Week 10: FNCE10002 Principles of Finance

THE UNIVERSITY OF MELBOURNE

Capital Structure and Payout Policy I

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10. Capital Structure and Payout Policy I

1. Examine the relevance of financial leverage
2. Examine the effects of financial leverage on business and financial risk
3. Examine capital structure theory and the Modigliani-Miller propositions
4. Examine the effects of corporate taxes on capital structure

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Required Readings: Weeks 10 – 12

- *Week 10*
  - GRAH, Ch. 13 (Sec 13.1 – 13.3)
- *Week 11*
  - GRAH, Ch. 13 (Sec 13.4 – 13.6) and Ch. 15
- *Week 12*
  - GRAH, Ch. 8 (Sec 8.1 – 8.3)

10.1 What is Financial Leverage?

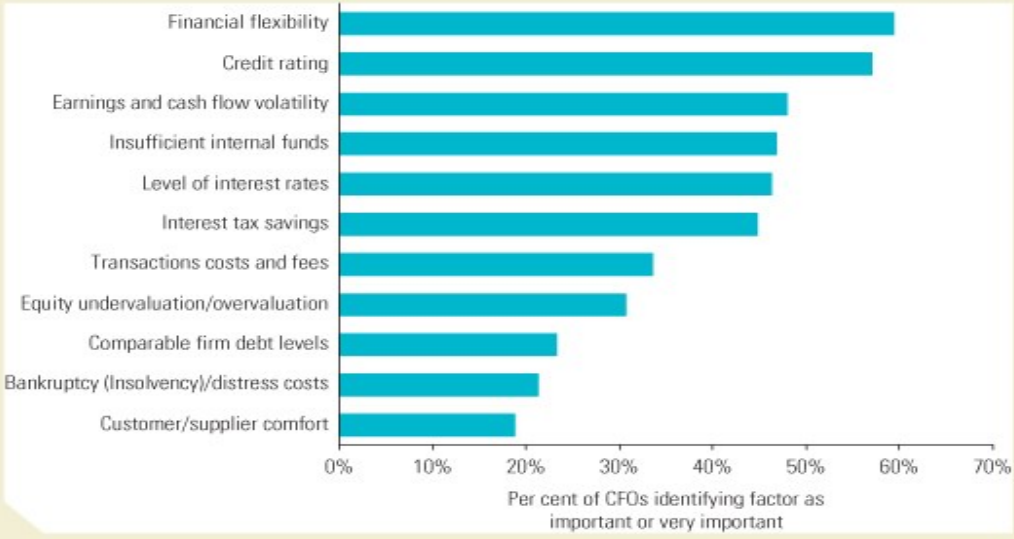
- The focus of this (and part of next) week is on the capital structure decisions of firms
  - What mix of debt and equity (ordinary shares) should be used to finance a firm's operations?
  - How much financial leverage should a firm have in its capital structure?
- The main questions we address are…
  - Can the firm's value be affected by its capital structure choices?
  - Does the firm's value depend on how its cash flows are divided between payments to shareholders and debtholders?
  - Is there an optimal capital structure that maximizes firm value?

What is Financial Leverage?

- The two main risks faced by firms are…
- Business (or operational) risk
  - The variability of future net cash flows attributed to the nature of the firm's operations
  - It is the risk faced by shareholders *if* the firm were financed only by equity
- Financial risk
  - The risk attributed to the use of debt as a source of financing a firm's operations
  - Surveys of managers indicate that they spend a lot of time quantifying and managing financial risk

Do Managers Care About Leverage?

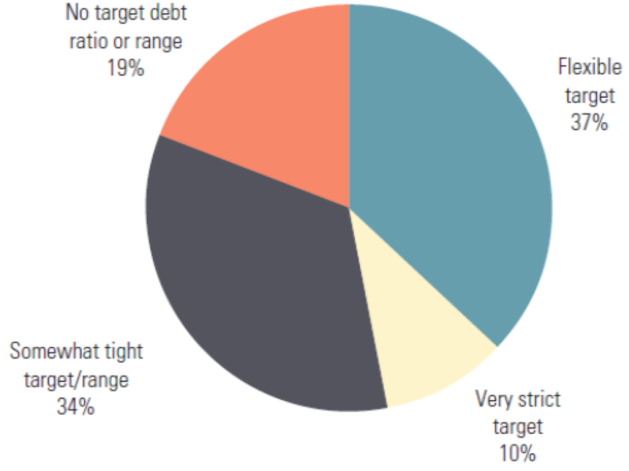
FIGURE 13.6 **WHAT FACTORS DO US COMPANIES CONSIDER WHEN CHOOSING DEBT POLICY?**



Source: Reprinted from Graham and Harvey, 'The Theory and Practice of Corporate Finance: Evidence From the Field', *Journal of Financial Economics*, Vol. 60, Issue 2-3, May/June, pp. 187–243, Copyright 2001, with permission from Elsevier. Other surveys are summarised in Miglo, Anton, "Trade-Off, Pecking Order, Signaling, and Market Timing Models" in Baker, H Kent, and Gerald S Martin, *Capital Structure and Corporate Financing Decisions Theory, Evidence, and Practice* (New Jersey: John Wiley & Sons, 2011) pp. 171–189.

Do Managers Have a Target Level of Leverage?

FIGURE 13.3 **DO COMPANIES HAVE TARGET CAPITAL STRUCTURES?**



Source: Graham and Harvey (2001), 'The Theory and Practice of Corporate Finance: Evidence From the Field,' *Journal of Financial Economics*, 60, pp. 187–243, copyright © 2001, with permission from Elsevier.

