Direcció Financera II

Chapter 3: Firm's Capital Structure
Part (a): Debt, Equity and Modigliani and Miller

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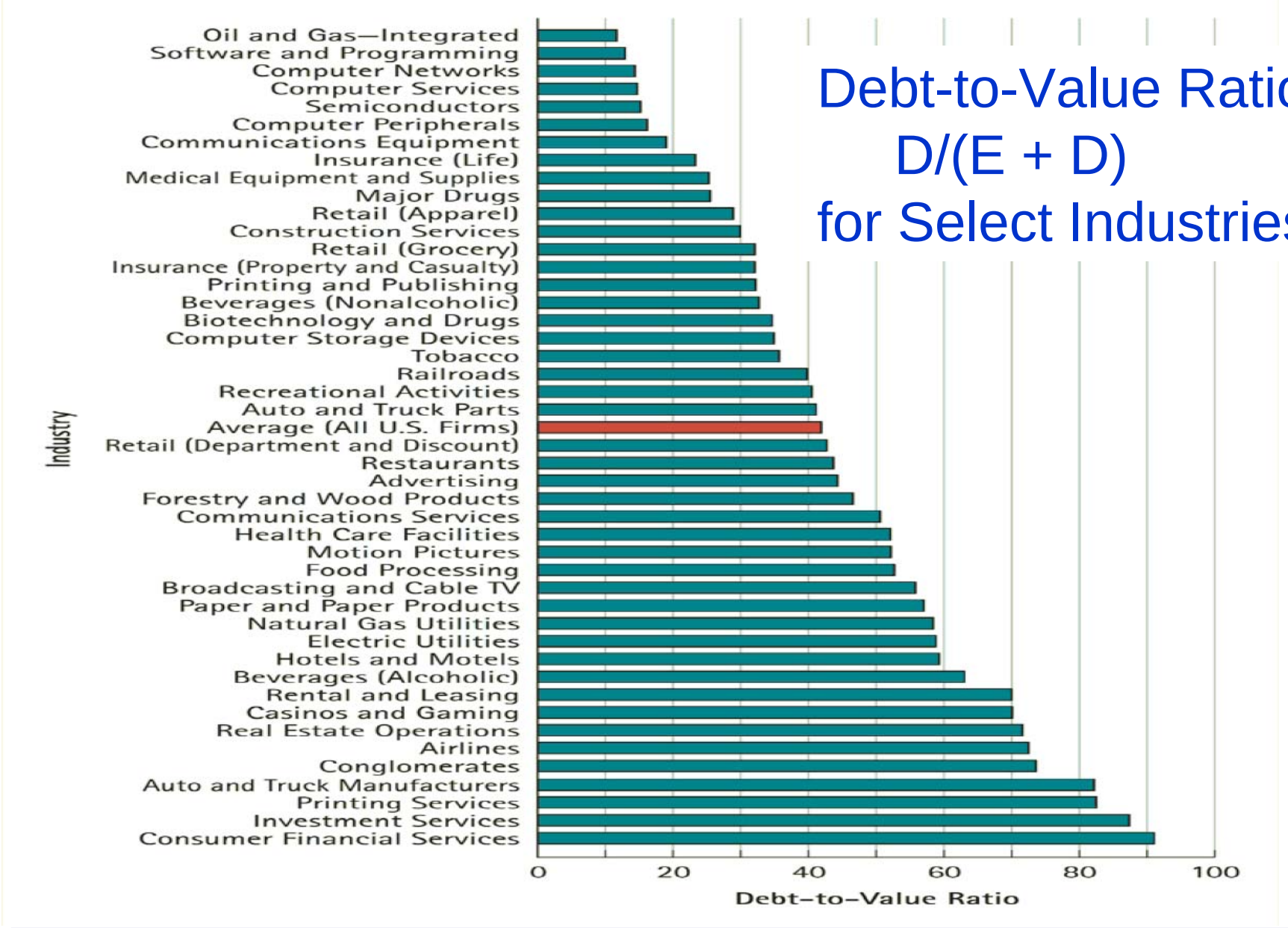
Financing Decision

