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Advanced Corporate Finance

3. Capital structure

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Objectives of the session

So far, NPV concept and possibility to move from accounting data to cash flows. But necessity to go further regarding the discount rate to use. This sessions' objectives

1. Understand the impact of the capital structure on the value of the firm in a world with and without taxes
2. Understand the impact of the capital structure on the cost of capital in a world with and without taxes
3. Set the theoretical model in perspective with real world observations

Practice of corporate finance: evidence from the field

- Graham & Harvey (2001) : survey of 392 CFOs about cost of capital, capital budgeting, capital structure.

- « *..executives use the mainline techniques that business schools have taught for years, NPV and CAPM to value projects and to estimate the cost of equity. Interestingly, financial executives are much less likely to follows the academically proscribed factor and theories when determining capital structure* »

- Are theories valid? Are CFOs ignorant?
- Are business schools better at teaching capital budgeting and the cost of capital than at teaching capital structure?

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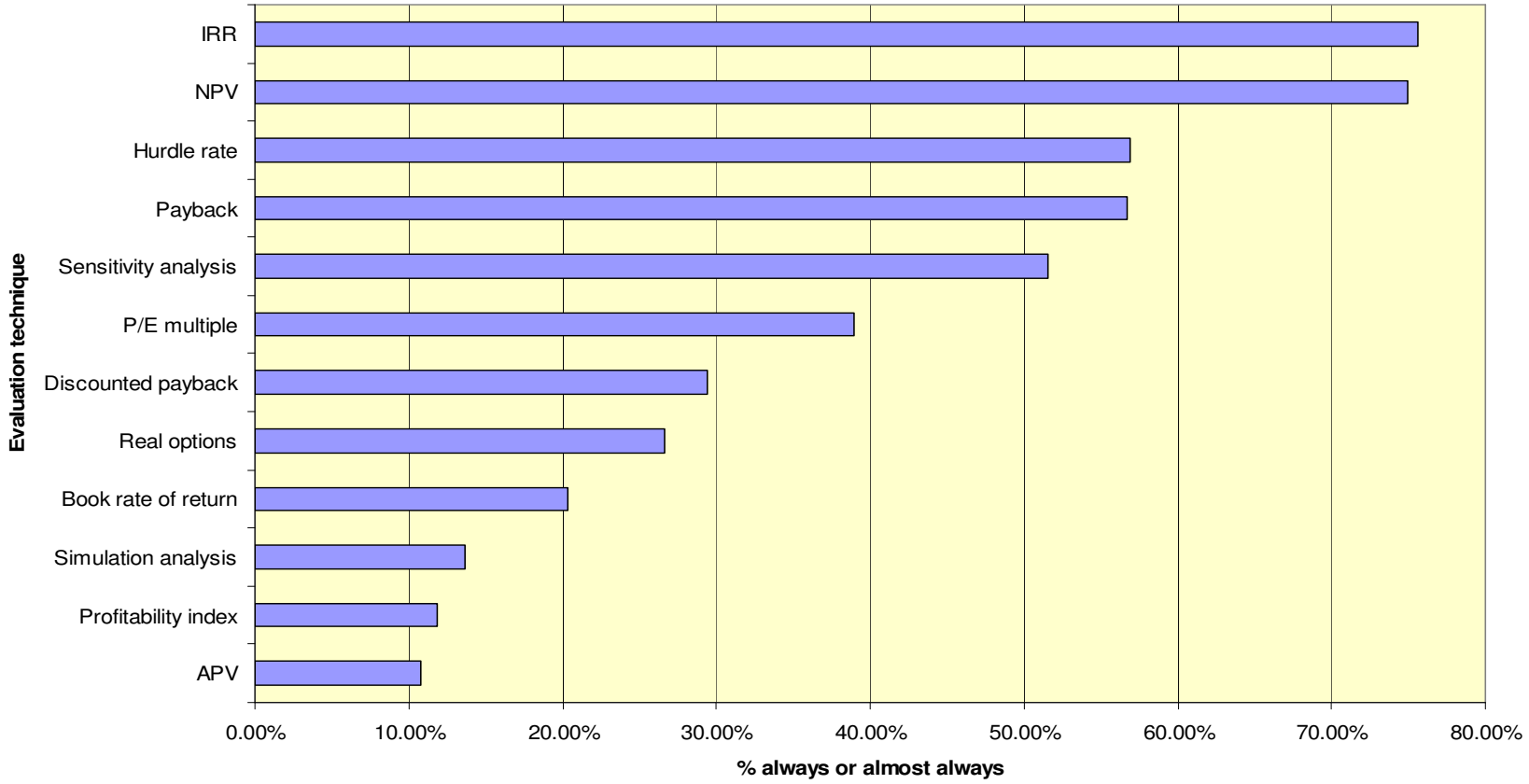
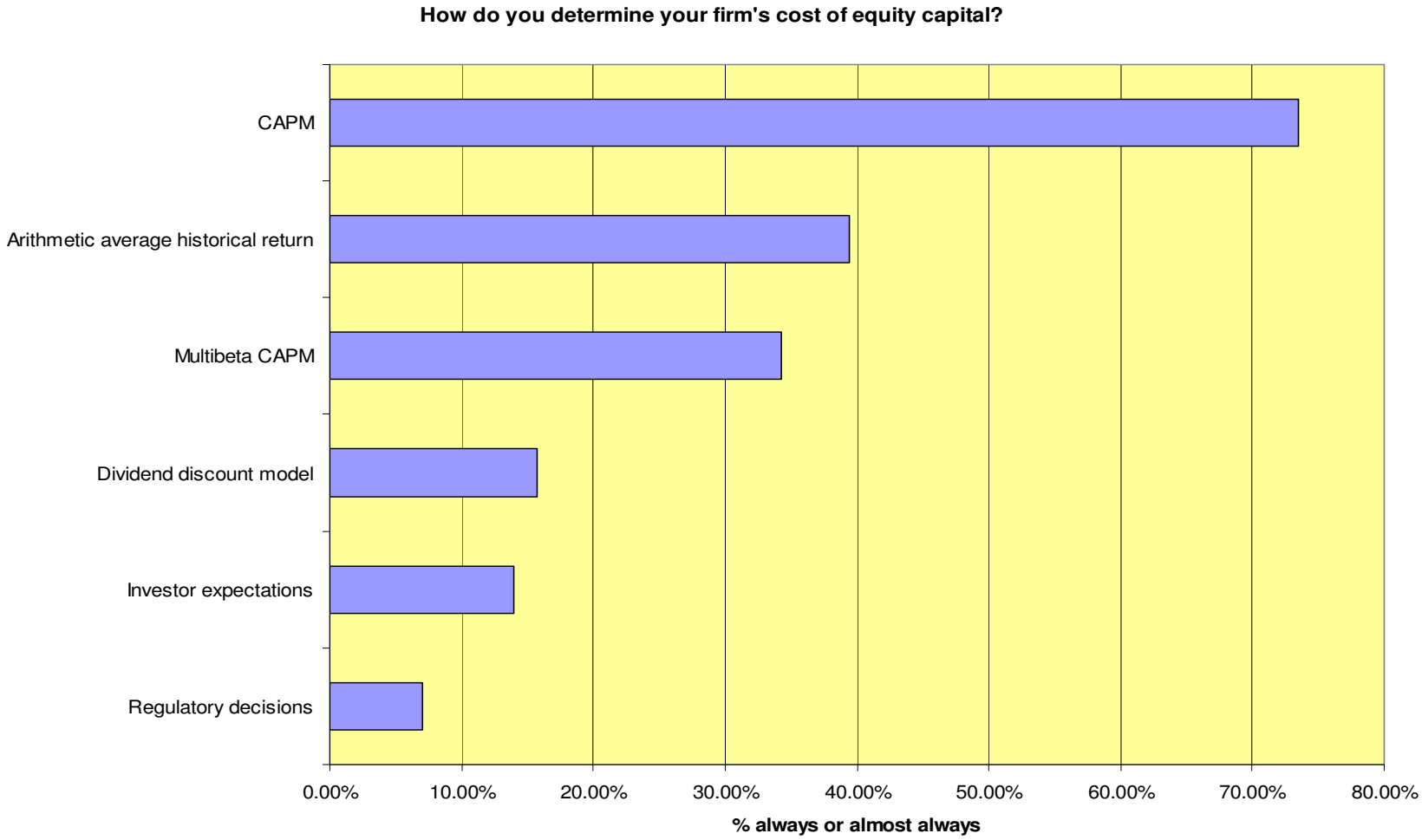
The message from CFOs: Capital budgeting

How freqently does your firm use the following techniques when deciding which project or acquisition to pursue?