What Type of Financing Do Managers Use

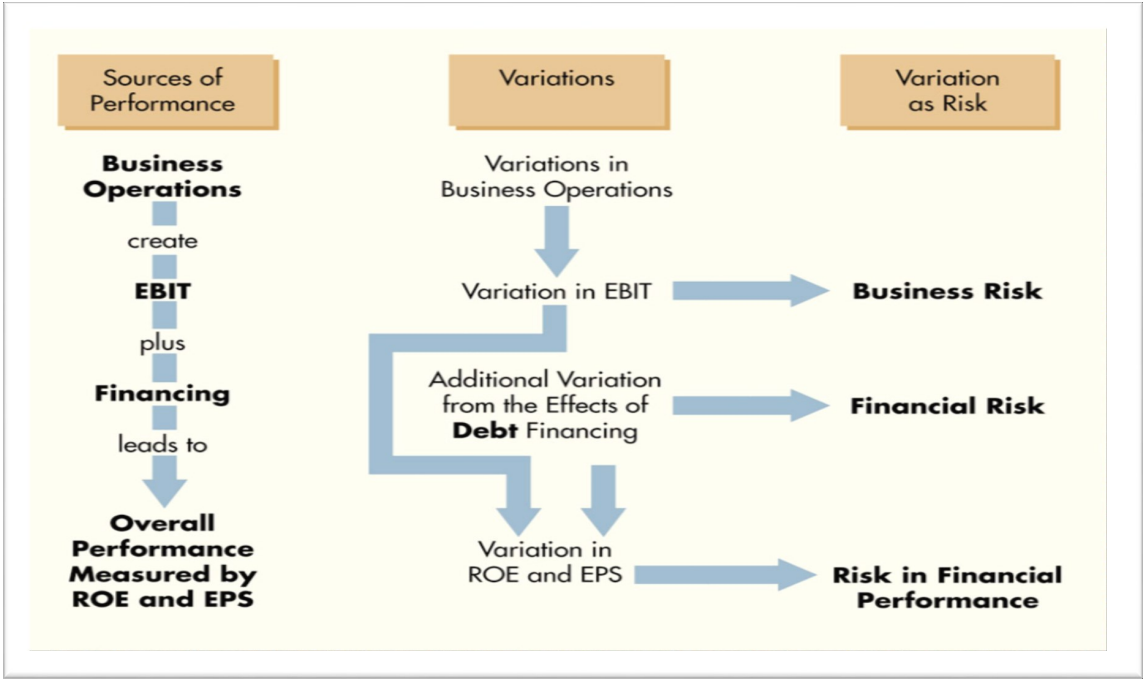
Rank	*Source of Capital*	*Score*
1	Retained earnings	5.61
2	Straight debt	4.88
3	Convertible debt	3.02
4	External ordinary shares	2.42
5	Straight preference shares	2.22
6	Convertible preference shares	1.72

Source: Damodaran Online, *pages.stern.nyu.edu/~adamodar*. Based on survey of CFOs of large US firms who ranked the sources of long term capital used by their firm.

10.2 Effects of Financial Leverage

- Financial risk exists if the firm's operations are financed using debt, that is, when there is financial leverage
  - Financial leverage is measured as the debt-to-equity (D/E) or the debt-to-total-assets or debt-to-value [$D/(D + E)$] ratios
- Effects of financial leverage?
  - Expected rate of return on equity increases
  - The variability of returns to shareholders also increases
  - Increasing leverage involves a trade-off between risk and return!
- Note that leverage varies both *within* and *across* industries
  - ANZ Bank versus CBA
  - Telstra versus ANZ Bank versus Computershare

Effects of Financial Leverage



Note: *EBIT* is earnings before interest and taxes, *ROE* is return on equity and *EPS* is earnings per share

Case Study 1: Leverage and Market Value

- *Glencore Shares Routed Amid Debt Concerns*
- *Sep 29, 2015:* Glencore Plc plunged 29 percent (on Sep 28), extending a rout that's wiped more than $US14 billion off its value this month and highlighting investor concerns that it is not cutting its debt load quickly enough.
- Switzerland-based Glencore (*LSE:* GLEN.L) trades everything from wheat to oil to cobalt. It's the world's biggest exporter of power-station coal, with more than 30 mines in Australia, Colombia and South Africa and is among the top three agricultural exporters in Russia, the European Union, Canada and Australia. The company controls more than 150 mining and metallurgical, oil production and agricultural assets and employs about 180,000 people.

Case Study 1: Leverage and Market Value

- Chief executive officer Ivan Glasenberg's debt-reduction plan announced three weeks ago and the move to sell a stake in its agricultural business reported by Bloomberg on Friday has failed to stanch the bleeding. Investec warned Monday that there was little value for shareholders should low raw-material prices persist. *"In the current climate, debt is fast becoming the most important consideration," Hunter Hillcoat and Marc Elliott, analysts at Investec, wrote in a note to investors. "Glencore may have to undertake further restructuring."*
- The slump on Monday was the most since its initial public offering in 2011. *The company has sold new stock and scrapped its dividend as part of the $US10 billion debt-reduction program as China's economic slowdown hurt demand for commodities. Goldman Sachs Group said last week that Glencore's recent steps to reduce debt and bolster its balance sheet were inadequate.*

Source: www.smh.com.au/business/markets/glencore-shares-routed-amid-debt-concerns-20150928-gjwuno.html

Case Study 1: Leverage and Market Value

- *Glencore Surges After Company Reassures Investors*
- *Sep 30, 2015:* Glencore, the commodities group that's lost almost $US45 billion ($64.4 billion) in market value this year, rallied after the company said it can withstand current market conditions. The shares surged 17 percent to 80.25 pence in late London trading on Tuesday (Sep 29). The advance recouped some of the 29 percent slump on Monday driven by concern the company has too much debt to withstand the declines in commodities.
- *"Our business remains operationally and financially robust ... we have positive cash flow, good liquidity and absolutely no solvency issues," according to the statement from the company. "Glencore has no debt covenants and continues to retain strong lines of credit and secure access to funding."*

Case Study 1: Leverage and Market Value

- "Investors can overreact on limited information," said Keith Pilbeam, a professor of economics and finance at City University London. *"You can't just sit back and take a 30 percent hit to your share price, this you have to react to."*
- Tuesday's rebound notwithstanding, the assurances from Glencore are unlikely to put to rest the questions swirling around the company. Indeed, the remarkable, two-day run in the stock market – down 29 percent on Monday, up 17 percent on Tuesday – only adds to concerns that the industry is opaque. *"The pummelling of Glencore (on Monday) was irrational," said Robin Bhar, an analyst at Societe Generale. "Unless you think commodity prices are going close to zero, then this was overdone."*

Source: www.afr.com/business/mining/glencore-surges-after-company-reassures-investors-20150929-gjxnqg

Case Study 1: Leverage and Market Value

Source: https://finance.yahoo.com/quote/GLEN.L?p=GLEN.L. The share price is quoted in British pence.

