Direcció Financera II

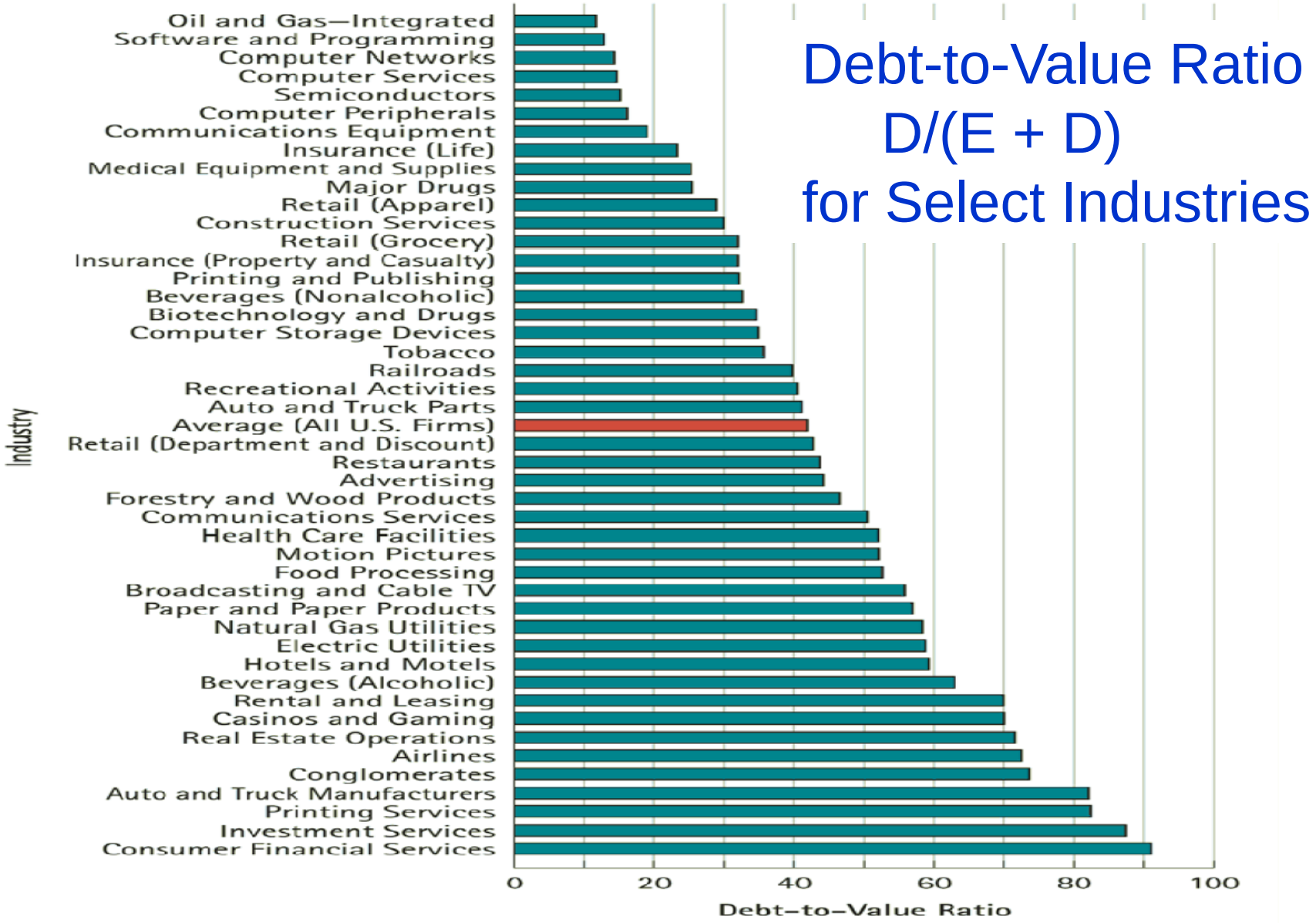
Chapter 2: Firm's Capital Structure (parts (a) and (b))