Source: Graham Harvey JFE 2001 *n*=392



The message from CFOs : cost of equity



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Cost of Capital with Debt

- Up to now, the analysis has proceeded based on the assumption that investment decisions are independent of financing decisions.

- Does
    - the value of a company change
    - the cost of capital change

- if leverage changes ?

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Example

- CAPM holds – Risk-free rate = 5%, Market risk premium = 6%
- Consider an all-equity firm:
  - Market value *V* 100
  - Beta 1
  - Cost of capital 11% (=5% + 6% * 1)
- Now consider borrowing 20 to buy back shares.
- Why such a move?
  - Debt is cheaper than equity
  - Replacing equity with debt should reduce the average cost of financing
- What will be the final impact
  - On the value of the company? (Equity + Debt)?
  - On the weighted average cost of capital (WACC)?

Weighted Average Cost of Capital (WACC)

- An average of:
  - The cost of equity r_{equity}
  - The cost of debt r_{debt}
  - Weighted by their relative **market values** (*E/V* and *D/V*)

$$r_{wacc} \equiv r_{equity} \times \frac{E}{V} + r_{debt} \times \frac{D}{V}$$

- Note: $V = E + D$

Modigliani Miller I (1958)

- Assume perfect capital markets: not taxes, no transaction costs

- Proposition I:
  - The market value of any firm is independent of its capital structure:

$$V = E+D = Assets = V_U$$

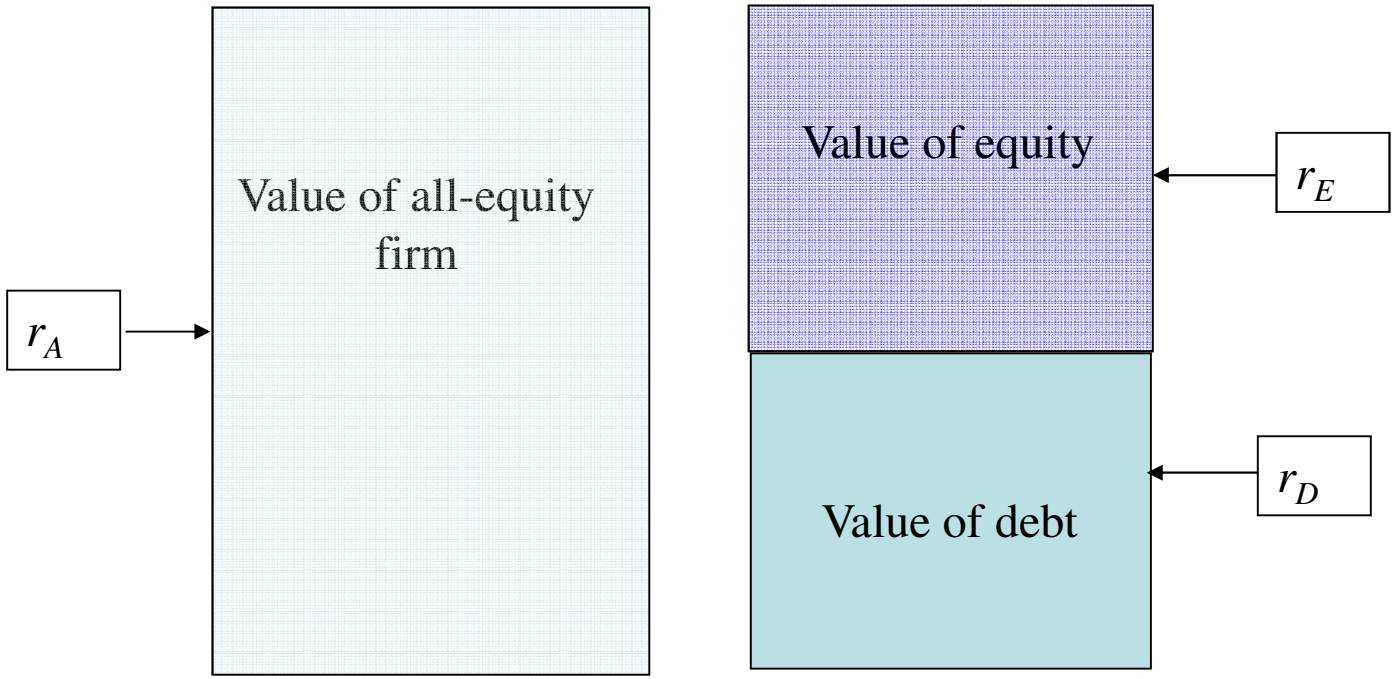
- Proposition II:
  - The weighted average cost of capital is independent of its capital structure

