Lecture 4:
Capital structure with perfect/imperfect capital markets

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Topics Covered

- Capital Structure, Firm Value and Cost of Capital in a Perfect Capital Market
- Capital Structure, Firm Value and Cost of Capital in a World with Taxes
- Implications of Modigliani and Miller (M&M) Propositions
- Costs of Financial Distress
- Optimal Capital Structure
- Theories of Financing Choices

Reading

1. Brealey, R. A., Myers, S. C., Allen, F., & Edmans, A. (2022). Principles of Corporate Finance (14th ed.). McGraw-Hill Education. ISBN: 978-1265074159. Chapter 16 & 17.
2. Hillier, D., Ross, S., Westerfield, R., Jaffe, J. & Jordan, B. (2021) Corporate Finance. 4th ed. London: McGraw-Hill Education. ISBN-13: 9781526848086. Chapters 18 & 19.
3. Stiglitz, J.E. (1969). A Re-examination of the Modigliani-Miller Theorem. *American Economic Review* 59, 784-793. https://www.jstor.org/stable/1810676
4. Kraus, A., Litzenberger, R. (1973) A State-Preference Model of Optimal Financial Leverage. *Journal of Finance* 28, 911-922. https://doi.org/10.2307/2978343
5. Myers, S.C. (2001) Capital Structure. *Journal of Economic Perspectives* 15, 81-102. https://doi.org/10.1257/jep.15.2.81

The Capital Structure Question

- Shareholders want management to select the mix of securities that maximizes firm value
- The firm's mix of securities is known as capital structure
- But can managers increase a firm's value by simply changing its capital structure, if future cash flows generated by assets are assumed to be constant?

Influential Work of Modigliani and Miller (M&M)

Franco Modigliani
(1918-2003)
Nobel Prize in 1985

Merton Howard Miller
(1923-2000)
Nobel Prize in 1990
[with Harry M. Markowitz
and William F. Sharpe]

- Without taxes
  Franco Modigliani and Merton H. Miller (1958) The Cost of Capital, Corporation Finance, and the Theory of Investment. *American Economic Review* 48, 261-297.
- With taxes
  Franco Modigliani and Merton H. Miller (1963) Corporate Income Taxes and the Cost of Capital: A Correction. *American Economic Review* 53, 433-443.

In a Tax-Free World

M&M Proposition I: The market value of a company does not depend on its capital structure.

Implications of Proposition I

Capital structure is irrelevant, managers can not increase a firm's value by changing the mix of securities used to finance firms

The Assumptions

1. There is no taxation
2. Perfect information is available to all economic agents and there are no transaction costs
3. There are no costs of financial distress and liquidation (shareholders will receive the same as the market value of their shares prior to liquidation if a firm is liquidated)
4. Firms can be classified into distinct risk classes
5. Individuals can borrow as cheaply as corporations

Example 1: Circle Cruises

A company is shortly to be formed, called Circle Cruises. It needs £1 million capital for investment. The business is expected to generate a constant annual cash flow of £125,000 in perpetuity. This cash flow will be all paid out to capital providers each year.
The prospective directors of Circle Cruises are considering three different capital structures:

1. Finance the business by all-equity, selling 100,000 shares at £10 each
2. Borrow £0.5 million at 10% interest rate per annum and sell 50,000 shares at £10 each
3. Borrow £0.75 million at 10% interest rate per annum and sell 25,000 shares at £10 each