- How are we going to pay for any investment?
  - Internal capital: retain earnings generated
  - External capital: Debt or equity?
    - Debt holder claims must be paid in full before the claims of equity holders can be paid
    - Equity holders elect the board of directors and thus ultimately control the firm
    - Equity holders receive cash in the form of dividends, which are not tax-deductible, while the interest payments of debt are a tax-deductible expense

Firm's Capital Structure

- The collection of securities a firm issues to raise capital from investors is called the **firm's capital structure**.
- In short "the firm's mix of debt and equity financing"
- When raising funds from investors a firm must choose…
  - what type of security to issue
  - and therefore what capital structure to have

Debt-to-Value Ratio D/(E + D) for Select Industries



Financing with equity?

- Project description:
  - Initial investment: £800m
  - Cash flows: £1400m (strong economy) or £900 (weak) next year
  - Each scenario is equally likely
  - Due to project risk, investors ask for an additional 10% over the 5% risk-free rate interest rate
  - NPV=?
- If project financed with equity, what is/are…
  - Market value of the firm's (unlevered) equity today?
  - Investors' equity returns in each scenario? Expected returns?

Financing with debt and equity?

- Suppose firm also borrows £500 initially,
  - What should the interest rate be?
  - How much would the firm owe in a year?
- What should now be the…
  - Market value of equity?
  - Equity returns if £500 in (levered) equity? Expected?
- What is the firm's average cost of capital?

Modigliani-Miller theorem

- Proposition 1: Capital structure of the firm is irrelevant (total value of the firm is independent of the capital structure) in the absence of…
  - Arbitrage opportunities
  - Taxes
  - Costs of bankruptcy
  - Information problems
  - Transaction costs

  } Sum of cash flows to debt and equity holders is constant

Proof (1)

- Take two identical firms, Unilevcom and Levcom, except for their capital structure

  They exist for a year and produce identical pretax profits X at the end of the year (unknown at the beginning)

  One is unleveraged (no debt) and the other is leveraged (has some debt)

  Assume that its debt is riskless, at the interest rate r_D

- Total and split cash flows are…

Proof (2): Cash Flows

	Company Unilevcom		Company Lunievcom	
	Future Cash Flow	Current Value	Future Cash Flow	Current Value
Debt	0	0	$(1+ r_D)D$	D
Equity	X	U	$X- (1+ r_D)D$	E
Total	X	U	X	D+E

Proof (3): What if D+E< U?

- What if Unilevcom has $100m worth of equity (U) and Lunilevcom has $60m of equity (E) and $30m of debt (D)?
  - Buy 10% of equity ($6m) and 10% of debt ($3m) of Lunilevcom
  - Sell short 10% of equity of Unilevcom ($10m)
  - Cash inflow of $1m at the beginning of the year
  - At the end of the year…
    - Receive: $.1[X-(1+r_D)D]+.1(1+r_D)D$
    - Pay: .1X
    - In total: 0!!
  - Arbitrage opportunity!
- Similarly, arbitrage opportunity if D+E > U
- Therefore D + E = U

Homemade leverage

Example: Stanley and Elco (before)

Elco	
Number of shares	1000
Price per share	$100
Market Value of Shares	$100,000
Market value of debt	$10,000

Stanley	
Number of shares	100
Payoff	$.1[X-(1+r_D)10{,}000]=.1X-(1+r_D)1{,}000$

Repurchasing Shares (leveraged recapitalisation)

- Firm wants to repurchase 500 shares
- Needs to raise $50,000 in debt

Elco	
Number of shares	500
Price per share	$100
Market Value of Shares	$ 50,000
Market value of debt	$ 60,000

Undoing the Capital Structure Change (typo corrected)

- Stanley can opt for not selling shares (Alternative A) or he can sell half of his shares (Alternative B)
- Which one is better?