$$r_{wacc} = r_A$$

  - r_A *is the cost of capital of an all equity firm (unlevered)*
  - *NB: Whatever the capital structure, the total assets of the firm remain constant here*

Cost of equity calculation

$$V(=V_U) = E + D$$



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

In practice

- Value of company: $V = 100$

	Initial	Final	
• Equity	100	80	
• Debt	0	20	
• Total	100	100	MM I
• WACC = r_A	11%	11%	MM II
• Cost of debt	-	5%	(assuming risk-free debt)
• *D/V*	0	0.20	
• Cost of equity	11%	12.50%	(to obtain $r_{wacc} = 11\%$)
• *E/V*	100%	80%	

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Why do we observe a constant r_{wacc}?

- Consider someone owning a portfolio of all firm's securities (debt and equity) with $X_{equity} = E/V$ (80% in example) and $X_{debt} = D/V$ (20%)
- Expected return on portfolio = $r_{equity} * X_{equity} + r_{debt} * X_{debt}$
- This is equal to the WACC (see definition):

$$r_{portoflio} = r_{wacc}$$

- But she/he would, in fact, own a fraction of the company. The expected return would be equal to the expected return of the unlevered (all equity) firm

$$r_{portoflio} = r_A$$

- The weighted average cost of capital is thus equal to the cost of capital of an all equity firm

$$r_{wacc} = r_A$$

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Relationship between MMI and MMII

- Assumption: perpetuities (to simplify the presentation)
- For levered companies, earnings before interest and taxes will be split between interest payments and dividends payments

$$EBIT = Int + Div$$

- Market value of equity: present value of future dividends discounted at the cost of equity

$$E = Div / r_{\text{equity}}$$

- Market value of debt: present value of future interest discounted at the cost of debt

$$D = Int / r_{\text{debt}}$$

Relationship between the value of company and WACC

- From the definition of the WACC:

$$r_{wacc} * V = r_{equity} * E + r_{debt} * D$$

- As $r_{equity} * E = Div$ and $r_{debt} * D = Int$

$$r_{wacc} * V = EBIT$$

$$V = EBIT / r_{wacc}$$

Market value of levered firm

EBIT is independent of leverage

If value of company varies with leverage, so does WACC in opposite direction

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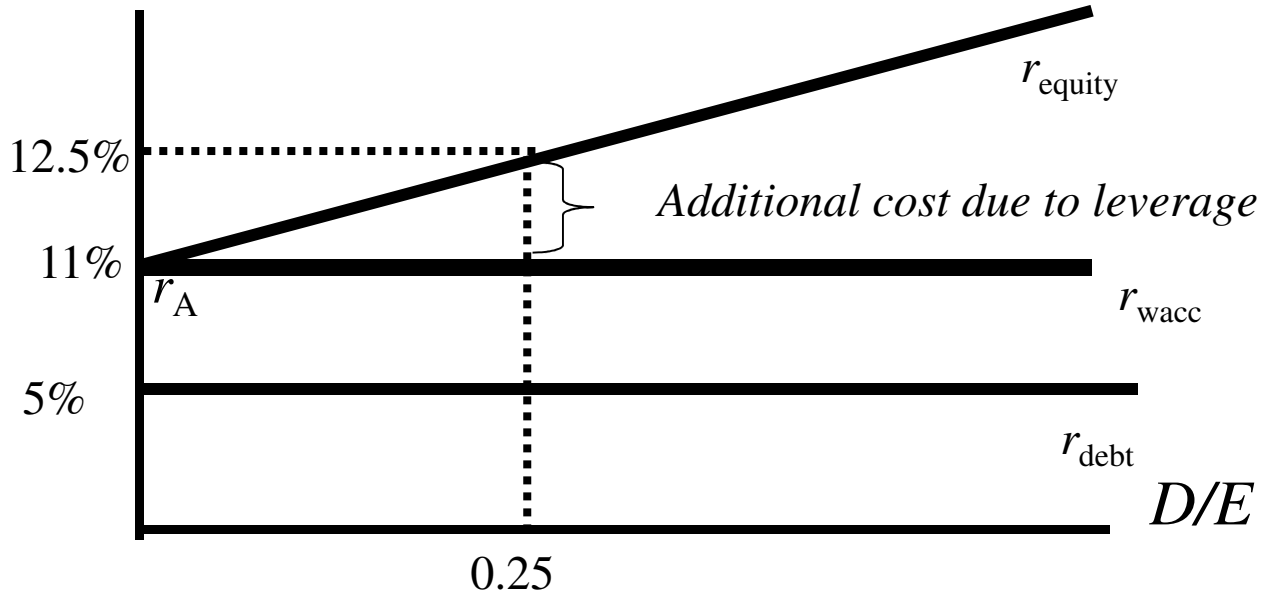
MM II: another presentation