Albert Banal-Estanol

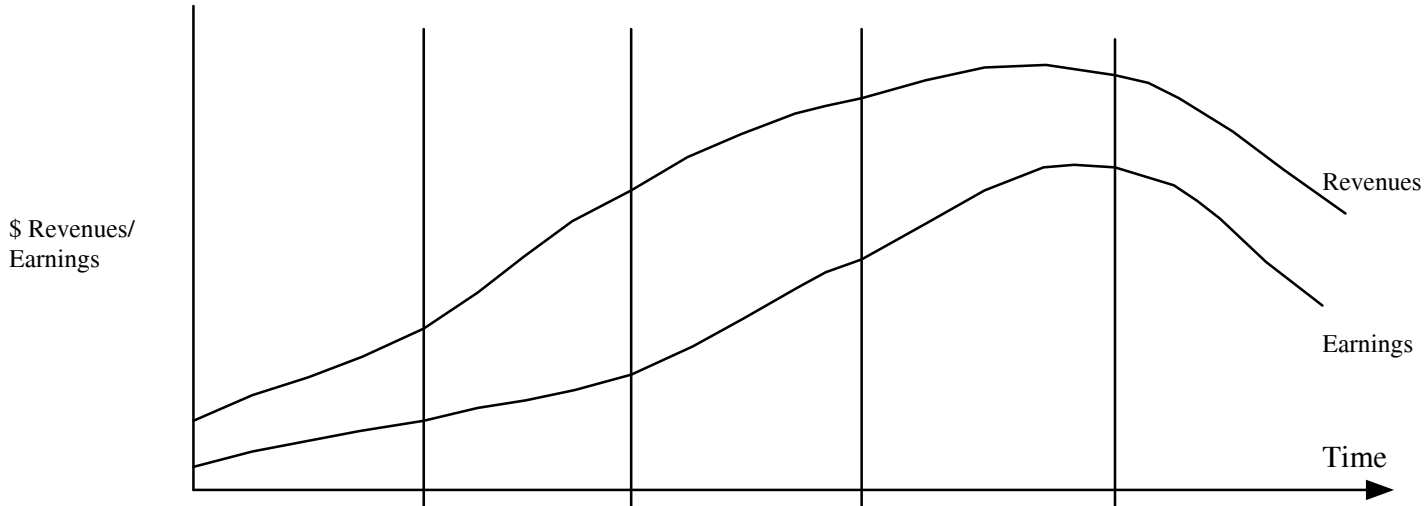
Financing Decision

- 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
- The collection of securities issued to raise capital from investors ("financing mix") = firm's **capital structure**

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



Financing Choices across the life cycle



External funding needs	High, but constrained by infrastructure	High, relative to firm value.	Moderate, relative to firm value.	Declining, as a percent of firm value	Low, as projects dry up.
Internal financing	Negative or low	Negative or low	Low, relative to funding needs	High, relative to funding needs	More than funding needs
External Financing	Owner's Equity Bank Debt	Venture Capital Common Stock	Common stock Warrants Convertibles	Debt	Retire debt Repurchase stock
Growth stage	Stage 1 Start-up	Stage 2 Rapid Expansion	Stage 3 High Growth	Stage 4 Mature Growth	Stage 5 Decline
Financing Transitions	Accessing private equity	Inital Public offering	Seasoned equity issue	Bond issues	

Link to capital budgeting (chapter 1)

- Invest in projects that yield a return (IRR) greater than minimum acceptable hurdle (discount) rate
  - Returns on projects should be measured based on cash flows generated and the timing of these cash flows
  - Hurdle (discount) rate should be higher for riskier projects and reflect the cost of capital used (equity but also debt)
- Therefore, we need to choose a financing mix that…
  - matches the assets being financed and
  - minimizes the hurdle rate
- If there are not enough investments that earn hurdle rate, return the cash to stockholders (see chapter 4)

Cost of capital

- In an unlevered firm,
  - cash flows of its assets are paid out to its equity holders, then

$$r_U := \frac{\text{operating income - market cap (U)}}{\text{market cap (U)}}$$

  - But, this should be equal to the cost of capital of the firm's assets:

$$r_U = r_A$$

- 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
  - that is, the estimates derived from the CAPM or APT models

Capital structure and cost of capital of the firm

- More generally, cost of capital can be viewed as return required by a portfolio comprising all equity and debt claims of the firm
- If you own all financial claims of the firm (equity and debt), the expected return would be given by

$$r_{WACC} := \frac{D}{D+E} r_D + \frac{E}{D+E} r_E = r_A$$

- Which capital structure minimises the cost of capital?

Motivating Case: (1) Equity Financing

- Project description:
  - Initial investment today: £800m
  - Cash flows: £1400m (success) or £900m (failure) end of the year
  - Each scenario (success, failure) 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?

