‘after-tax’ cost of debt =  $(1-\tau) r_b$
- The after-tax cost of equity is  $r_s$
- Question: Why don’t firms rely exclusively on debt to raise capital?

# Other questions

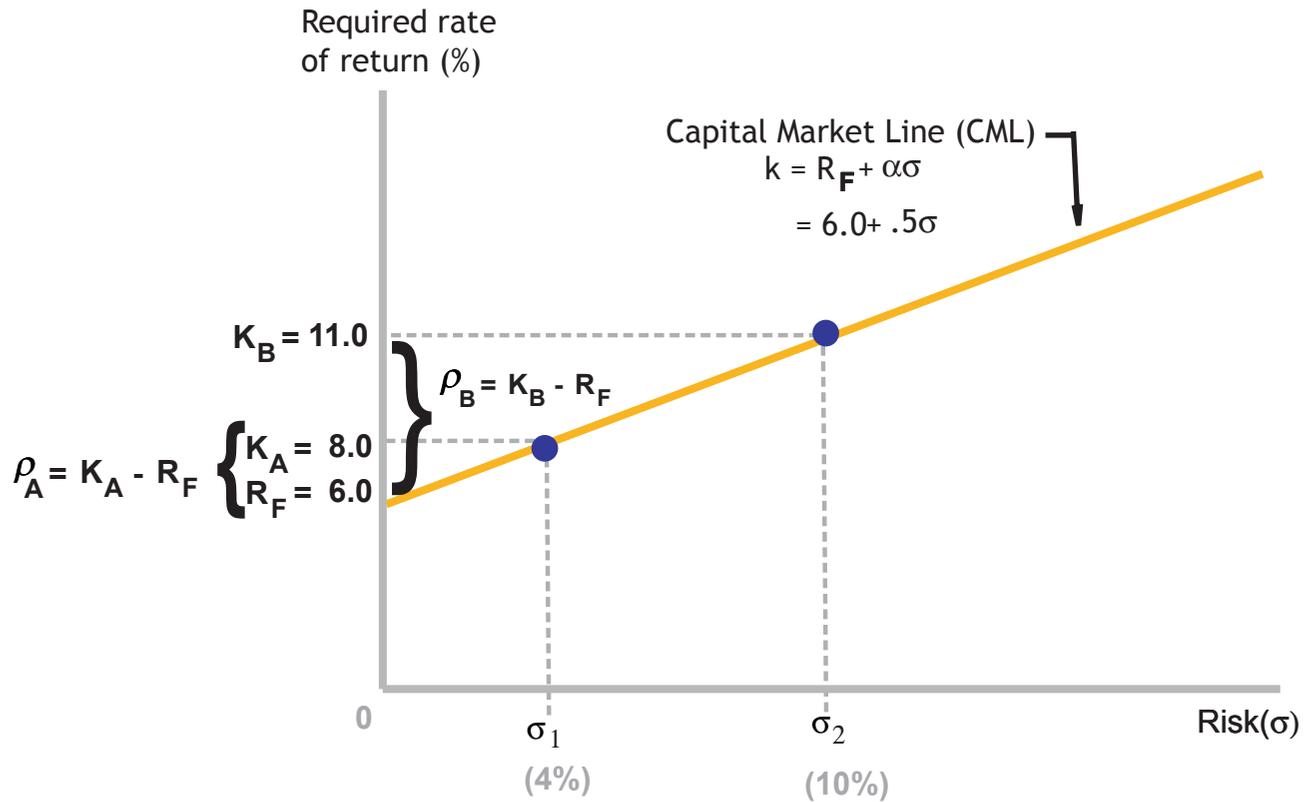
- What determines the ‘capital structure’ of the company -- i.e., the proportions of the different types of financing that it uses?
- What other factors affect the relative cost of the different types of financing? For a given type of financing, do all projects and companies have access to capital at the same cost?