Case Study 2: Bad Debt, Worse Timing

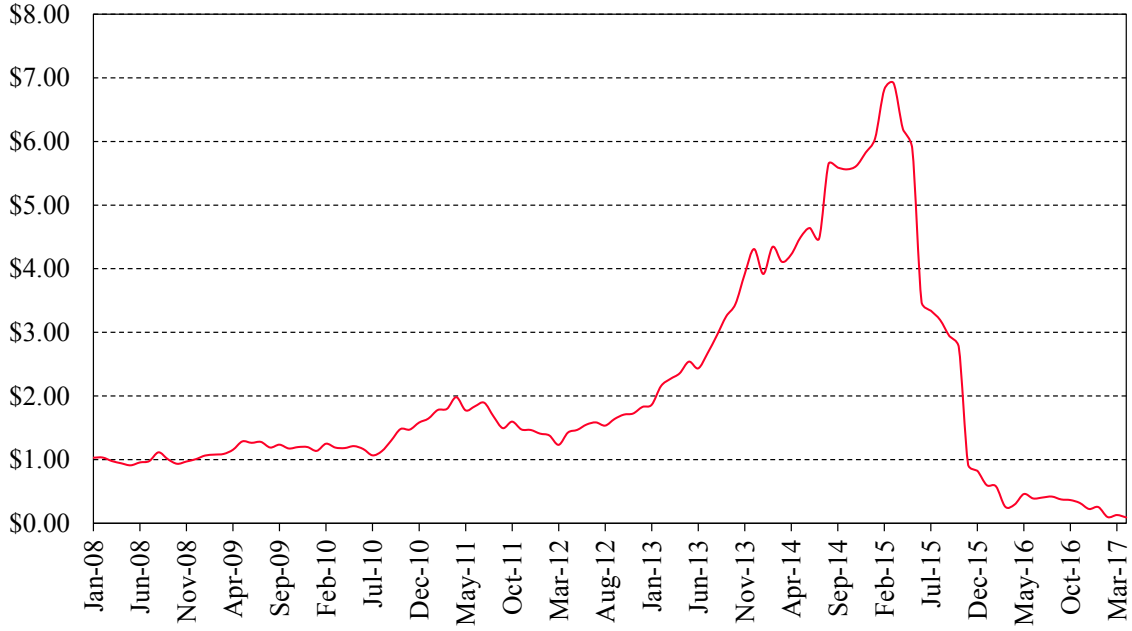
- *Slater and Gordon investors lose hope of recovering money as shares crash to 11c*
- *March 23, 2017:* Slater and Gordon (*ASX:* SGH) shareholders are losing hope of recovering money from their investments in the struggling law firm, with many small investors facing losses in the hundreds of thousands of dollars. *Kim and Nick, who do not want their full names to be used, have lost a total of almost $500,000 investing in Slater and Gordon. Kim alone lost around $450,000. "I made the mistake of putting all my money into that share – so I've learnt a few lessons along the way," Kim said. Kim was forced to sell a house and car to cover his losses.* He has joined a class action against the company but, like other investors, is not hopeful of recovering his money. *Slater and Gordon was the first law firm in the world to be listed on the stock exchange, but the decline of the one-time market darling has been spectacular and painful for investors, with $2.8 billion wiped off its share price. Shares hit a high of almost $8.00 in 2015, but have since crashed to 11 cents. Most analysts have dropped the stock, and Morningstar has valued it at just 1 cent.*

Case Study 2: Bad Debt, Worse Timing

- The firm's troubles began with a $1.3 billion purchase of the professional services arm of UK firm Quindell in 2015. However, within months, Quindell was subject to a fraud investigation and forced to restate earlier accounts. *Last month, the firm reported a half-year net loss of $425 million, and its debts are sitting around $740 million.*
- *The company has been working to restructure its debt for months, but last week, its major lenders sold off their investment at a massive loss to secondary lenders. But, Slater and Gordon has told the ASX its new lenders want to keep the company afloat.*
- *"It's extremely difficult, because if you're generating very low rates of return on your equity and your assets it suggests your assets are overvalued on the balance sheet and that makes banks very wary,"* said fund manager Roger Montgomery.

Source: www.abc.net.au/news/2017-03-23/slater-and-gordon-investors-lose-hope-of-recovering-money/8379948?section=business

Case Study 2: Bad Debt, Worse Timing



The share price on April 24, 2019 was $1.91 or $0.019 unadjusted for the 1:100 reverse split in Dec 2017

Note: These prices have *not* been adjusted for a 1:100 reverse share split that took place in early Dec 2017

10.3 Modigliani and Miller (MM) Analysis

- Our theoretical setting for analyzing the capital structure decisions of firms is based on the analysis of Modigliani and Miller (1958, 1963)
- The Modigliani and Miller (MM) analysis is based on the assumption that capital markets are perfect…
  - Firms and investors can trade the same set of securities at competitive market prices
  - There are no taxes, transaction costs or issuance costs
  - Firms have a fixed investment policy and their investment decisions are not affected by their financing decisions
  - There are no costs associated with firm liquidation
- Are these assumptions realistic?

Modigliani and Miller (MM) Analysis

- For simplicity, we also assume that all cash flows from operations are perpetual and all earnings are paid out as dividends
- Recall that the value of the firm is the present value of the future expected cash flows
- When there is *no* debt, *no* corporate taxes *and* 100% payout…
  - Earnings to shareholders, $EAT = EBI = EBIT$
  - EAT = Earnings after taxes
  - EBI = Earnings before interest
  - $EBIT$ = Earnings before interest and taxes
- In this case, the firm's weighted average cost of capital, r_O is also equal to its cost of equity, r_E

Modigliani and Miller (MM) Analysis

- Assuming that all cash flows from operations are perpetual and all earnings are paid out as dividends, we get…
- Value of the firm (and value of equity) with *no* debt…
  - $V_U = EBI/r_O = EBI/r_E = E_U$
- Value of the firm with *non-zero* debt…
  - $V_L = E_L + D_L$
  - $E_L = (EBI - \text{Interest})/r_E$
  - $D_L = \text{Interest}/r_D$
  - r_O is the firm's cost of capital (*Note:* The text uses r_A)
  - r_E is the firm's cost of equity (*Note:* The text uses r_L)
  - r_D is the firm's cost of debt

Modigliani and Miller Proposition 1

- *Proposition 1 states that in a perfect capital market, the total value of a firm is equal to the market value of the total cash flows generated by its assets and is not affected by its choice of capital structure*
- Changing the mix of debt versus equity used to finance a firm's operations *will* change the way in which the net operating income (or net earnings) is divided between debtholders and shareholders but it will *not* change the value of the firm
- MM proposition 1 states that the value of an unleveraged and an leveraged firm will be the same *if* the cash flows generated from their assets are the same
  - $V_U = V_L$

Modigliani and Miller Proposition 1

- *Illustration:* Consider two firms, *U* and *L*, which have the same assets but different capital structures. Firm *U* has no debt in its capital structure while firm *L* is leveraged. Proposition 1 states that, based on the assumptions made, these firms are perfect substitutes for each other and their market values *will be the same*
- MM proposition 1 states that…
  - $V_U = V_L$
- If the market values are not the same there are *riskfree arbitrage opportunities*
  - Buy low; sell high… *or*
  - Sell high; buy back low

Modigliani and Miller Proposition 1

- An investor who purchases 1% of the unleveraged firm *U* will receive 1% of the firm's net earnings after interest and taxes (which are zero) for a dollar investment of 1% of V_U