Motivating Case: (2) Equity and Debt Financing

- Suppose firm also borrows £500m 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 today?
  - For this equity value, equity returns in each scenario? Expected?
- In sum...
  - Total value of the firm in each case (levered, unlevered)?
  - Return on equity and debt in each case?
  - What is the firm's "average cost of capital" in each case?

Plan of the chapter

- Part (a):
  - Debt, Equity and Modigliani and Miller
- Part (b):
  - Taxes, Bankruptcy Costs and the trade-off theory
- Part (c):
  - Agency costs and asymmetric information

(see next set of slides)

Part (a): Debt, Equity and Modigliani and Miller

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 first 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	$B = (1+ r_D)D$	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

What if debt is "risky"?

- Face value of debt B'. X' can be lower than B'
- Do we still have E' + D' = U'? Why?

	Company Unilevcom		Company Lunievcom	
	Future Cash Flow	Current Value	Future Cash Flow	Current Value
Debt	0	0	?	D'
Equity	X'	U'	?	E'
Total	X'	U'	X'	D'+E'

Proposition 2: Cost of 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 realised returns)

- Therefore, in expected terms:

$$r_{Wacc} := \frac{E}{E+D} r_E + \frac{D}{E+D} r_D = r_U \, (= r_A)$$

- Firm's WACC is independent of capital structure

Cost of equity capital

- As a result,

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

(return on equity increases with leverage)

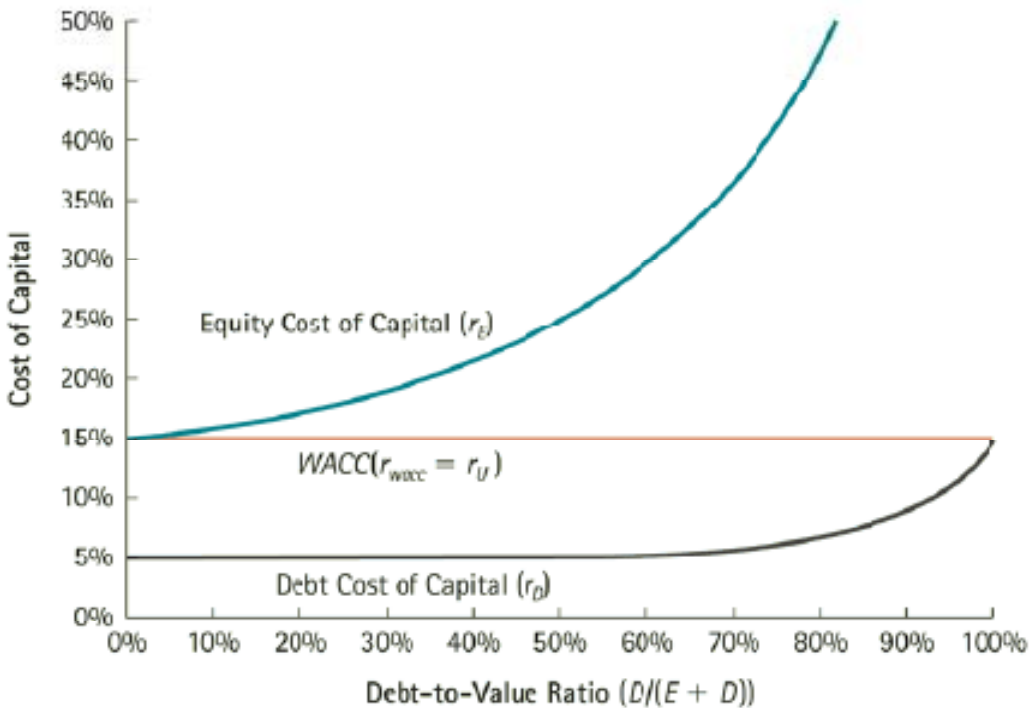
- As a result, for a levered firm, equity cost of capital is…
  - higher than cost of capital of the assets,
  - and therefore of the project

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 beta 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 of bankruptcy

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

Part (b): Taxes, Bankruptcy Costs and the Trade-of Theory

Departures from M&M

- In part (a), we showed that, in the M&M world…
  - Capital structure does not affect firm's value nor WACC
  - Thus, investment & financing decisions independent

- In this part (b), we should consider…
  - Corporate taxes
  - Personal taxes
  - Costs of bankruptcy
  - Problems of asymmetric information