# The relationship between investment risk and expected returns

- Each class of financing is perceived by investors to be associated with a different level of risk
  - Bonds
  - Preferred stock
  - Common stock
- The required rate of return is the minimum rate of return necessary to induce investors to buy or hold a security
  - For any given security, the required rate of return,  $r$ , equals the riskless rate of interest,  $R_F$ , plus a risk premium,  $\rho$

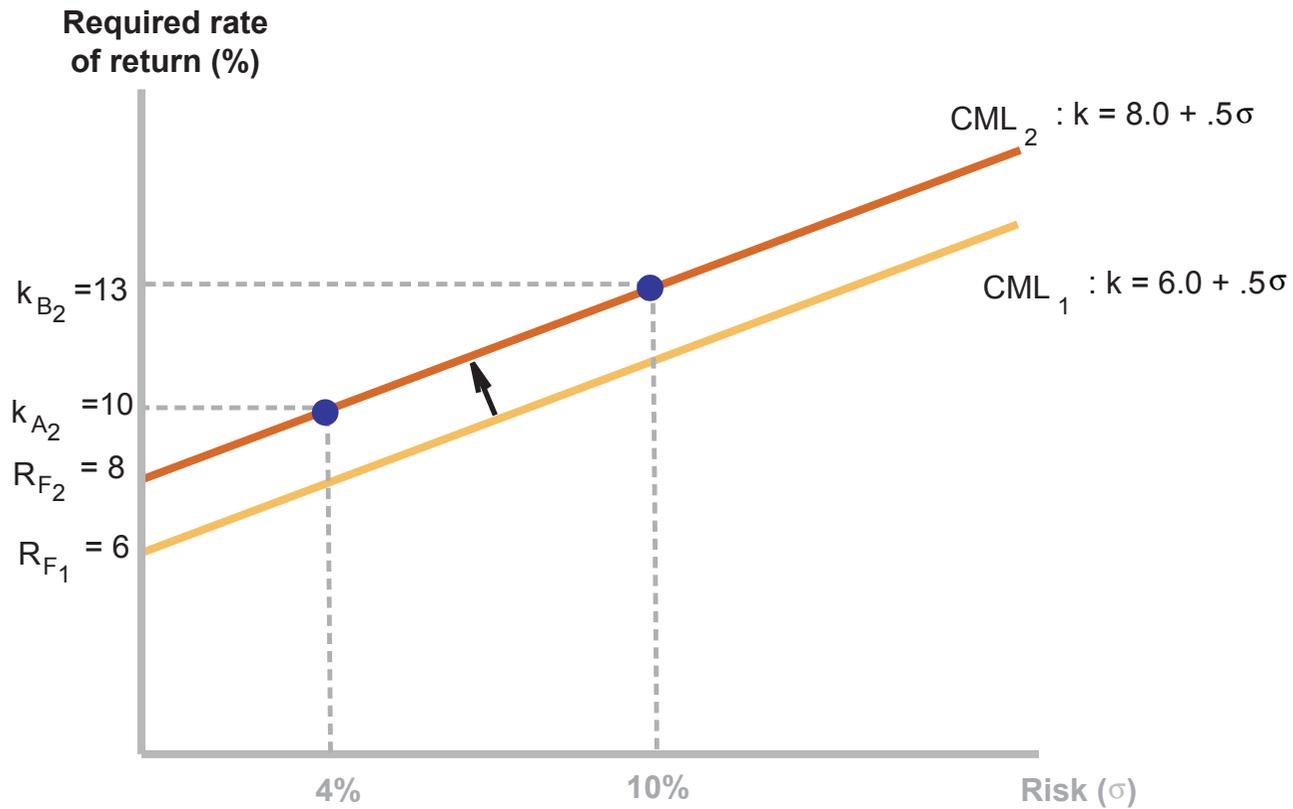
$$r = R_F + \rho$$

# The relationship between risk and required rate of return



Source: Weston and Brigham

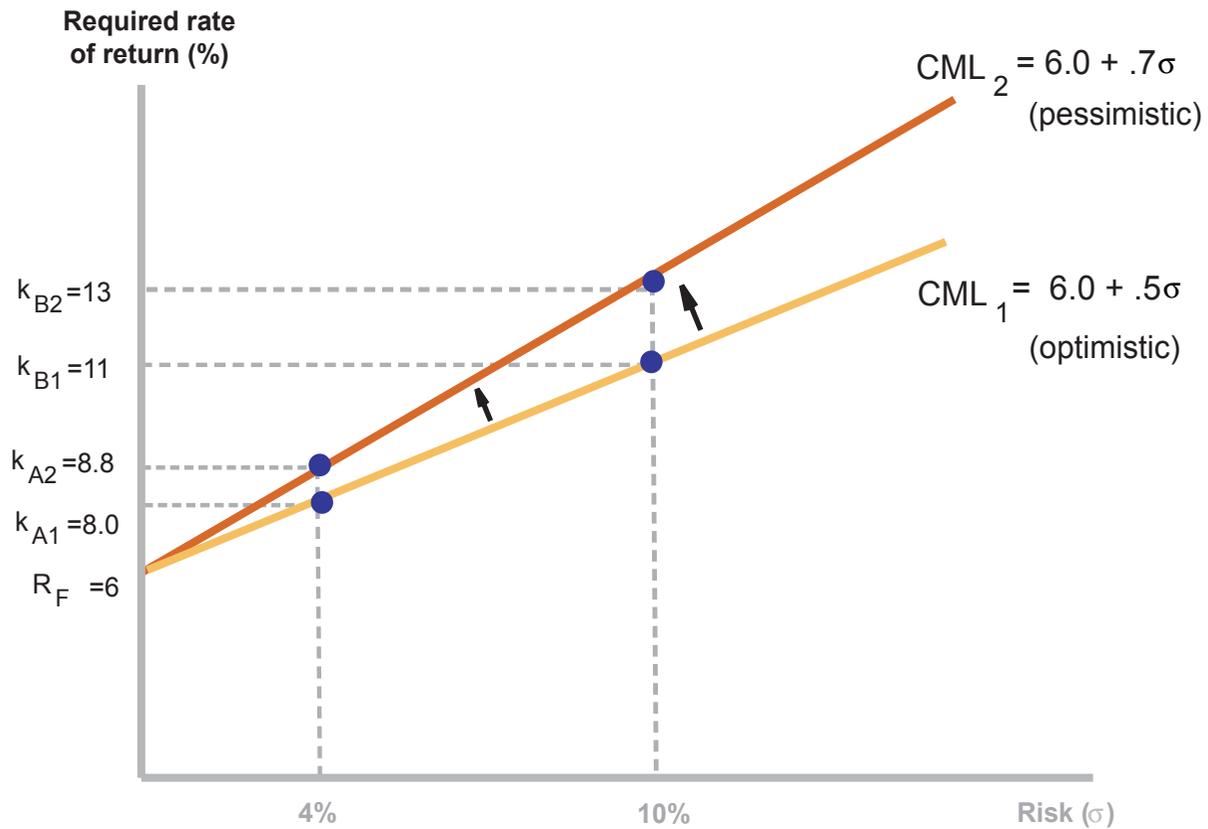
# The effect of rising interest rate on the required rate of return



Source: Weston and Brigham

Nuclear Energy Economics and  
Policy analysis

# The Effect of Changing Investor Attitudes on the Required Rate of Return



Source: Weston and Brigham

# Sources of risk

- Macroeconomic risks
    - Interest rates
    - Tax policies
  - Industry-specific business risks
    - Technological uncertainties
    - Market uncertainties
    - Competitor uncertainties
  - Firm-specific business risks
    - Managerial performance
  - Financial risks
    - Effect of degree of financial ‘leverage’ (debt-to-equity ratio)
-  – Effect of degree of financial ‘leverage’ (debt-to-equity ratio)

## Effect of financial leverage on the cost of capital

Example (from Weston and Brigham):

Consider three firms in the same industry that are identical except for their financial policies.