Stanley

Alternative A: Number of shares	100
Payoff	$.2[X - (1 + r_D)60{,}000] = .2X - (1 + r_D)12{,}000$
Alternative B: Number of shares	50
Payoff	$.1[X - (1 + r_D)60{,}000] + r_D 5{,}000 = .1X - (1 + r_D)1{,}000$

- If firm doesn't change capital structure, can Stanley get the payoff structure in alternative (A) (even with capital structure "before")?
- Shareholders can undo the effect of a change
- Shareholder is indifferent to changes in the firm's capital structure

What if debt may not be repaid?

Example: Suppose that the ownership can costlessly move from shareholders to debt holders

Elco

Number of shares	1000
Price per share	$100
Market Value of Shares	$100,000
Market value of debt	$10,000

Stanley

Number of shares	100
Payoff	$.1[X-(1+r_{DS})10{,}000]=.1X-(1+r_{DS})1{,}000$
	(*if* this amount is positive!)
	(*DS* stands for senior debholders, "or paid first")

Suppose new debt is junior (subordinated)

Example: Elco issues again new debt and Stanley buys

	Scenario A: cash flow exceeds all obligations	Scenario B: cash flow exceeds sr but not jr debt obligations	Scenario C: cash flow does not exceed sr debt obligations
50 shares of stock	$.1[X-(1+r_{DS})10,000-(1+r_{DJ})50,000]$	0	0
5000 of new debt	$(1+r_{DJ})5,000$	$.1[X-(1+r_{DS})10,000]$	0
Total	$.1[X-(1+r_{DS})10,000]$	$.1[X-(1+r_{DS})10,000]$	0

What if new debt is not subordinated?

- *Think about it as an exercise!*
- Transfer of wealth from existing debt holders to shareholders:
  - If new debt has the same seniority then the existing debt holders are worse off
  - In scenarios B and C, shareholders are better off
- Still, total value is unaltered: M&M still holds

Proposition 2: Cost of equity capital

- Proposition 1 states that:

$$E + D = U \quad (= A \text{ or market value of assets})$$

- By holding all debt and equity, we can replicate cash flows from unlevered equity, and as in portfolio theory:

$$\frac{E}{E+D} R_E + \frac{D}{E+D} R_D = R_U$$

(where R denotes returns) or

$$R_E = R_U + \frac{D}{E}(R_U - R_D)$$

- Therefore, in expected terms:

$$r_E = r_U + \frac{D}{E}(r_U - r_D)$$

(return on equity increases with leverage)

Back to Investment decisions

- In an unlevered firm, cash flows of its assets are paid out to its equity holders
- Therefore, the cost of capital for the firm's assets is:

$$r_A = r_U = \frac{\text{operating income}}{\text{market cap or U}}$$

- Projects should be discounted at their appropriate risk
- If firm assets have same risk as project evaluated…
  - and firm is unlevered
  - use equity cost of capital as the cost of capital for the project

What if the firm is levered?

- For a levered firm, equity cost of capital is…
  - higher than cost of capital of the assets,
  - and therefore of the project
- But we can compute the returns of the assets by