Corporate and personal taxes

Corporate Taxes

- M&M: without taxes (and without bankruptcy costs, etc,.):
  - companies should be indifferent between debt and equity
- If taxes, exist, the objective should be to minimise them

- Suppose for the moment that…
  - companies are taxed but…
  - investors are not (e.g. pension funds)
- In order to minimize corporate taxes…
  - Interest payments are tax-deductible while dividends are not
  - Firms prefer debt to equity

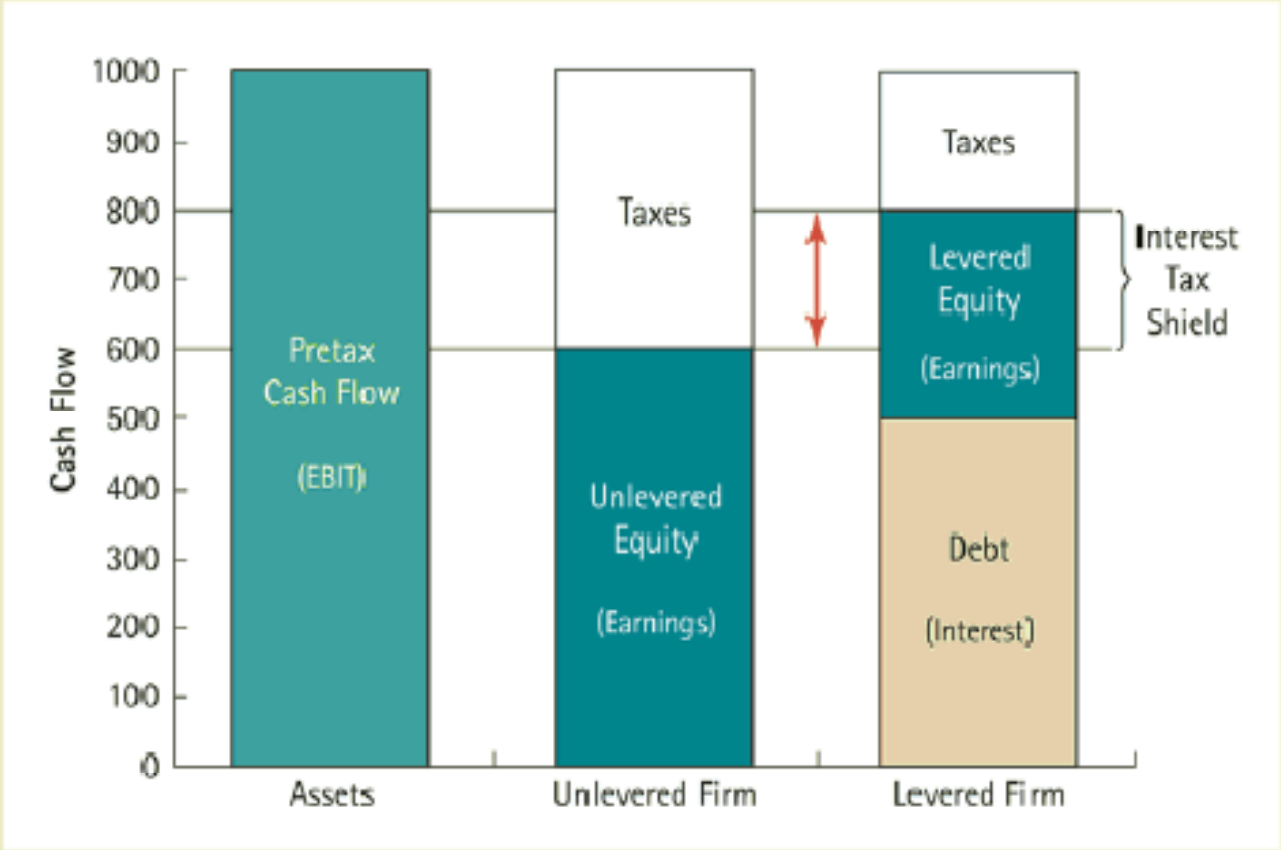
Example: D.F. Builders (DFB)

1	**DFB Income Statement ($ million)**	**2005**	**2006**	**2007**	**2008**
2	Total sales	$3,369	$3,706	$4,077	$4,432
3	Cost of sales	−2,359	−2,584	−2,867	−3,116
4	Selling, general, and administrative expense	−226	−248	−276	−299
5	Depreciation	−22	−25	−27	−29
6	**Operating income**	762	849	907	988
7	Other income	7	8	10	12
9	**EBIT**	769	857	917	1,000
10	Interest expense	−50	−80	−100	−100
11	**Income before tax**	719	777	817	900
12	Taxes (35%)	−252	−272	−286	−315
13	**Net income**	$467	$505	$531	$585

- What was the amount available to investors in 2005?
- Would it have been higher or lower without leverage?