$$r_{equity} = r_A + (r_A - r_{debt}) \times \frac{D}{E}$$



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Why does r_{equity} increases with leverage?

- Because leverage increases the risk of equity.
- To see this, back to the portfolio with both debt and equity.

- Beta of portfolio: $\beta_{portfolio} = \beta_{equity} * X_{equity} + \beta_{debt} * X_{debt}$
- But also: $\beta_{portfolio} = \beta_{Asset}$
- So:

$$\beta_{Asset} = \beta_{Equity} \times \frac{E}{E+D} + \beta_{Debt} \times \frac{D}{E+D}$$

- or

$$\beta_{Equity} = \beta_{Asset} + (\beta_{Asset} - \beta_{Debt}) \times \frac{D}{E}$$

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Example

- Assume debt is riskless:

$$\beta_{Equity} = \beta_{Asset}\left(1 + \frac{D}{E}\right) = \beta_{Asset}\frac{V}{E}$$

- Beta asset = 1
- Beta equity = 1(1+20/80) = 1.25
- Cost of equity = 5% + 6% × 1.25 = 12.50%

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However… we are not in a perfect world

- There are Corporate Taxes
- And in many countries, interest are tax deductible => tax shield
- Tax shield = Interest payment × Corporate Tax Rate

  $= (r_D \times D) \times T_C$
- r_D : cost of new debt
- D : market value of debt
- Value of levered firm

  = Value if all-equity-financed + PV(Tax Shield)
- PV(Tax Shield) - Assume permanent borrowing

$$PV\,(TaxShield\;) = \frac{T_C \times r_D D}{r_D} = T_C D$$

$$V_L = V_U + T_C D$$

Numerical Illustration

	A	B
<u>Balance Sheet</u>		
Total Assets	1,000	1,000
Book Equity	1,000	500
Debt (8%)	0	500
<u>Income Statement</u>		
EBIT	240	240
Interest	0	40
Taxable Income	240	200
Taxes (40%)	96	80
Net Income	144	120
Dividend	144	120
Interest	0	40
Total	144	160

Assume r_A= 10%, depreciation covers new investment in capital, and no changes in WCR

(1) Value of all-equity-firm:

$V_U = 144 / 0.10 = 1{,}440$

(2) PV(Tax Shield):

Tax Shield = 40 x 0.40 = 16

PV(TaxShield) = 16/0.08 = 200

(3) Value of levered company:

$V_L = 1{,}440 + 200 = 1{,}640$

(4) Market value of equity:

$E_L = V_L - D = 1{,}640 - 500 = 1{,}140$

What about the cost of equity?

1) Cost of equity increases with leverage:

$$r_E = r_A + (r_A - r_D) \times (1 - T_C) \times \frac{D}{E}$$

Proof:

$$E = \frac{(EBIT - r_D D) \times (1 - T_C)}{r_E}$$

But $V_U = EBIT(1\text{-}T_C)/r_A$

and $E = V_U + T_C D - D$

Replace and solve

2) Beta of equity increases

$$\beta_E = \beta_A [1 + (1 - T_C) \frac{D}{E}]$$

In example:

r_E = 10% +(10%-8%)(1-0.4)(500/1,140)
= 10.53%

or

$r_E = DIV/E$ = 120/1,140 = 10.53%

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What about the weighted average cost of capital?