$$r_A = r_U = \frac{E}{E+D} r_E + \frac{D}{E+D} r_D \equiv r_{Wacc}$$

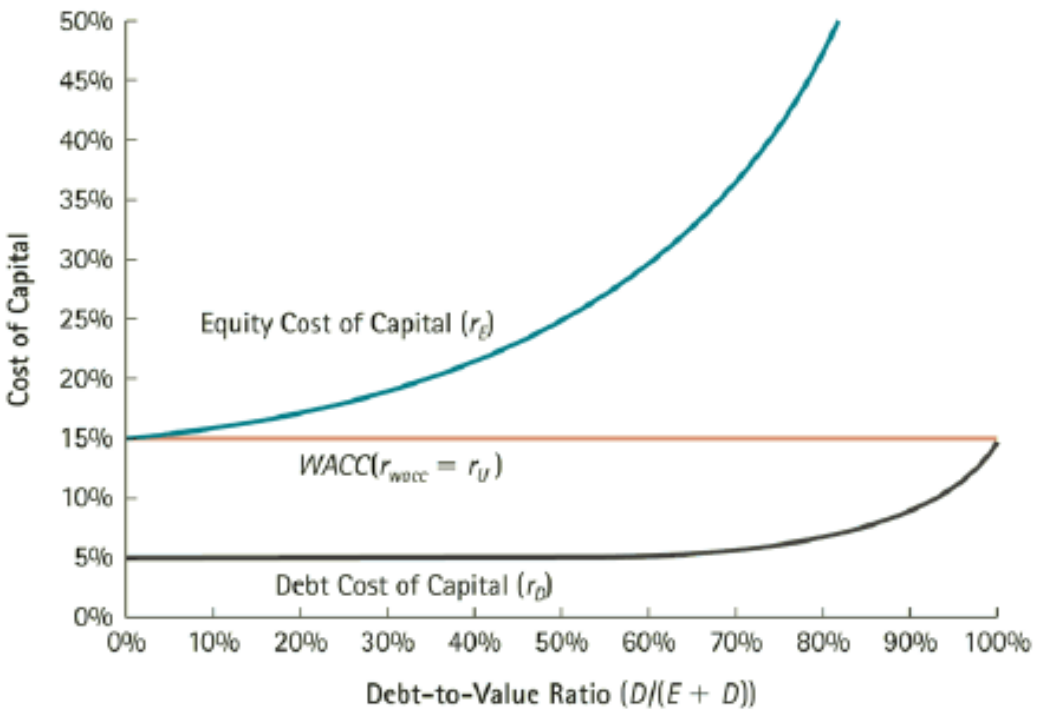
- Firm's WACC is independent of capital structure

FIGURE 15.5

WACC and Leverage with Perfect Capital Markets

Panel (a) represents the data in panel (b) for the coffee shop example. As the fraction of the firm financed with debt increases, both the equity and the debt become riskier and their cost of capital rises. Yet because more weight is put on the lower-cost debt, the weighted average cost of capital remains constant.

Panel (a) Equity, Debt, and WACC for Different Amounts of Leverage



Panel (b) WACC Data for Alternative Capital Structures

E	D	r_E	r_D	$r_E \frac{E}{E+D} + r_D \frac{D}{E+D}$	$= r_{wacc}$
30,000	0	15.0%	5.0%	15.0% × 1.0 + 5.0% × 0.0	= 15%
24,000	6,000	17.5%	5.0%	17.5% × 0.8 + 5.0% × 0.2	= 15%
15,000	15,000	25.0%	5.0%	25.0% × 0.5 + 5.0% × 0.5	= 15%
3,000	27,000	75.0%	8.3%	75.0% × 0.1 + 8.3% × 0.9	= 15%

What is the (unlevered) beta of a project?

- Because…
  - Unlevered equity is equivalent to portfolio of debt and levered equity
  - and beta of a portfolio is weighted average of betas of the securities:

$$\beta_U = \frac{E}{E+D}\beta_E + \frac{D}{E+D}\beta_D$$

where the unlevered beta is equivalent to the eta of the firm's assets (measuring risk of the firm's business activities)

- Therefore the equity beta is given by

$$\beta_E = \beta_U + \frac{D}{E}(\beta_U - \beta_D)$$

- And if the firm has no risk

$$\beta_E = \left(1 + \frac{D}{E}\right)\beta_U$$

Reading

- See Journal of Economic Perspectives special issue vol. 2, issue 4, (1988) including…
  - Battacharya (1988): “Corporate Finance and the
  - Legacy of Modigliani and Miller”
  - Modigliani (1988) “MM -Past, Present, Future”

- Original Modigliani and Miller paper:
  - “The cost of capital, corporation finance and the theory of investment”, American Economic Review, 1958