The Cash Flows of the Unlevered and Levered Firm

By increasing the cash flows paid to debt holders through interest payments, a firm reduces the amount paid in taxes. The increase in total cash flows paid to investors is the interest tax shield. (The figure assumes a 40% marginal corporate tax rate.)



Corporate Taxes, Cash Flows and Value

- Assume firm is financed with equity and risk-free perpetuity bond (pays r_D forever)
- After-(corporate) tax payments are:

$$C_t = (X_t - r_D D)(1 - T_C) + r_D D = X_t(1 - T_C) + T_C\, r_D D$$

where T_C are the corporate taxes

- Therefore, given that payments of..
  - An unlevered firm would be $X_1(1 - T_C)$, $X_2(1 - T_C)$, $X_3(1 - T_C)$, and,
  - Second term of cash flow is constant, we have that…
  - $V_L = V_U + T_C D$ (present value of the interest tax shield is $T_C D$)

(if T_C=35% for every euro in permanent debt, value increases by 35c)

Personal Taxes

- Most investors are taxed when they receive cash
  - Interest income from debt taxed as income (T_D)
  - Equity investors pay taxes on dividends & capital gains (T_E)

- Typically…
  - Capital gains are taxed at lower rates than dividends or interests
  - Capital gains (and therefore taxes on them) might be deferred

- As a result: $T_E < T_D$

Personal and Corporate Taxes and Value

- Assuming all shareholders have same tax rates:

$$C_t = (X_t - r_D D)(1 - T_C)(1 - T_E) + r_D D (1 - T_D)$$

or

$$C_t = X_t (1 - T_C)(1 - T_E) + r_D D [(1 - T_D) - (1 - T_C)(1 - T_E)]$$

- Discounted at the after-tax rate $r_D (1 - T_D)$, PV of second term is $T_g D$, where

$$T_g = 1 - (1 - T_C)(1 - T_E) / (1 - T_D)$$

- Therefore, $V_L = V_U + T_g D$

Relative advantage formula (RAF)

(Debt vs. equity)

$$\frac{1-T_d}{(1-T_e)\ (1-T_c)}$$

	Advantage
RAF > 1 (T_g >0)	**Debt**
RAF < 1 (T_g <0)	**Equity**

WACC with corporate taxes

- Suppose here that…
  - Project has average risk (=risk of the company)
  - Debt-equity ratio is constant
  - Corporate taxes is the only imperfection
- Cost of capital of the project is equal to the after-tax WACC:

$$r_{wacc} := \frac{E}{E+D} r_E + \frac{D}{E+D} r_D (1 - T_C) < r_U = r_A$$

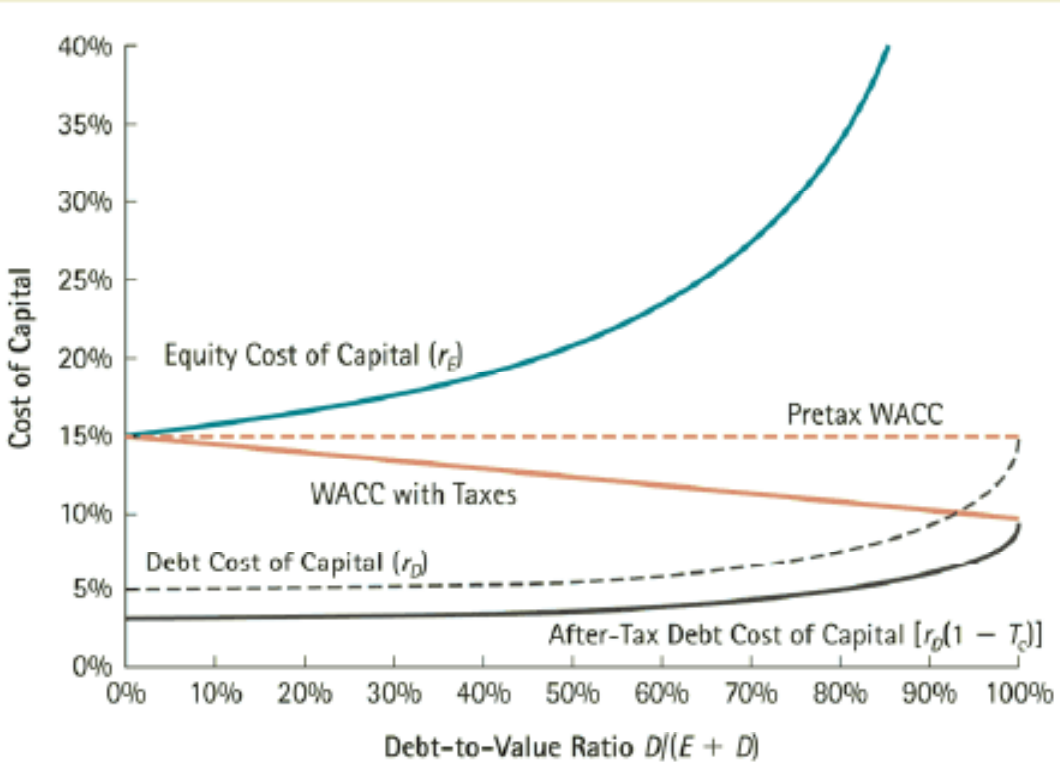
- After-tax borrowing is lower because interest is tax-deductible
- Hence, cost of capital decreases with debt
- It can then be shown that the levered value of an investment then is

$$V_o^L = \frac{C_1}{1+r_{wacc}} + \frac{C_2}{(1+r_{wacc})^2} + \frac{C_3}{(1+r_{wacc})^3} + \ldots + \frac{C_T}{(1+r_{wacc})^T}$$

WACC with corporate taxes

The WACC with and without Corporate Taxes

We compute the WACC as a function of leverage using Eq. 15.9. Whereas the pretax WACC remains constant, with taxes the WACC declines as the firm increases its reliance on debt financing and the benefit of the interest tax deduction grows. The figure assumes a marginal corporate income tax rate of 35%.



Avco's new line of packaging, RFX

- Technology expected obsolete after four years
- Expected sales of $60 million per year over the next four years
- Manufacturing costs and operating expenses expected to be $25 million and $9 million, respectively, per year
- Upfront R&D and marketing expenses of $6.67 million
- $24 million investment in equipment (depreciated via the straight line method over four years)

- Avco pays a corporate tax rate of 40%

Expected cash flows from the project

	Year	0	1	2	3	4
Incremental Earnings Forecast ($ million)						
1	Sales	–	60.00	60.00	60.00	60.00
2	Cost of Goods Sold	–	(25.00)	(25.00)	(25.00)	(25.00)
3	**Gross Profit**	–	35.00	35.00	35.00	35.00
4	Operating Expenses	(6.67)	(9.00)	(9.00)	(9.00)	(9.00)
5	Depreciation	–	(6.00)	(6.00)	(6.00)	(6.00)
6	**EBIT**	(6.67)	20.00	20.00	20.00	20.00
7	Income Tax at 40%	2.67	(8.00)	(8.00)	(8.00)	(8.00)
8	**Unlevered Net Income**	(4.00)	12.00	12.00	12.00	12.00
Free Cash Flow						
9	Plus: Depreciation	–	6.00	6.00	6.00	6.00
10	Less: Capital Expenditures	(24.00)	–	–	–	–
11	Less: Increases in NWC	–	–	–	–	–
12	**Free Cash Flow**	(28.00)	18.00	18.00	18.00	18.00

Avco's Market Value Balance Sheet ($ mill.) and cost of capital without the RFX project

Assets		Liabilities		Cost of Capital	
Cash	20	Debt	320	Debt	6%
Existing Assets	600	Equity	300	Equity	10%
Total Assets	620	Total Liabilities and Equity	620		

- Net debt: D=320m - 20m=300m
- Suppose further…
  - Project has similar risk than the company
  - Debt/equity ratio constant

Is RFX a good idea?

- Avco's WACC:

$$r_{wacc} = \frac{300}{300+300}(10\%) + \frac{300}{300+300}(6\%)(1-0.40) = 6.8\%$$

- Project's value:

$$V_o^L = \frac{18}{1+1.068} + \frac{18}{(1+1.068)^2} + \frac{18}{(1+1.068)^3} + \frac{18}{(1+1.068)^4}$$

- NPV= 61.25m – 28m = 33.25m > 0

WACC at a different ratio

If the project is financed with a debt ratio different to that of the firm, ratios of the formula change…but also costs of financing!