Firm A: No debt (0% leverage)

Firm B: 50% debt finance

Firm C: 75% debt finance

<u>FIRM A</u>			
		Total debt	\$0
		Net worth of equity	\$200
		investors	
Total assets	<u>\$200</u>	Total liabilities	<u>\$200</u>
		(claims)	

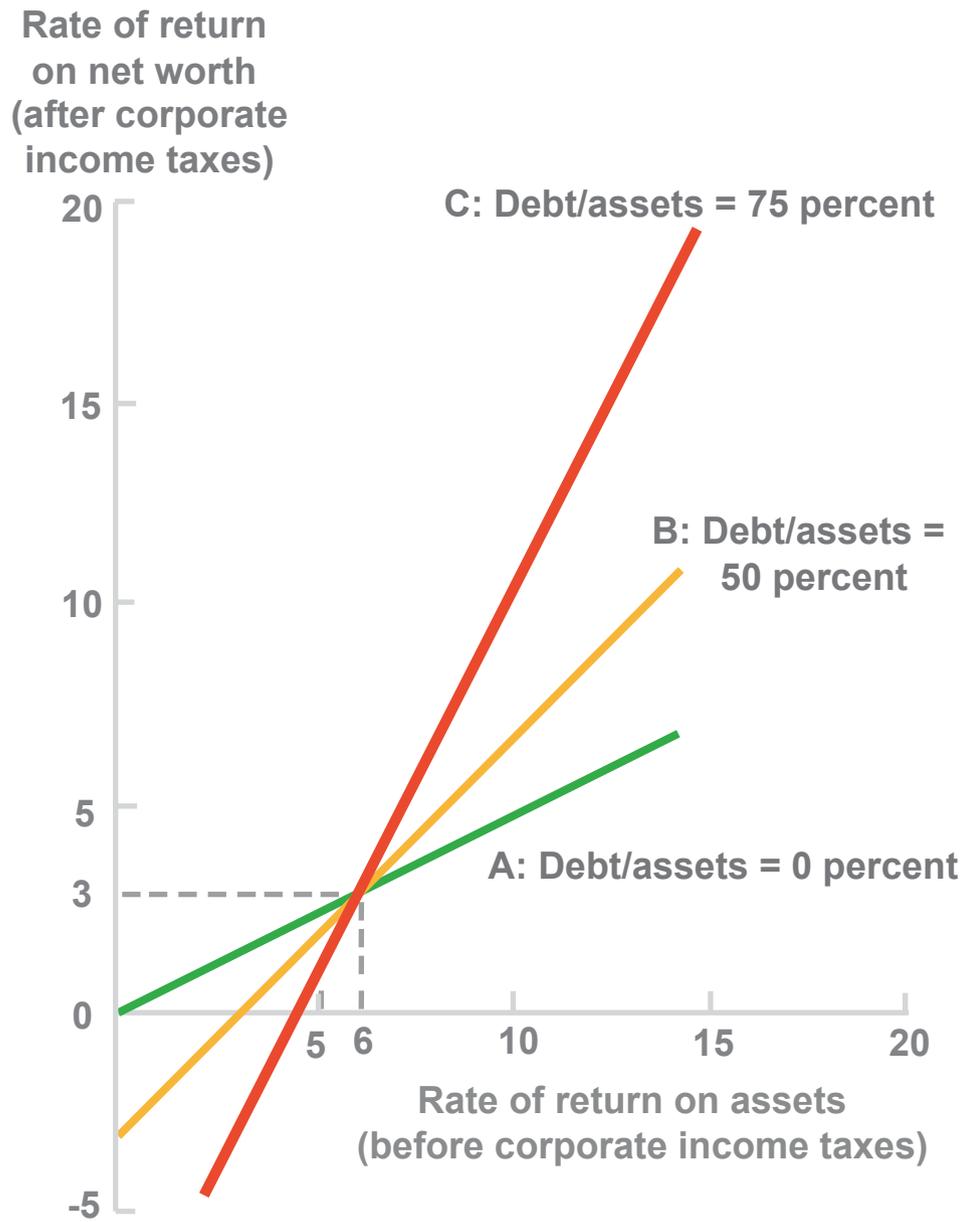
<u>FIRM B</u>			
		Total debt (6%)	\$100
		Net worth of equity	\$100
		investors	
Total assets	<u>\$200</u>	Total liabilities	<u>\$200</u>