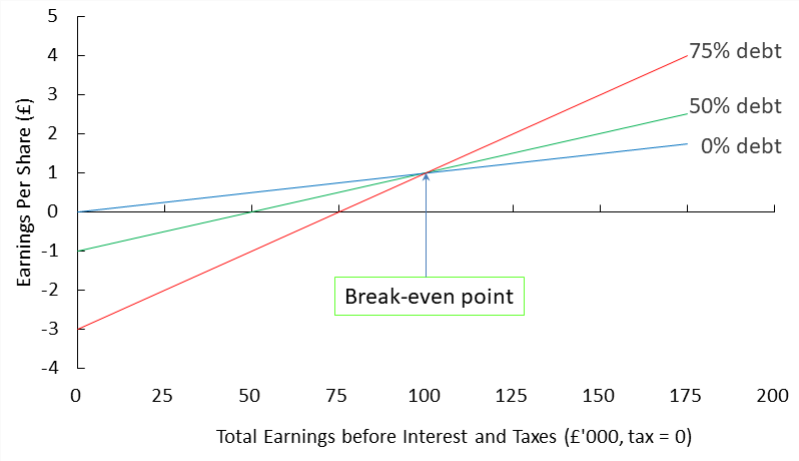
Suppose the assumptions underlying M&M's argument hold, show that the value of Circle Cruises is unchanged across the three structures.

Example 1: Solution

Table 1. Capital Structure and Firm Value

	Balance Sheet	Structure 1	Structure 2	Structure 3
(1)	Debt	0%	50%	75%
(2)	Equity	100% (£1 million)	50%	25%
(3)	Liabilities and Equity	100% [=(1)+(2)]	100%	100%
	Income Statement			
(4)	Earnings	125,000	125,000	125,000
(5)	Interest Payments	0 [=(1)×(3)×10%]	50,000	75,000
(6)	Dividend Payments	125,000 [=(4)–(5)]	75,000	50,000
(7)	**ROE (%)**	**12.5 [=(6)÷(2)]**	**15**	**20**
(8)	Debt Value	0 [=(1)×(3)]	500,000	750,000
(9)	Equity Value	1,000,000 [=(6)÷(7)]	500,000	250,000
(10)	**Firm Value**	1,000,000 [=(8)+(9)]	1,000,000	1,000,000

How Does Debt Affect Return and Risk?



Debt, and Return and Risk to Shareholders

- The effect of debt on the returns to shareholders depends on the firm's EBIT. If EBIT is above the break-even point (more than £100,000), debt is beneficial; if it is below this point, it is not.
- However, shareholders have to bear more risk because returns become more sensitive to changes in EBIT (this is why the use of debt is known as financial leverage/gearing)

Homemade Leverage

- As debt impacts both return and risk to shareholders, does capital structure become important?
- Shareholders can adjust the financial leverage by borrowing and lending on their own
- The use of personal borrowing to alter the degree of financial leverage is called homemade leverage

Debt and EPS: Different Structures

Table 2. Capital Structure and EPS

	Balance Sheet	Structure 1	Structure 2	Structure 3
(1)	Debt	0%	50%	75%
(2)	Equity	100% (£1 million)	50%	25%
(3)	Liabilities and Equity	100% [=(1)+(2)]	100%	100%
	Income Statement			
(4)	Earnings	125,000	125,000	125,000
(5)	Interest Payments	0 [=(1)×(3)×10%]	50,000	75,000
(6)	Dividend Payments	125,000 [=(4)–(5)]	75,000	50,000
(7)	ROE (%)	12.5	15	20
(8)	No. of Shares	100,000	50,000	25,000
(9)	Share Price	£10	£10	£10
(10)	**EPS**	£1.25 [=(6)÷(8)]	£1.50	£2.0

Homemade Leverage: Circle Cruises

- Shareholders lever their financial positions by borrowing and buying shares , replicating the company's leverage positions
- A shareholder who owns 100 shares in Structure 2 or 3 can sell these shares and borrow more to invest into Structure 1

Table 3.

	Sell 100 shares in CS 2 or 3 BORROW to LEVER	
	Buy 200 shares in CS 1	Buy 400 shares in CS 1
No. of shares owned	200 [=100+100]	400
Amount borrowed (£)	1000 [=100 x £10]	3000
EPS (Structure 1)	1.25	1.25
Total Earnings (£)	250 [=200x1.25]	500
Interest Payments (£)	100 [=1000x10%]	300
Net Earnings (£)	150	200
	100 shares in Structure 2	100 shares in Structure 3

Homemade Un-leverage: Circle Cruises

- Shareholders 'un-lever' their positions by selling shares and lending the money out
- A shareholder uses leverage to acquire 100 shares in Structure 1 can sell these shares, lend out part of the money and invest in either Structure 2 or 3

Table 4.