- Weighted average cost of capital decreases with leverage (as $V_L > V_U$ $WACC < r_A$)
- *Weighted average cost of capital*: discount rate used to calculate the market value of firm by discounting net operating profit less adjusted taxes (NOPLAT)
- *NOPLAT* = Net Income + Interest - Tax Shield
- $= (EBIT - r_D D)(1 - T_C) + r_D D - T_C r_D D$
- = Net Income for all-equity-firm = $EBIT(1 - T_C)$

$$V_L = NOPLAT / WACC$$

$$r_E E + r_D (1 - T_C) D = EBIT\ (1 - T_C)$$

- As:

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

In example: *NOPLAT* = 144
V_L = 1,640
WACC = 10.53% x 0.69 + 8% x 0.60 x 0.31 = 8.78%

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What if debt is not permanent?

	0	1	2	3	4	5	6
EBITDA		340	340	340	340	340	340
Dep		100	100	100	100	100	100
EBIT		240	240	240	240	240	240
Interest		40	32	24	16	8	0
Taxes		80	83	86	90	93	96
Earnings		120	125	130	134	139	144
CFop		220	225	230	234	239	244
CFinv		-100	-100	-100	-100	-100	-100
DIV		-20	-25	-30	-34	-39	-144
ΔDebt		-100	-100	-100	-100	-100	
Book eq.	500	600	700	800	900	1,000	1,000
Debt	500	400	300	200	100	0	0

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Company Valuation

- 1. Value of unlevered company
  - Free Cash Flow unlevered = 144
  - $V_U = FCF_U / r_A = 144 / 0.10 = 1{,}440$
- 2. PV(Taxshield)

$$PV(TaxShield) = \frac{16}{1.08} + \frac{12.8}{(1.08)^2} + \frac{9.6}{(1.08)^3} + \frac{6.4}{(1.08)^4} + \frac{3.2}{(1.08)^5} = 40.3$$

- 3. Value of levered company
  - $V = 1{,}440 + 40.3 = 1\ 480.3$
- 4. Value of equity
  - $E = 1\ 480.3 - 500 = 980.3$

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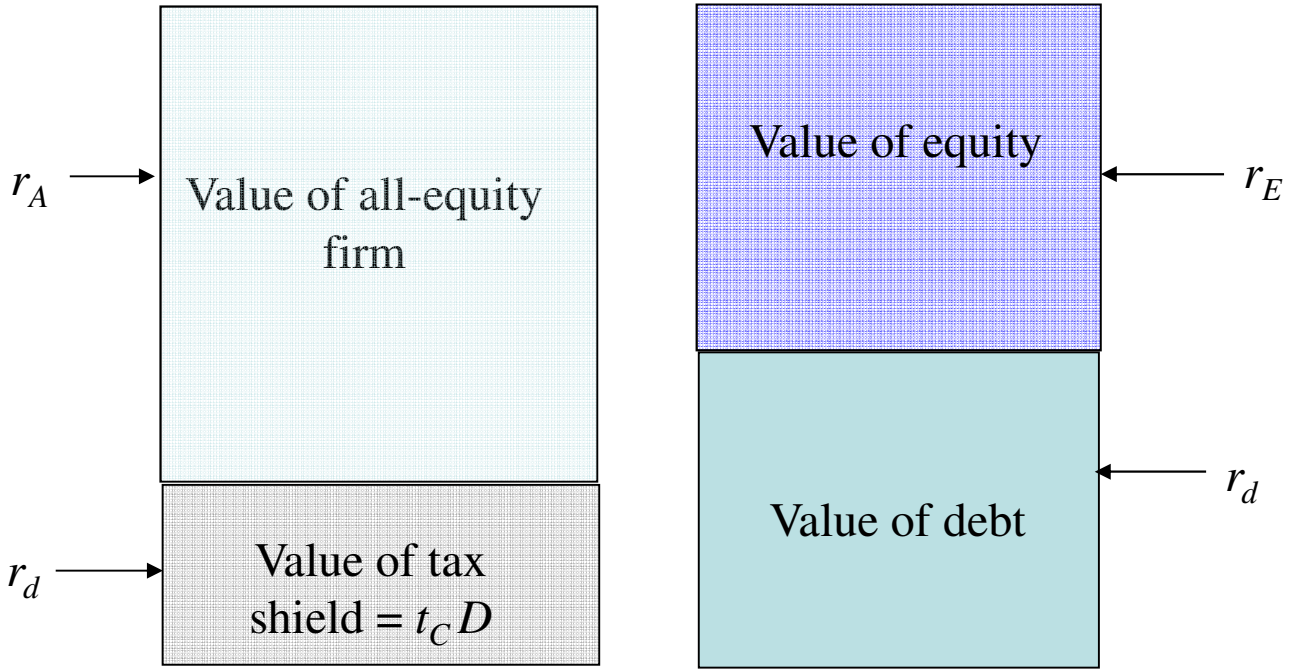
Alternative methods?