	Dollar Investment	*Dollar Return*
Equity	$0.01 \times V_U$	$0.01 \times EBI$

Modigliani and Miller Proposition 1

- The investor could alternatively purchase 1% of both the debt and equity of the leveraged firm *L* to receive 1% of the firm's interest payment on debt and 1% of the profits less interest on debt for a dollar investment of 1% in the debt and equity of *L*

	Dollar Investment	*Dollar Return*
Debt	$0.01 \times D_L$	0.01 × Interest
Equity	$0.01 \times E_L$	0.01 × (*EBI* – Interest)
Total	$0.01 \times V_L$	0.01 × *EBI*

- Since the dollar return is the same in the two cases, we *must* have $V_U = V_L$

Modigliani and Miller Proposition 1

- An investor could also purchase 1% of the equity of the leveraged firm *L* to receive 1% of the firm's profits less the interest on debt for a dollar investment of 1% of E_L, which is equal to 1% of $(V_L - D_L)$

	Dollar Investment	*Dollar Return*
Equity	$0.01 \times E_L$	$0.01 \times (EBI - \text{Interest})$
Or…	$0.01 \times (V_L - D_L)$	$0.01 \times (EBI - \text{Interest})$

- *Note:* $V_L = E_L + D_L$ so $E_L = V_L - D_L$
- *How can this investment position be replicated with firm U which has no debt in its capital structure?*

Modigliani and Miller Proposition 1

- An investor can replicate the previous position using *homemade leverage* – Borrow on personal account 1% of firm *L*'s borrowing, that is, 1% of D_L and purchase 1% of firm *U*
  - Note that when you borrow funds the dollar "investment" is a *negative* amount

	Dollar Investment	*Dollar Return*
Borrowing	$-0.01 \times D_L$	$-0.01 \times$ Interest
Equity	$0.01 \times V_U$	$0.01 \times EBI$
Total	$0.01 \times (V_U - D_L)$	$0.01 \times (EBI -$ Interest$)$

- The dollar return is again the same in the two cases so $V_U = V_L$

Modigliani and Miller and No Arbitrage

- *Illustration:* Firms A and B are identical in every respect except that firm A has no debt in its capital structure while firm B has $2,000,000 in debt outstanding on which the interest rate is 8% p.a. Neither firm pays any corporate taxes and all cash flows are perpetual. The following information is provided for firms A and B

	Firm A	*Firm B*
Earnings before interest (*EBI*)	$700,000	$700,000
Interest on debt, r_D	--	$160,000
Earnings available to shareholders	$700,000	$540,000
Cost of equity, r_E	14%	18%
Market value of equity	$5,000,000	$3,000,000
Market value of debt	--	$2,000,000
Total market value	$5,000,000	$5,000,000

Modigliani and Miller and No Arbitrage

- Interest on debt = 0.08(2000000) = $160,000
- Market value of equity for firm *A*, $E_A = V_A = EBI/r_E$
  - $E_A = 700000/0.14 = \$5{,}000{,}000$
- Market value of equity for firm *B*, $E_B = (EBI - \text{Interest})/r_E$
  - $E_B = 540000/0.18 = \$3{,}000{,}000$
- *Note:* $V_B = E_B + D_B = V_A = E_A$
- *Case 1:* Assume that an investor owns 1% of firm A's shares. Show why this investor will be indifferent between investing in firm A or B
- *Case 2:* Next assume that an investor owns 1% of firm B's shares. Show why this investor will also be indifferent between investing in firm A or B

Modigliani and Miller and No Arbitrage

- *Case 1:* Sell shares in A and invest in B's equity *and* debt
  - Sell firm A's shares for 0.01(5000000) = $50,000
  - Invest in 1% of firm B's equity *and* 1% in firm B's debt
  - Funds invested in firm B's equity = 0.01(3000000) = $30,000
  - Funds invested in firm B's debt = 0.01(2000000) = $20,000

Income from investment in B's shares is[1]	$5,400
Income from investment in B's debt is[2]	$1,600
Income from investment in A's shares was[3]	$7,000
Net increase in income	$0

[1] Income from investment in B's shares = 0.18(30000) = $5,400
[2] Income from investment in B's debt = 0.08(20000) = $1,600
[3] Income from investment in A's shares = 0.14(50000) = $7,000

Modigliani and Miller and No Arbitrage

- *Case 2:* Sell shares in B, borrow funds and invest in A's equity
  - Sell firm B's shares for 0.01(3000000) = $30,000
  - Debt-to-equity ratio of firm B = 2000000/3000000 = 66.67%
  - Borrow $20,000 (= 30000 × 0.6667) at 8% p.a. (*homemade leverage*) and buy $50,000 of firm A's shares

Income from investment in A's shares is[1]	$7,000
Income from investment in B's shares was[2]	$5,400
Increase in income	$1,600
Less Interest paid (at 8%)[3]	$1,600
Net increase in income	$0

[1] Income from investment in A's shares = 0.14(50000) = $7,000
[2] Income from investment in B's shares = 0.18(30000) = $5,400
[3] Interest on personal loan = 0.08(20000) = $1,600

Modigliani and Miller and Arbitrage

- *Illustration (continued):* Firms A and B are identical in every respect except that firm A has no debt in its capital structure while firm B has $2,000,000 in debt outstanding on which the interest rate is 8% p.a. Neither firm pays any corporate taxes and all cash flows are perpetual. The following information is provided for firms A and B

	Firm A	*Firm B*
Earnings before interest (*EBI*)	$700,000	$700,000
Interest on debt, r_D	--	$160,000
Earnings available to shareholders	$700,000	$540,000
Cost of equity, r_E	14%	16%
Market value of equity	$5,000,000	$3,375,000
Market value of debt	--	$2,000,000
Total market value	$5,000,000	$5,375,000

Modigliani and Miller and Arbitrage

- Interest on debt = 0.08(2000000) = $160,000
- Market value of equity for firm *A*, $E_A = V_A = EBI/r_E$
  - $E_A = 700000/0.14 = \$5{,}000{,}000$
- Market value of equity for firm *B*, $E_B = (EBI - \text{Interest})/r_E$
  - $E_B = 540000/0.16 = \$3{,}375{,}000$
- *Note:* $V_B = E_B + D_B > V_A = E_A$
- Assume that an investor owns 1% of firm B's shares. Show how this investor can increase her income via riskfree arbitrage. What will happen to the market values of these firms and why?
- Investor would… Buy low; sell high!