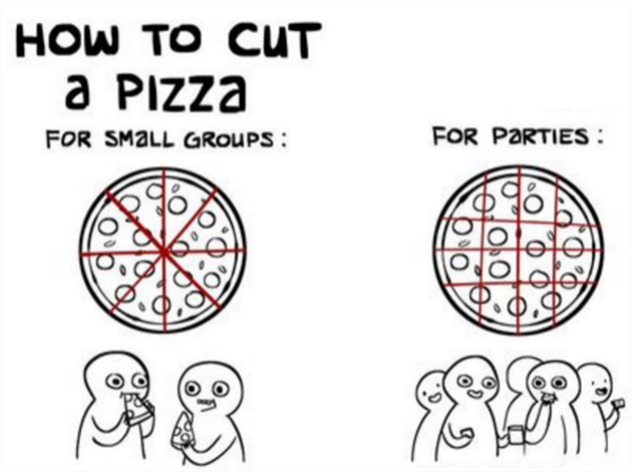
	Sell 100 shares in CS 1 LOAN to UNLEVER	
	Buy 50 shares in CS 2	Buy 25 shares in CS 3
Shares owned	50 [=100-50]	25
Money loaned out (£)	500 [=50x£10]	750
Earnings from Shares	75 [=50x£1.5]	50
Interest Earnings	50 [=500x10%]	75
Total Earnings	125	125

£125 = return from 100 shares in CS 1

EPS and Its Sensitivity to Total Earnings

- The firm does not really do anything for its shareholders by using debt because any shareholder who prefers debt can simply create it
- It actually makes no difference whether Circle Cruises adopts Capital Structure 1, 2 or 3
- Leverage increases the return to shareholders but it also increases risk: the two effects cancel each other out, leaving shareholder value unchanged

Summary of M&M Proposition I



In a Tax-Free World

M&M Proposition II: A firm's WACC is the same no matter what mixture of debt and equity is used to finance firms

Implications of Proposition II

- The risk of the equity depends on two factors:
  (1) the risk of the firm's operations (business risk)
  (2) the degree of financial leverage (financial risk)
- Business risk determines WACC and financial risk is determined by the leverage ratio ($\frac{D}{E}$)
- The cost of equity increases proportionately with the leverage ratio

Cost of Equity and Financial Leverage

$$WACC = r_E \times w_E + r_D \times w_D = r_E \times \frac{E}{V} + r_D \times \frac{D}{V} \quad (1)$$

- $WACC = r_A$: the return on the firm's overall assets
- $V = D + E$
- $r_A = r_E \times \frac{E}{V} + r_D \times \frac{D}{V}$

$$r_E = r_A + (r_A - r_D) \times \frac{D}{E} \quad (2)$$

- $r_A = r_U$ for all-equity-financed (un-levered) firms
- Proposition I implies that the value of the firm's assets is unchanged to capital structure, so r_A (WACC) is unaffected but r_E (cost of equity) changes