- Using PV(Tax Shields) => obviously OK
- But valuation may also be done on basis of the weighted average cost of capital
- Indeed, by definition (and if constant perpetuity)
- $V_L = NOPLAT / r_{WACC} = EBIT$ x $(1\text{-}Tc)/ r_{WACC}$

- So if one knows the value of the wacc and the value of the EBIT, valuing the company should be straightforward
- However, the value of the wacc is not so easy to determine
- Question of the assumptions made…

Cost of equity calculation

$$V_L = V_U + t_C D = E + D$$



$$r_a \times \frac{V_u}{V_L} + r_d \times \frac{T_c D}{V_L} = r_e \times \frac{E}{V_L} + r_d \times \frac{D}{V_L}$$

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What about Personal Taxes?

- Suppose operating income = 1

• If paid out as	Interest	Equity income
• Corporate tax	0	T_C
• Income after corporate tax	1	$1 - T_C$
• Personal tax	T_P	$T_{PE}(1-T_C)$
• Income after all taxes	$1- T_P$	$(1-T_{PE})(1-T_C)$

- With T_C corporate Tax, T_P personal tax on interest income, T_{PE}, personal tax on equity income. NB: Marginal Rates!

PV(TaxShield) with corporate and personal taxes

- At the investor level, tax advantage of debt is positive if:

$$1\text{-}T_P > (1\text{-}T_C)(1\text{-}T_{PE})$$

$$PV\ (TaxShield\ ) = [1 - \frac{(1-T_C)(1-T_{PE})}{(1-T_P)}] \times D$$

- Note: if $T_P = T_{PE}$, then PV(TaxShield) = $T_C D$

- *NB: Tax advantages may heavily change from one country to the other because taxation differs! But also whitin country => function of the situation of each investor*

Where does the PV(TaxShield) formula come from?

After taxes income for

Stockholders	$(EBIT - r_D D)(1-T_C)(1-T_{PE})$
Debt holders	$r_D D(1-T_P)$
Total	$(EBIT - r_D D)(1-T_C)(1-T_{PE}) + r_D D(1-T_P)$

This can be written as:

$$\underbrace{EBIT(1-T_C)(1-T_{PE})}_{V_u} + \underbrace{r_D D(1-T_P)\times(1-\frac{(1-T_C)(1-T_{PE})}{(1-T_P)}}_{D}$$

Market values V_u D

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What about the real world?

- Huge differences regarding leverage
- Industry influence
- Cash balances (and thus reflection to have in terms of net debt)

- Low amount of debt for some industries ⇔ puzzle?

  If PV(Tax Shield) >0, why not 100% debt? Or a high figure well above 50% for example?

- Several explanations have been suggested
  - Limits to tax benefits of debt => need to have taxable earnings (not really the case for start-ups or new high tech companies). Optimally, in theory, from tax savings perspective EBIT = interest payments => 0 tax! But there are limits to this!

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What about the real world

- Empirical Evidence => Internationally low level of leverage (20%-40%)

⇒ firms do not seem to exploit the full benefits of leverage

⇒ Graham (2000) using the full tax function estimates that tax benefits of interest deductibility represent 9.7% of market value for a typical firm

- Two counterbalancing forces:
  - cost of financial distress
    - As debt increases, probability of financial problem increases
  - agency costs
    - Conflicts of interest between shareholders and debt holders
- Interest payments MUST be made... There is obviously more flexibility regarding Dividends => firms with unstable earning may be more reluctant to use leverage at a high level

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Trade-off theory