Modigliani and Miller and Arbitrage

- Sell firm B's shares for 0.01(3375000) = $33,750
- Debt-to-equity ratio of firm B = 2000000/3375000 = 59.26%
- The investor should borrow $20,000 (= 33750 × 0.5926) at 8% p.a. (*homemade leverage*) and buy $53,750 of firm A's shares (*what has the investor done here?*)

Income from investment in A is[1]	$7,525
Income from investment in B was[2]	$5,400
Increase in income	$2,125
Less Interest paid (at 8%)[3]	$1,600
Net increase in income	$525

[1] Income from investment in A's shares = 0.14(53750) = $7,525
[2] Income from investment in B's shares = 0.16(33750) = $5,400
[3] Interest on personal loan = 0.08(20000) = $1,600

MM and Capital Structure Changes

- *Illustration:* ABL Ltd is currently an all-equity financed firm which is analyzing its capital structure with the intention of issuing debt and repurchasing some of its existing equity. Assume that all of its available earnings will be paid out as dividends to shareholders and zero corporate taxes. The firm's current situation is shown in the table on the next slide. Based on an expected earnings before interest of $1,500,000 its expected earnings and dividends per share are $1.50. There are three other possible outcomes for the earnings before interest as shown in the table. Assume that the earnings generated by the firm are expected to be a constant perpetual stream over time

MM and Capital Structure Changes

Number of shares	1,000,000			
Price per share	$10			
Market value of equity	$10,000,000			
	Expected and other outcomes			
Earnings before interest	$500,000	$1,000,000	$1,500,000	$2,000,000
Earnings per share (*EPS*)	$0.50	$1.00	$1.50	$2.00
Return on assets, r_O	5%	10%	15%	20%
Return on equity, r_E	5%	10%	15%	20%

Notes: *EPS* = Earnings to shareholders/Number of shares
Return on assets, r_O = Earnings before interest/Market value of firm
Return on equity, r_E = Earnings to shareholders/Market value of equity
The shaded cells indicate the expected outcome
Corporate taxes are zero and all cash flows are perpetual
With no debt, earnings to shareholders is equal to earnings before interest

MM and Capital Structure Changes

- ABL's CFO is considering issuing $5,000,000 of debt at an interest rate of 10% p.a. and using the proceeds to repurchase 500,000 shares. The CFO analyzes the effect of this new capital structure in the following table and graphs
  - New debt issued = $5,000,000
  - Number of shares repurchased = 500,000
  - Value of shares repurchased = 500000 × 10.00 = $5,000,000
  - New capital structure: 50% equity and 50% debt

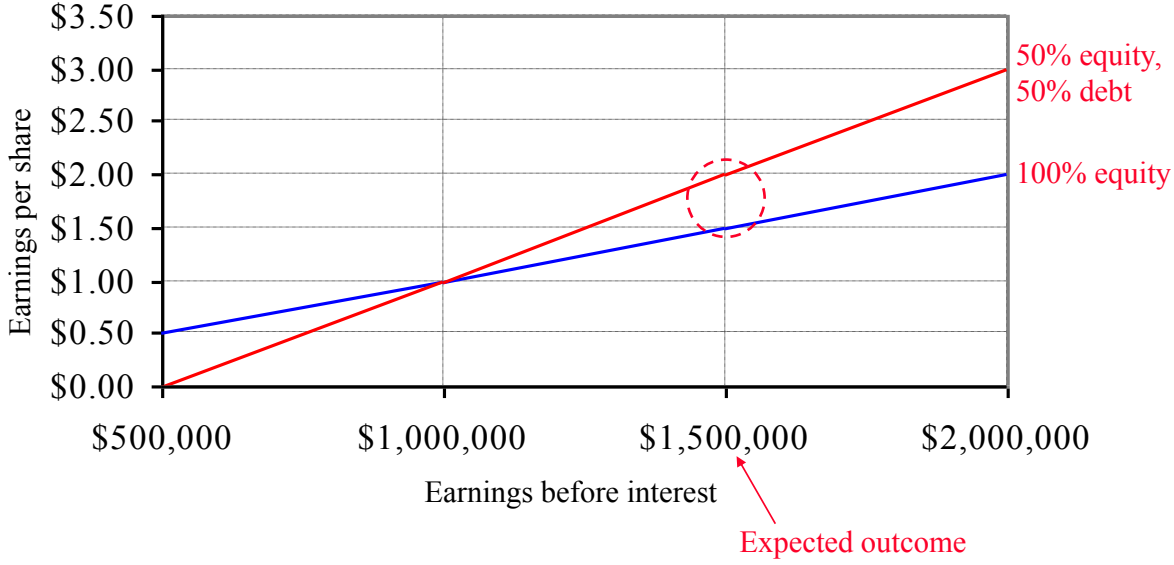
MM and Capital Structure Changes

Number of shares	500,000			
Price per share	$10			
Market value of equity	$5,000,000			
Market value of debt	$5,000,000			
	Expected and other outcomes			
Earnings before interest	$500,000	$1,000,000	$1,500,000	$2,000,000
Interest on debt (at 10%)	$500,000	$500,000	$500,000	$500,000
Earnings to shareholders	$0	$500,000	$1,000,000	$1,500,000
Earnings per share (*EPS*)	$0.00	$1.00	$2.00	$3.00
Return on equity, r_E	0%	10%	20%	30%

Notes: *EPS* = Earnings to shareholders/Number of shares
Return on equity, r_E = Earnings to shareholders/Market value of equity
The shaded cells indicate the expected outcome
Corporate taxes are zero and all cash flows are perpetual