<u>FIRM C</u>			
		Total debt (6%)	\$150
		Net worth of equity	\$50
		investors	
Total assets	<u>\$200</u>	Total liabilities	<u>\$200</u>

## Stockholder Returns under Various Leverage and Economic Conditions

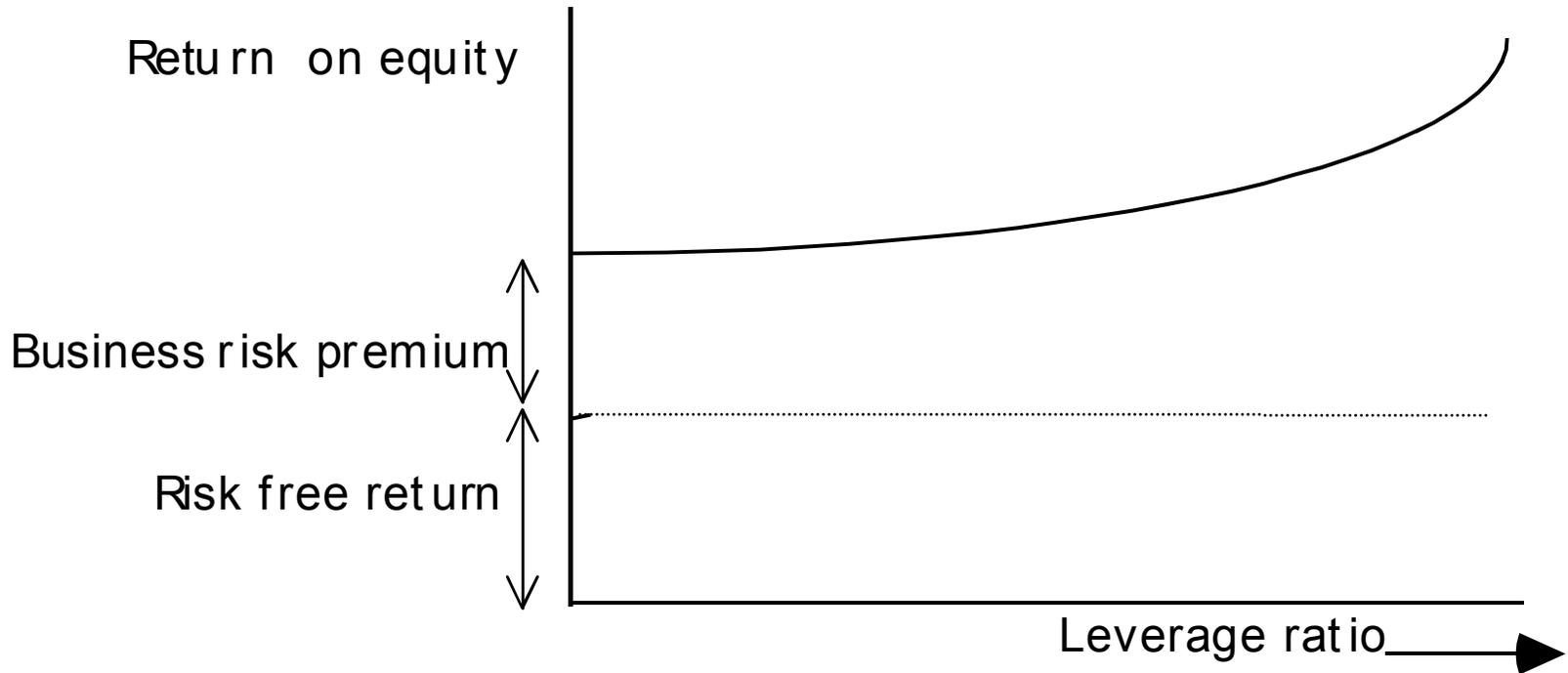
	<i>Economic Conditions</i>					
	<i>Very poor</i>	<i>poor</i>	<i>Indifference Level</i>	<i>Normal</i>	<i>Good</i>	<i>Very Good</i>
Rate of return on assets before interest and taxes	2 %	5 %	6 %	8 %	11 %	14 %
Earnings before interest and taxes (EBIT)	\$ 4	\$ 10	\$ 12	\$ 16	\$ 22	\$ 28
<b><i>Firm A: Leverage Factor 0%</i></b>						
<b><i>EBIT</i></b>	\$ 4	\$ 10	\$ 12	\$ 16	\$ 22	\$ 28
Less: Interest expense	0	0	0	0	0	0
Taxable Income	\$ 4	\$ 10	\$ 12	\$ 16	\$ 22	\$ 28
Taxes (50%) <sup>a</sup>	2	5	6	8	11	14
Available to common stock	\$ 2	\$ 5	\$ 6	\$ 8	\$ 11	\$ 14
Percent return on net worth	1 %	2.5 %	3 %	4 %	5.5 %	7 %
<b><i>Firm B: Leverage Factor 50%</i></b>						
<b><i>EBIT</i></b>	\$ 4	\$ 10	\$ 12	\$ 16	\$ 22	\$ 28
Less: Interest expense	6	6	6	6	6	6
Taxable income	\$ (2)	\$ 4	\$ 6	\$ 10	\$ 16	\$ 22
Taxes (50%) <sup>a</sup>	(1)	2	3	5	8	11
Available to common stock	\$ (1)	\$ 2	\$ 3	\$ 5	\$ 8	\$ 11
Percent return on net worth	- 1 %	2 %	3 %	5 %	8 %	11 %
<b><i>Firm C: Leverage Factor 75%</i></b>						
<b><i>EBIT</i></b>	\$ 4	\$ 10	\$ 12	\$ 16	\$ 22	\$ 28
Less: Interest expense	9	9	9	9	9	9
Taxable income	\$ (5)	\$ 1	\$ 3	\$ 7	\$ 13	\$ 19
Taxes (50%) <sup>a</sup>	(2.5)	.5	1.5	3.5	6.5	9.5
Available to common stock	\$ (2.5)	\$ .5	\$ 1.5	\$ 3.5	\$ 6.5	\$ 9.5
Percent return on net worth	- 5 %	1 %	3 %	7 %	13 %	19 %