Table 5. Capital Structure, Cost of Equity and WACC

	Balance Sheet	Structure 1	Structure 2	Structure 3
(1)	Debt	0%	50%	75%
(2)	Equity	100% (£1 million)	50%	25%
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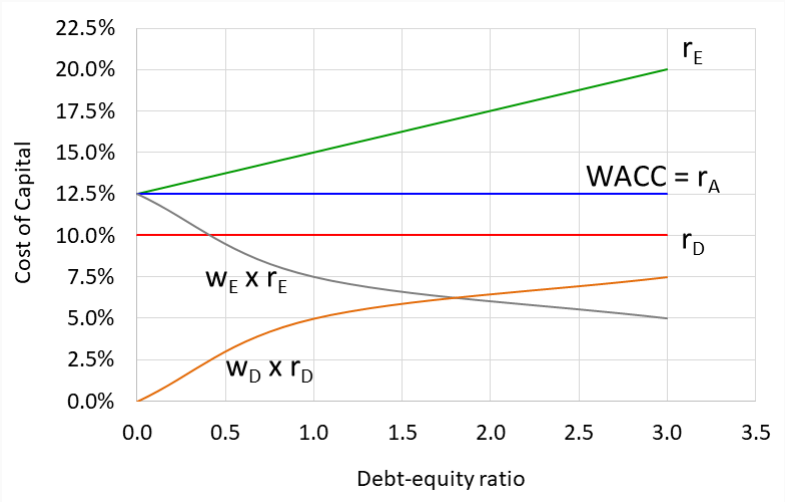
	Income Statement			
(4)	Earnings	125,000	125,000	125,000
(5)	Interest Payments	0 [=(1)×(3)×10%]	50,000	75,000
(6)	Dividend Payments	125,000 [=(4)–(5)]	75,000	50,000
(7)	**ROE (%)**	**12.5**	**15**	**20**
(8)	$r_E w_E$ (%)	12.5	7.5	5
(9)	$r_D w_D$ (%)	0	5	7.5
(10)	**WACC (%)**	12.5	12.5	12.5

Capital Structure, Cost of Equity and WACC



Two Features of Debt

- Debt has two distinguishing features that have not been taken into account:
  - Interest paid on debt is tax deductible, so if there are taxes, debt can add some benefits to firms (Assumption 1 does not hold)
  - Failure to meet debt obligations leads to financial distress and can result in bankruptcy, adding cost to the use of debt (Assumption 3 does not hold)
- So what will happen to M&M Propositions I and II when we consider the effect of corporate taxes?

In a World with Taxes

- We consider the effect of corporate taxes by examining the case of without and with leverage

Example 2: W-Mart

Table 6.	Without	With
EBIT ($billion)	24.19	24.19
Interest	0	2.55
Taxable income	24.19	21.64
Tax (30%)	7.26	6.49
Net income	16.93	15.15

Table 7. Cash Flow from Assets

	Without	With
EBIT	24.19	24.19
Tax (30%)	7.26	6.49
Total	16.93	17.69

Source: https://uk.finance.yahoo.com, adjusted data in Jan 2016, Wal-Mart

- Capital structure is now having some effect because cash flows are not the same from identical assets

Interest Tax Shield

- The cash flow to shareholders and bondholders

Table 8. Cash Flow Distribution ($ billion)

	Without	With
To shareholders	16.93	15.15
To bondholders	0	2.55
Total	16.93	17.69

- Total cash flow in case of leverage is \$0.76 billion more $(17.69 - 16.93)$ because tax bill is \$0.76 billion less $(7.26 - 6.49)$
- Tax saving: $2.55 \times 30\% = \$0.76$ billion. This tax saving is called the interest tax shield.

Taxes and M&M Proposition I

- Suppose the debt is perpetual, the same \$0.76 billion shield will be generated every year forever
- Because the tax shield is generated by paying interest, it has the same risk as debt; suppose the cost of debt is 5.1% for W-Mart, the present value of the tax shield is:
- $PV_{\text{(tax shield)}} = \frac{\text{Tax shield}}{0.051} = \frac{(T_C \times D \times r_D)}{r_D} = T_C \times D$
- $PV_{\text{(tax shield)}} = \frac{\$0.76 \text{ billion}}{0.051} = 30\% \times \$50.03 \text{ billion} \approx \$15 \text{ billion}$
- \$50.03 billion is the amount of debt (adapted data from Wal-Mart)