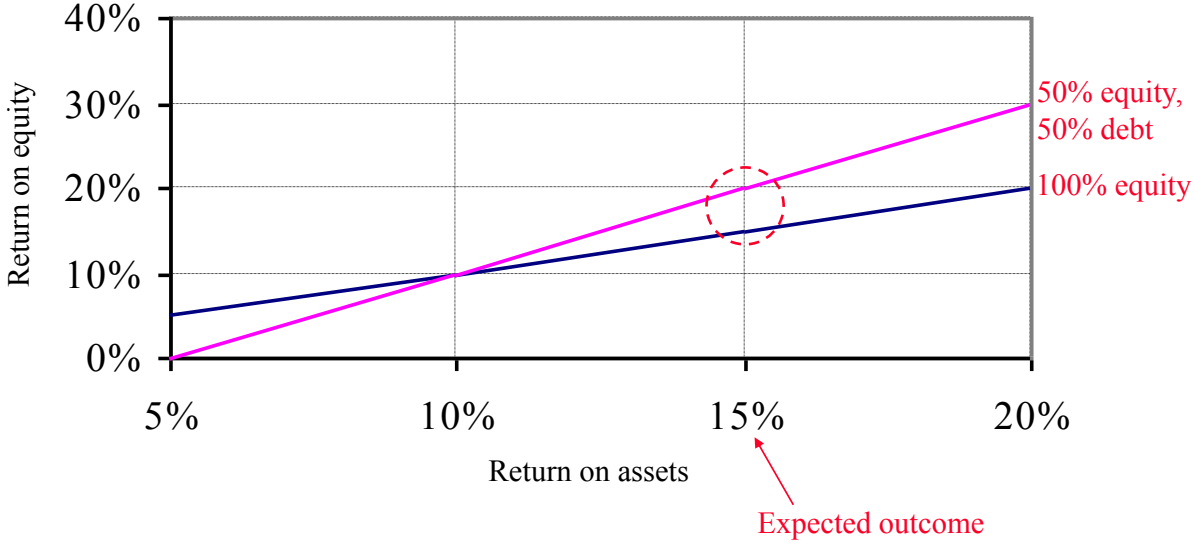
MM and Capital Structure Changes

Earnings before interest and *EPS* for the two capital structures



MM and Capital Structure Changes

Return on assets and return on equity for the two capital structures



Note: The return on assets (r_O) is the same for the two capital structures

MM and Capital Structure Changes

- The CFO argues that it is better to adopt the new capital structure because the return to shareholders is increased by leveraging the firm if the earnings are above $1,000,000. Since the *expected* earnings are $1,500,000 a clear case can be made for issuing debt and repurchasing equity
  - Earnings per share with debt = $2.00 > $1.50 (without debt)
  - Return on equity with debt = 20% > 15% (without debt)
- *What's the flaw in this argument?*

MM and Capital Structure Changes

- The analysis assumes that shareholders cannot achieve the same outcome that the firm has and so will value the leveraged firm higher!
- We allow for shareholders to borrow on personal account and achieve the *same* outcome as the leveraged firm using this *homemade leverage*
- *Implication?*
  - Shareholders will *not* value the leveraged firm any higher than the unleveraged firm!

MM and Capital Structure Changes

- An investor can mimic the leveraged firm by borrowing on their own account (*homemade leverage*) and invest all the funds in the unleveraged firm
- *Illustration:* A shareholder with \$10 to invest can borrow another \$10 at an interest rate of 10% p.a. and invest \$20 in two shares of the unleveraged firm. The shareholder has invested \$10 of her own funds and the payoffs of this investment are shown in the table on the next slide
- Note that the net earnings and return on investment to the shareholder are the *same* as those of an investor who purchases one share in the leveraged firm
- The share prices (market values) of both firms *must* be equal!
  - $V_U = V_L$

MM and Capital Structure Changes

Strategy 1: Two shares of the unleveraged firm *plus* homemade leverage

	Expected and other outcomes			
Earnings on shares	$1.00	$2.00	$3.00	$4.00
Interest on personal debt	$1.00	$1.00	$1.00	$1.00
Net earnings on investment	$0.00	$1.00	$2.00	$3.00
Return on investment	0%	10%	20%	30%

Strategy 2: One share of the leveraged firm

	Expected and other outcomes			
Earnings on shares	$0.00	$1.00	$2.00	$3.00
Return on investment	0%	10%	20%	30%

Notes: *Return on investment* = Net earnings/Investment
The shaded cells indicate the expected outcome

MM and Capital Structure Changes

- An investor who has invested funds in the leveraged firm's equity can *undo* this leverage by *lending* funds
- *Illustration:* A shareholder who has \$20 invested in the unleveraged firm can replicate this unleveraged investment by investing \$10 in one share of the leveraged firm and lending \$10 at an interest rate of 10% p.a. The shareholder's payoffs on these investments are shown in the table on the next slide
- Note again that the net earnings and return on investment to the shareholder are the *same* so the share prices (market values) of both firms *must* be equal
  - $V_U = V_L$

MM and Capital Structure Changes

Strategy 1: Two shares of the unleveraged firm

	Expected and other outcomes			
Earnings on shares	$1.00	$2.00	$3.00	$4.00
Return on investment	5%	10%	15%	20%

Strategy 2: One share of the leveraged firm plus lending $10 at 10%

	Expected and other outcomes			
Earnings on shares	$0.00	$1.00	$2.00	$3.00
Interest on $10 loan	$1.00	$1.00	$1.00	$1.00
Net earnings on investment	$1.00	$2.00	$3.00	$4.00
Return on investment	5%	10%	15%	20%

Notes: *Return on investment* = Net earnings/Investment
The shaded cells indicate the expected outcome

Modigliani and Miller Proposition 2

- *Proposition 2 states that the cost of equity of a leveraged firm will increase in direct proportion to its debt-to-equity ratio*
  - The cost of equity of a leveraged firm is equal to the cost of capital of an unlevered firm *plus* a premium that is proportional to the debt-to-equity ratio
  - Note that the overall cost of capital (r_O) of the firm remains unchanged (why?)
  - For *default risk free* debt the cost of debt (r_D) remains unchanged as well
  - The rate of increase in the return on equity (r_E) depends on the spread between the firm's overall cost of capital and its cost of debt (r_D)

Modigliani and Miller Proposition 2

- The firm's overall cost of capital (r_O) is the rate of return expected by investors on the firm's assets
- Assuming that only debt and equity are used, we have…

$$r_O = \left(\frac{D}{D+E}\right) r_D + \left(\frac{E}{D+E}\right) r_E$$

where r_D = Cost of debt (required return on debt)

r_E = Cost of equity (required return on equity)

D = Market value of debt

E = Market value of equity

$V = D + E$

Modigliani and Miller Proposition 2

- According to MM proposition 1 the firm's overall cost of capital must be the same no matter how much leverage exists
- Consider the WACC of a leveraged firm…

$$r_O = \left(\frac{D}{D+E}\right) r_D + \left(\frac{E}{D+E}\right) r_E$$

- Multiplying both sides by (D + E)/E, we get…

$$\left(\frac{D+E}{E}\right) r_O = \left(\frac{D}{E}\right) r_D + r_E$$

Modigliani and Miller Proposition 2

- Rearranging the terms, we get…

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

- Implication?
- The required return on equity is directly proportional to (and a linear function of) the firm's debt-to-equity ratio
- The higher the debt-to-equity ratio, the higher the required return on equity
- *Does this make intuitive sense?*
- *What is the relation between systematic risk (β) and the debt-to-equity ratio?*

Modigliani and Miller Proposition 2

- The cost of equity, debt and WACC are related to their systematic risks via the CAPM and security market line relation

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

- Recall that from the CAPM's security market line relation, we have…

$$E(r_j) = r_f + [E(r_m) - r_f]\beta_j$$

- Substituting the second expression in the first expression for $j = E$, O and D and simplifying gives us…

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

Modigliani and Miller Proposition 2

- The firm's systematic risk is also directly proportional to (and a linear function of) the firm's debt-to-equity ratio

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

- Implication?
- The higher the debt-to-equity ratio, the higher the systematic risk of equity
- The higher the systematic risk of equity the higher the required rate of return on equity
- *There are no free lunches in financial markets!*