<sup>a</sup>The tax calculation assumes that losses are carried back and result in tax credits

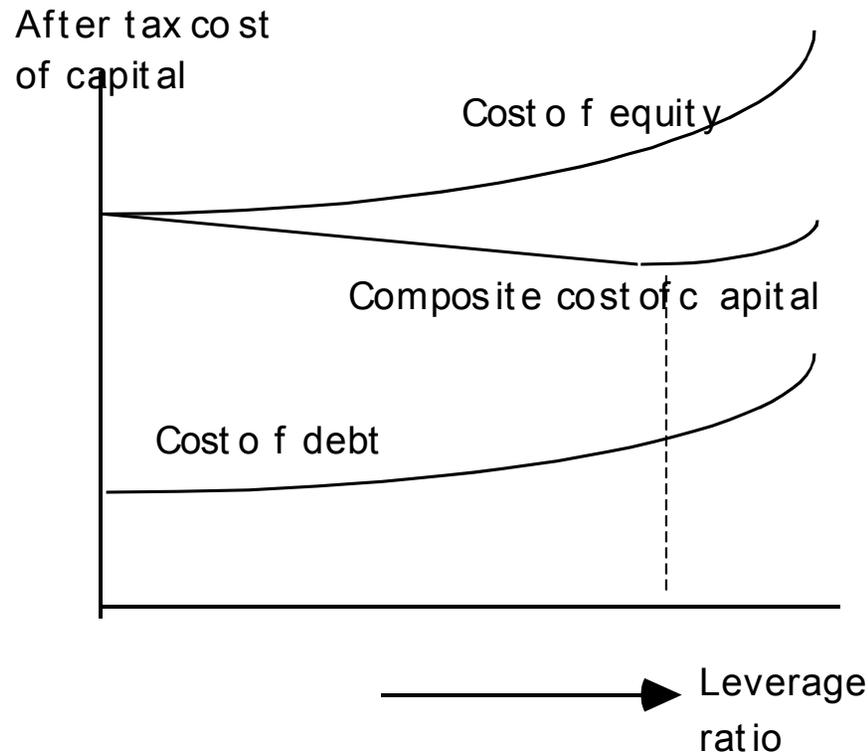


**Nuclear Energy Economics and  
Policy Analysis**

The required return on equity increases with the leverage ratio (i.e., debt-to-equity ratio)