Step 1–Opportunity cost of capital (cost of equity for no debt)–M&M I

$$r_A = r_D \frac{D}{V} + r_E \frac{E}{V}$$

Step 2 – Estimation of new cost of debt r_D with the new ratio, and new cost of equity – M&M II

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

Step 3 – New WACC with new weights

$$r_{WACC} = r_D (1 - T_C) \frac{D}{V} + r_E \frac{E}{V}$$

Example

A firm had debt and equity at the 40%/60%, with r_D=6% and r_E=12.4%. If a new project is financed with only 20% of debt

Step 1 – r_A with the current leverage of the 40%

$$r_A = .06(.4) + .124(.6) = .0984$$

Step 2 – D/V change to 20% (cost of debt is 6%)

$$r_E = .0984 + (.0984 - .06)(.25) = .108$$

Step 3 – New WACC

$$r_{WACC} = .06(1 - .35)(.2) + .108(.8) = .0942$$

Costs of Bankruptcy

Illiquidity vs. Insolvency

- Firm is not obliged to pay dividends to equity holders, but…
- Firm failing to make debt payments is in default

- Example: Armin (10m shares outstanding)…
  - New product makes it worth (a) £150m or (b) £80m at end of the year
  - Choose (U) all-equity or (L) debt maturing at end of the year with a total £100m due

- If success (a):
  - How much equity and debt holders own for each case (U and L)?
  - What if the company chooses L and does not have £100m in cash? Will it default?

- If not successful (b):
  - How much equity and debt holders own for each case?

Sharing the Loss

TABLE 16.1 **Value of Debt and Equity with and without Leverage ($ million)**

	Without Leverage		With Leverage	
	Success	**Failure**	**Success**	**Failure**
Debt value	—	—	100	80
Equity value	150	80	50	0
Total to all investors	150	80	150	80

Bankruptcy costs

- Important only if bankruptcy affects revenues or costs
- Direct costs:
  - legal process of restructuring (court costs, advisory fees)
  - on average 2-3% of the assets
  - Examples:
    - Enron $30m per month, $750 in total
    - Worldcom (reorganisation to become MCI) $657m
    - United Airlines, 8.6m per month for legal and professional services related to chapter 11 reorganisation
- Indirect costs:
  - Loss of customers, suppliers,… (see next slide)

Some indirect costs of financial distress

- Loss of customers:
  - Bankruptcy may enable firms to walk away from future commitments (support, future upgrades,…)
- Loss of suppliers:
  - Bankruptcy may enable firms not to pay for inventory
  - Swissair forced to shut because suppliers refuse to fuel planes
- Loss of employees:
  - Fear of job security
  - Pacific Gas and Electric Co. paid to retain 17 key employees
- Loss of receivables:
  - Debtors might have an opportunity to avoid obligations
- Fire sales of assets:
  - Companies need to sell assets quickly to raise cash

Cost of debt in the presence of bankruptcy

- Westlake…
  - wants to borrow $1m for one year from a bank
  - has 10% of going bankrupt, in which case assets can be sold for $600,000
  - Legal costs would be $100,000
- Then,…
  - How much interest will the bank charge if it wants an average return of 10%?
  - How much of this is due to the costs of bankruptcy?