Modigliani and Miller Proposition 2

- *Example:* Consider the illustration related to ABL Ltd and the case related to the expected outcomes. The cost of debt is 10% and the cost of equity (and capital) of the unleveraged firm is 15%. Assume that the systematic risk of the firm's assets is the same as that of the market portfolio and that the debt is riskfree. How does the cost of equity change as the debt-to-equity ratio changes?
  - *Given:* $r_O = 0.15$, $r_D = 0.10$, $\beta_O = 1$ and $\beta_D = 0$

Modigliani and Miller Proposition 2

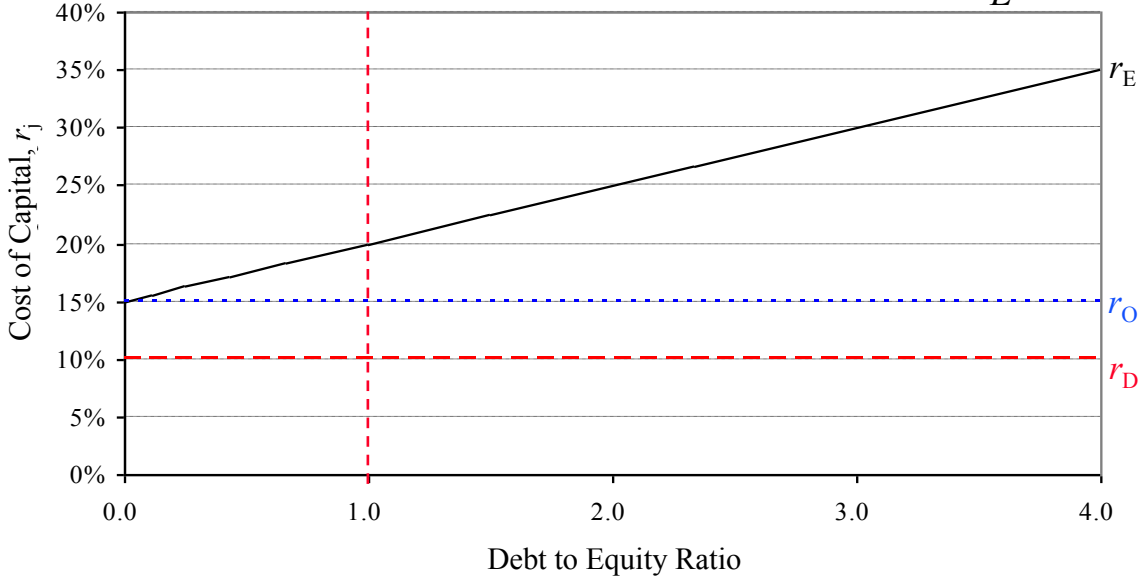
- The cost of equity for the leveraged firm is…

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

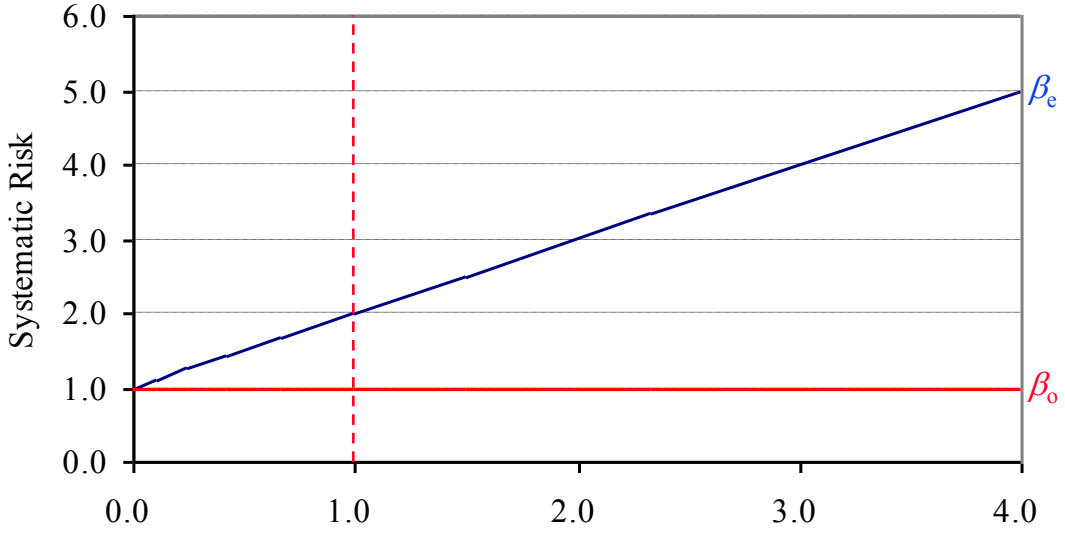
Debt	*D/E Ratio*	*Cost of Equity*
$0	0.00	15.0%
$1,000,000	0.11	15.6%
$2,000,000	0.25	16.3%
$3,000,000	0.43	17.1%
$4,000,000	0.67	18.3%
$5,000,000	1.00	20.0%
$6,000,000	1.50	22.5%
$7,000,000	2.33	26.7%
$8,000,000	4.00	35.0%

Modigliani and Miller Proposition 2

The cost of equity for the leveraged firm is: $r_E = r_O + (r_O - r_D)\frac{D}{E}$



Modigliani and Miller Proposition 2



The beta of equity for the leveraged firm is: $\beta_E = \beta_O + (\beta_O - \beta_D)\frac{D}{E}$

10.4 MM and Market Imperfections

- Modigliani and Miller's original analysis assumes away capital market imperfections including…
  - Transaction costs
  - Different cost of borrowing for firms and individuals
  - Changing cost of debt due to changing risk
  - Agency costs
  - Corporate taxes and personal taxes
  - Costs associated with financial distress and default
- We focus on the major market imperfections of corporate taxes, financial distress/default and (briefly) agency costs

MM and Corporate Taxes

- Corporate taxes
  - Modigliani and Miller (1963) extended their previous analysis and dropped the assumption of zero corporate taxes
- Under the "classical" tax system…
  - As leverage increases, a firm's value will increase because the interest on debt is a tax deductible expense
  - This results in an increase in the after-tax net cash flows to the firm and investors (note that we assume that all cash flows are paid out as dividends)