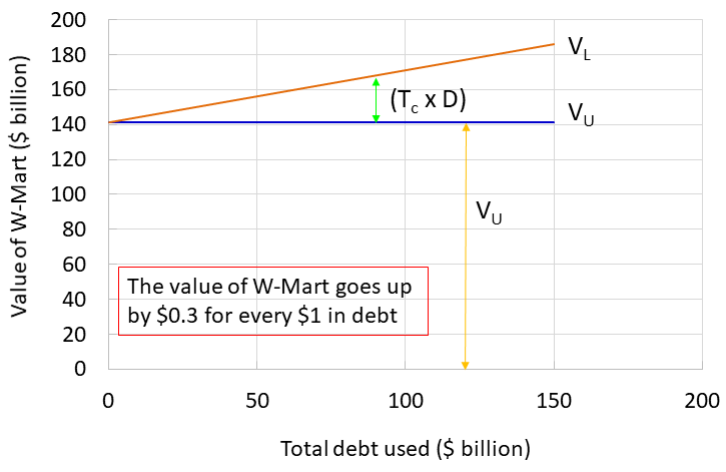
M&M Proposition I with Taxes

- Value of levered firm = value of firm if unlevered + present value of tax shield
- $V_L = V_U + T_C \times D$ (if the debt is perpetual)

W-Mart's Value: Un-levered vs. Levered

- Assume the cost of equity of W-Mart (r_U) is 12%
- $V_{\text{(WMart-U)}} = \frac{EBIT \times (1 - T_C)}{r_U} = \frac{16.93}{0.12} = \$141.09$ billion
- $V_{\text{(WMart-L)}} = V_{\text{(WMart-U)}} + T_C \times D = 141.09 + 30\% \times 50.03 = \$156.09$ billion

Proposition I with Taxes: W-Mart



Valuing the Interest Tax Shield: W-Mart

Suppose W-Mart plans to pay $2.55 billion in interest each year for the next 10 years, and then repay the principal of $50.03 billion in year 10. The tax rate is 35% throughout this period. The annual cost of debt is 5.1%. The interest tax shields have the same risk as the debt. What is the present value of the interest tax shields from the debt?

Solution

The future cash flow of the tax shield is

$$0.35 \times 2.55 = 0.89 \text{ billion},$$

which the firm will receive each year for the next ten years. Therefore, we can value it as a 10-year annuity:

$$PV_{\text{Tax Shield}} = 0.89 \times \frac{1}{0.051}\left(1 - \frac{1}{1.051^{10}}\right) = 6.84 \text{ billion}.$$

Proposition II with Taxes: WACC (1)

- With taxes, $WACC = r_E \times \frac{E}{V} + r_D \times \frac{D}{V} \times (1 - T_C)$

$$WACC = (r_E \times \frac{E}{V} + r_D \times \frac{D}{V}) - (r_D \times \frac{D}{V} \times T_C) \quad (3)$$

- $(r_D \times \frac{D}{V} \times T_C)$ in (3) is the reduction in WACC because of interest tax shield compared to tax-free in Eq.(1)

$$r_E = r_U + (r_U - r_D) \times \frac{D}{E} \times (1 - T_C) \quad (4)$$

Proposition II with Taxes: WACC (2)

Table 9. Net Income Changes

D/E	0	0.47	1.41	4.17
EBIT	24.19	24.19	24.19	24.19
Interest	0	2.55	5.10	7.64
PBT	24.19	21.64	19.09	16.54
Tax (30%)	7.26	6.49	5.73	4.96
Net income	16.93	15.15	13.36	11.58

Table 10. Components of WACC

D (Debt)	0	50.03	100.06	150.09
V_U	141.09	141.09	141.09	141.09
V_L	141.09	156.09	171.10	186.11
D/E	0.00	0.47	1.41	4.17
E/V	1	0.679	0.415	0.194
r_E	0.12	0.143	0.188	0.321
D/V	0	0.321	0.585	0.806
r_D	0.051	0.051	0.051	0.051
$1-T_C$	0.7	0.7	0.7	0.7

Source: https://uk.finance.yahoo.com [adjusted data from Wal-Mart]