Summing up: the trade-off theory

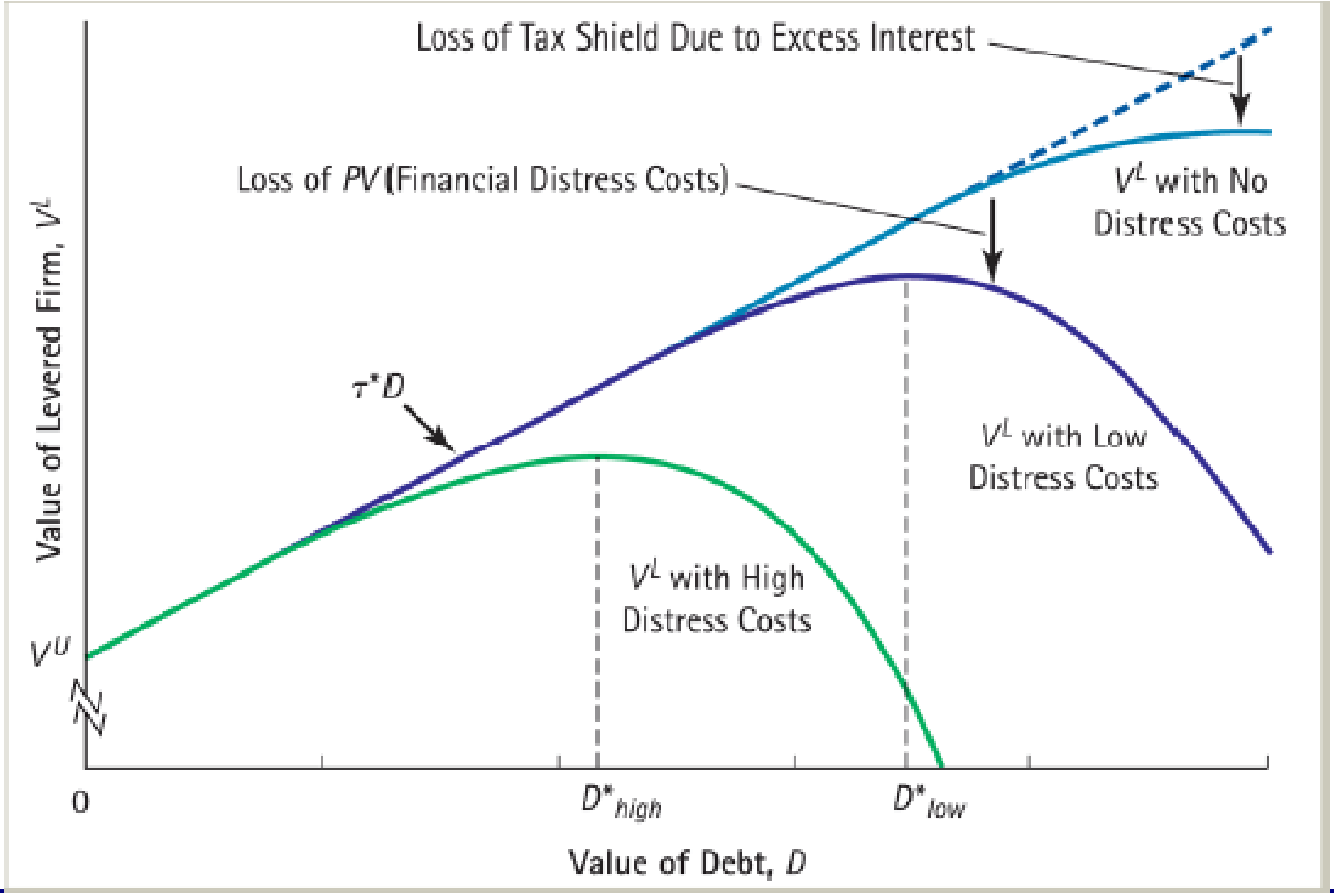
- Tax benefits vs costs of financial distress costs:

$$V_L = V_U + PV(\text{Interest tax shield}) - PV(\text{Financial Distress Costs})$$

- To determine the PV(Financial distress costs), need to compute…

1. Probability, which:
   - increases with the amount of a firm's liabilities, relative to assets
   - increases with the volatility of a firm's cash flows and asset values
2. Magnitude of costs once in distress, which depends on industry:
   - Technology: high (loss of customers, key personnel, lack of tangible assets being liquidated)
   - Real estate: low (assets can (in normal times) be sold relatively easily)

Optimal leverage



Appendix

Valuing Perpetuities

A perpetuity is a constant level cash flow that continues forever.

Examples: i) Firms
ii) Consol Bonds
iii) Preferred Stock
iv) Some specific Projects (e.g. rental arrangements)

Valuing Perpetuities (2)

Present value of a perpetuity is (constant cash flows Cf and constant r):

$$\text{PV(perp.)} = \sum_{t=1}^{\infty} \frac{Cf}{(1+r)^t} = \frac{Cf}{r}$$

Proof:

$$V = \frac{CF}{(1+r)} + \frac{CF}{(1+r)^2} + \frac{CF}{(1+r)^3} + \ldots$$

$$(1+r)V = CF + \frac{CF}{(1+r)} + \frac{CF}{(1+r)^2} + \ldots$$

subtract the first equation from the second

$$rV = CF \quad \text{(or)} \quad V = \frac{CF}{r}$$