MM and Corporate Taxes

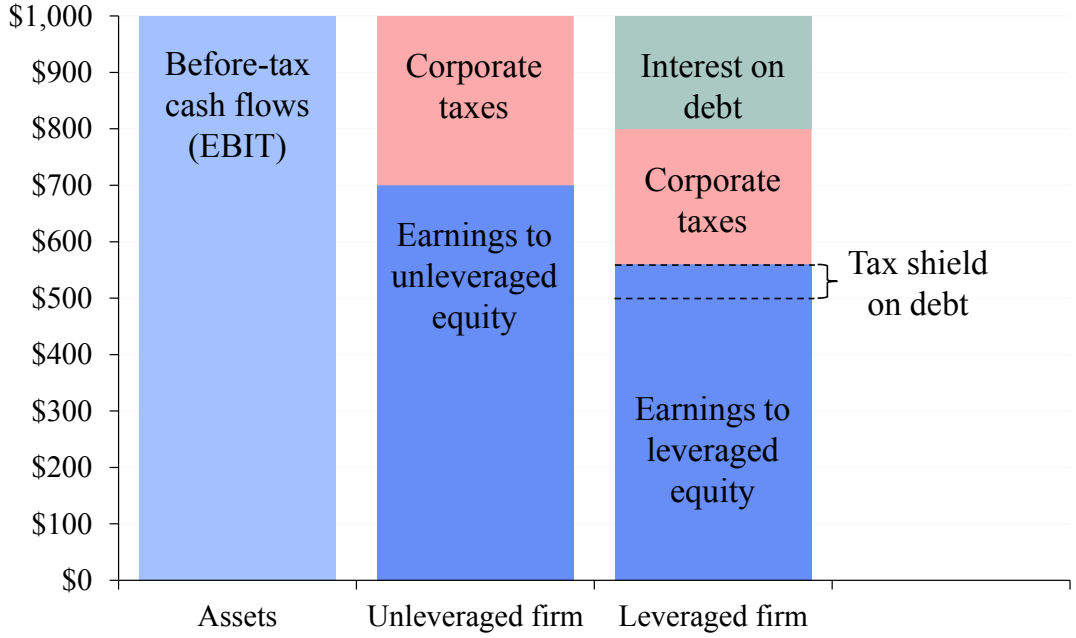
- *Example:* Consider two firms, *U* and *L*, which are identical in terms of their assets and operations but which have different capital structures. Firm *U* has no debt in its capital structure while firm *L* is leveraged and has borrowed $2,000,000 at a cost of debt of 10%. Assume that the debt is permanent, that is, it is "rolled over" when it matures at a cost of 10% forever. Assume that the earnings generated by the firms are expected to be a constant perpetual stream over time. Also assume that all of the firms' available earnings are paid out as dividends to shareholders, a corporate tax rate of 30% and a classical tax system. The firms' cash flows are shown in the table on the next slide

MM and Corporate Taxes

	Firm U	*Firm L*
EBIT	$1,000,000	$1,000,000
Interest on debt (at 10%)	$0	$200,000
Earnings before taxes	$1,000,000	$800,000
Tax on earnings (at 30%)	$300,000	$240,000
Earnings to shareholders	$700,000	$560,000
Earnings to shareholders *and* bondholders	$700,000	$760,000

Notes: *EBIT* = Earnings before interest and taxes
Interest on debt = 2000000 × 0.10 = $200,000 per year
Earnings to shareholders and debtholders = Interest on debt + Earnings to shareholders
All cash flows are perpetual and the corporate tax rate is 30%

MM and Corporate Taxes



What happens when the level of debt increases?

MM and Corporate Taxes

- The difference in the earnings to shareholders and debtholders is the (perpetual) *interest tax shield* of $60,000
  - Interest on debt = $D \times r_D = 2000000 \times 0.10 = \$200{,}000$
  - Interest tax shield = $t_c \times D \times r_D = 0.30(200000) = \$60{,}000$
- The total value added to the leveraged firm's value is the present value of this tax shield. Since the tax shield is a perpetual cash flow, we have…
  - Present value of tax shield = Tax shield/r_D
  - Present value of tax shield = $(t_c \times D \times r_D)/r_D = t_c \times D$
  - Present value of tax shield = 60000/0.10 *or* 0.30×2000000
  - Present value of tax shield = $600,000

MM and Corporate Taxes

- The value of the leveraged firm, V_L now is…
- $V_L = V_U + \text{PV(Tax shield)}$
- $V_L = V_U + (t_c \times D \times r_D)/r_D$
- $V_L = V_U + t_c D$
- Implication?
  - With the introduction of corporate taxes in the MM analysis the existence of debt matters!
  - The conclusion is that firm should maximize the level of debt in their capital structure as this will maximize the value of the firm
- *Does this make sense, especially in the current market environment?*

MM and Corporate Taxes

- Note that in the more typical case, where debt is *not* perpetual, the above analysis still holds and the value of the leveraged firm, V_L is…
  - $V_L = V_U$ + PV(Tax shield)
- *Example:* ABL Ltd has borrowed $1 billion for an eight year period. Its interest rate on debt is 6% p.a. and it plans to pay $60 million in interest every year for the next 8 years. It will repay the principal of $1 billion at the end of year 8. Assume that these payments are riskfree and ABL's marginal tax rate will be unchanged at 30% during this period. Based on this information, how much will the interest tax shield increase the value of ABL?

MM and Corporate Taxes

- The annual interest tax shield is…
  - $D \times r_D \times t_c = 1000000000(0.06)(0.30)$
- Annual interest tax shield = $18.0 million per year for 8 years
- The present value of the interest tax shield is…

$$PV(TS) = \left(\frac{Interest}{r_D}\right)\left(1 - \frac{1}{(1+r_D)^n}\right)$$

$$PV(TS) = \left(\frac{18.0}{0.06}\right)\left(1 - \frac{1}{(1+0.06)^8}\right) = \$111.78m$$

- *What are the potential weaknesses in the above analysis?*

Key Concepts

- Business risk is the variability of future net cash flows attributed to the nature of the firm's operations
- Financial risk is the risk attributed to the use of debt as a source of financing a firm's operations
- The level of financial leverage varies across firms in the same industry as well as across firms in different industries
- Modigliani and Miller's proposition 1 states that the market value of a firm is independent of its capital structure
- Modigliani and Miller's proposition 2 states that the expected return on equity of a leveraged firm increases in direct proportion to its debt-to-equity ratio
- In the presence of corporate taxes the capital structure decision is no longer irrelevant to the firm's market value

Formula Sheet

- Value of the firm without debt: $V_U = EBI/r_O$
- Value of equity with debt: $E_L = (EBI - \text{Interest})/r_E$
- Value of debt: $D_L = \text{Interest}/r_D$
- Value of the firm with debt: $V_L = E_L + D_L$
- Cost of equity: $r_E = r_O + (r_O - r_D)\frac{D}{E}$
- Beta of equity: $\beta_E = \beta_O + (\beta_O - \beta_D)\frac{D}{E}$
- Value of the leveraged firm (perpetual debt): $V_L = V_U + t_c D$

(*Note:* The formula sheet on the final exam will contain all the formulas covered in lectures but *without* the descriptions)