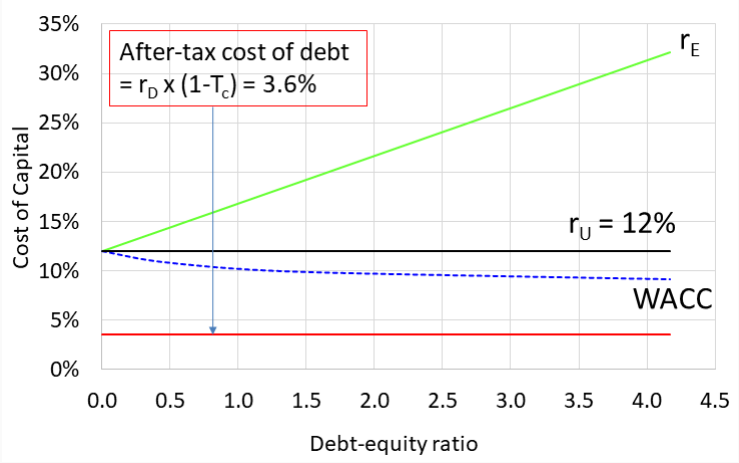
W-Mart cost of capital

Table 11. Cost of Capital (%)

D/E ratio	0.00	0.47	1.41	4.17
r_E	12	14.3	18.8	32.1
r_u	0.12	0.12	0.12	0.12
WACC	12	10.8	09.9	09.1
$r_D*(1-T_c)$	3.6	3.6	3.6	3.6

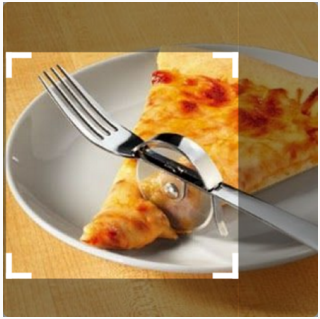
Source: https://uk.finance.yahoo.com [Jan. 2016, adjusted data from Wal-Mart]

Proposition II with Taxes: W-Mart



Summary of M&M Proposition I & II with Taxes

- Selling a slice of pizza to debt holders, there is no tax (interest paid before being taxed)
- Thus, by selling more slices to debt holders, the revenues from a single pizza increase
- While the total amount of pizza does not change, the owner will give less away in taxes, leaving more pizza to sell to customers



Implications of Proposition I & II with Taxes

- Debt financing is highly advantageous; a firm's value increases and its WACC decreases as the firm relies more on debt financing (even though cost of equity also rises)
- In the extreme case, a firm's optimal structure is 99% plus of debt (in theory, W-Mart can reach the lowest WACC = 3.6% if financed by 100% debt, see Table 11)

The Real World

- Why are M&M's results important if, after all, capital markets are not perfect in the real world?
- M&M's propositions reveal that any effects of capital structure must be due to frictions that exist in capital markets
- These propositions imply that the true role of a firm's financial policy is to deal with financial market imperfections (such as taxes, transaction costs and asymmetric information...)

Costs of Financial Distress

- Financial distress occurs when promises to creditors are broken or honoured with difficulty
- Costs of financial distress:
  - The direct cost: bankruptcy cost (direct and indirect)
  - The indirect cost: cost of avoiding bankruptcy when experiencing financial distress

Cost of Bankruptcy: McCrory Corporation

- McCrory Corporation, founded 1882, used to be one of the largest and oldest operators of traditional five-and-dime stores in the U.S.
- The company missed $3.37 million debt payment on the 17 Feb 1992 with another $75 million due to bondholders in Jul 1992
- Filed for bankruptcy on the 26 Feb 1992
- Through Oct 1995, $39 million in fees had been paid to lawyers, bankers and accountants (direct cost)
- At least $5 million in fees paid to keep the firm operating while in bankruptcy (indirect cost)
- McCrory Corporation ceased to exist altogether on 30 Sep 1997 and creditors received nothing

Source:
Ross, Westerfield and Jordan (2003)
http://www.nytimes.com/1992/02/27/business/mccrory-chain-files-for-bankruptcy.html

Cost of Avoiding Bankruptcy

- Xerox, founded 1906 in the U.S., is a global maker and marketer of document solutions such as copiers and printers
- In 2000, Xerox found itself on the verge of bankruptcy because of huge debt and declining sales
  - The company borrowed to expand business beyond its core copier business
- Xerox's cash reserves dwindled to nearly $100 million, almost nothing for a firm of its size, while its debt ballooned to almost $19 billion