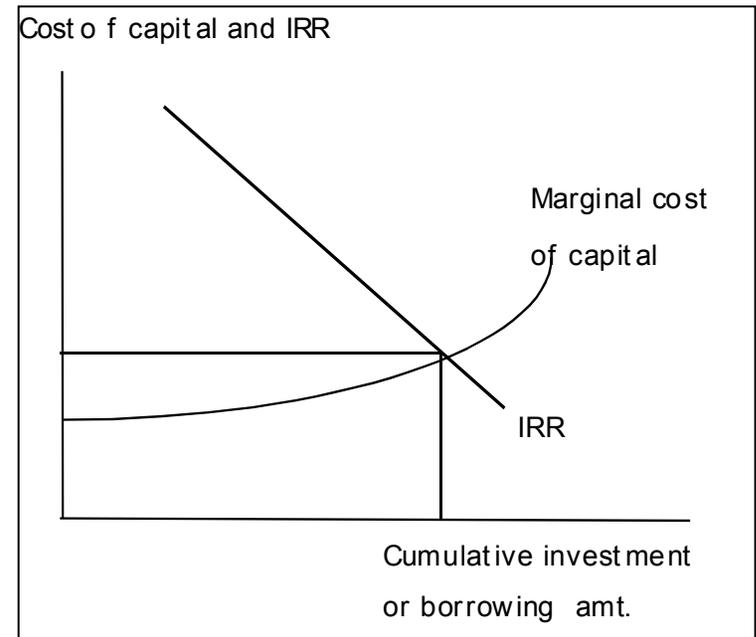
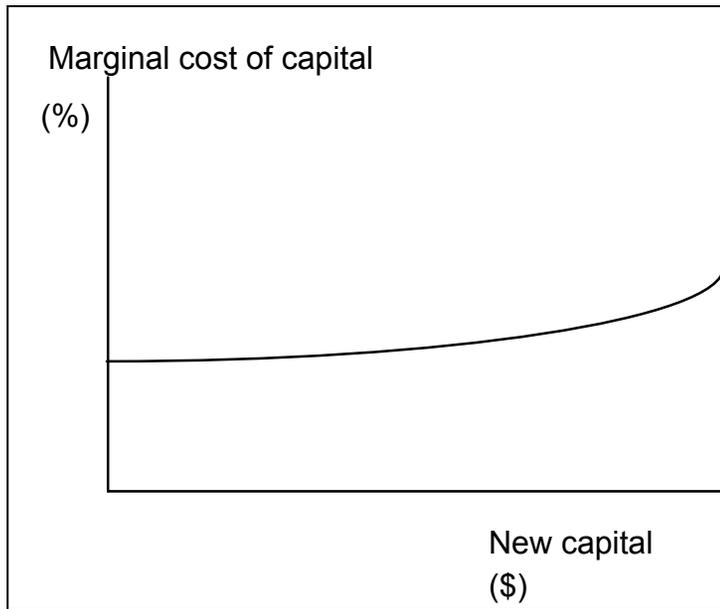


There is, in general, a degree of leverage at which the cost of capital is minimized



Note: the more stable the industry is, the higher the optimal leverage ratio (i.e., the greater the use of debt)

## Marginal cost of capital for a given firm\*



\*At each stage, the capital structure is chosen to minimize the cost of capital

### Complications:

1. Determination of optimal capital structure/marginal cost of capital curve is complex.
2. Effect of capital rationing. Firms may be unwilling to operate at the intersection:
  - Uncertainties in projections may cause firm to 'play it safe'
  - Expectation of better investment opportunities in future years may cause firms to stop short of intersection point.