Xerox's Share Price (XRX - NYSE)

Source: https://uk.finance.yahoo.com

New CEO Appointment

- On the day that Anne Mulcahy's appointment to CEO was announced, the stock dropped 15%
- *'I think I am more motivated by fear of failure than a desire to succeed'* Anne Mulcahy

Anne M. Mulcahy
CEO & Chairwoman
Xerox Corp. (2001-2010)

Meetings with 58 Bankers

Sanford I. Weill
CEO & Chairman
Citigroup (1998-2006)

Gerald R. Ford
Former President of the U.S.
(1974-1977)

Robert E. Rubin
Former Secretary of the U.S. Treasury
(1995-1999)

Turnaround at Xerox

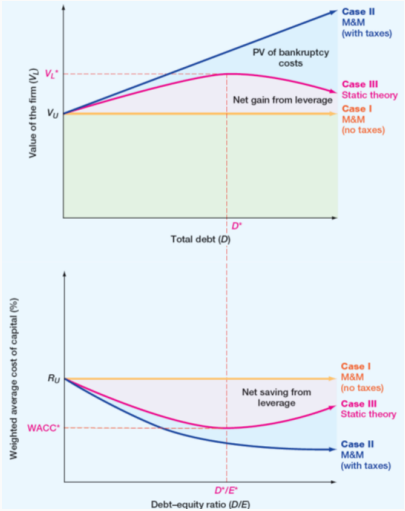
- All bankers agreed to renew credit line
- Xerox cut costs by eliminating 13,600 positions, selling off its Chinese and Hong Kong operations, and 50% of Fuji Xerox to Fuji Photo Film
- Xerox moved from losing $273 million in 2000 to earning $91 million in 2003

Source:
Ross, Westerfield and Jordan (2003)
http://www.forbes.com/2002/11/06/1106soapbox.html
https://www.gsb.stanford.edu/insights/anne-mulcahy-keys-turnaround-xerox
http://knowledge.wharton.upenn.edu/article/the-cow-in-the-ditch-how-anne-mulcahy-rescued-xerox/
http://blogs.wsj.com/moneybeat/2014/06/16/life-lessons-from-former-citi-ceo-sandy-weill/
http://www.uni-muenster.de/PeaCon/global-texte/g-a/ga-p/citiboard.pdf

Optimal Capital Structure

- Where there are no taxes, bankruptcy costs, or other real world imperfections, the firm's value is not affected by its debt policy: no optimal structure [Case I]
- With taxes, and no bankruptcy costs, the firm's value increases as the firm borrows more: the optimal capital structure is 99% plus of debt [Case II]
- With taxes and bankruptcy costs, the optimal point is where the tax benefit from an extra dollar in debt is exactly equal to the cost that comes from the increased probability of financial distress [Case III]

The Capital Structure Question



Source: Ross, Westerfield & Jordan (2016) *Fundamentals of Corporate Finance*, 11th ed. (Figure 16.8, p. 554).

Financing Choices: Trade-off Theory (1)

- Trade-off theory: debt levels are chosen to balance interest tax shields against the costs of financial distress (consistent with M&M).
- This theory can explain why companies have different capital structure (high-tech vs. hotels):
  - Companies with risky, intangible assets tend to rely on equity financing.
  - Companies with relatively safe, tangible assets should have higher debt-to-equity ratios.

Trade-off Theory (2)

- To explain why some of the most successful companies have little debt (Apple, Google, Microsoft)
- Intangible assets should go with low debt, but these companies pay large amounts of taxes, and could borrow enough to save millions of dollars in tax without raising concerns about financial distress

Financing Choices: Pecking Order Theory (1)

- Firms prefer to issue debt rather than equity if internal finance is insufficient
- This theory is based on asymmetric information between managers and investors
  - Pessimistic managers time to issue stocks when they think their companies' stock is overpriced
  - Optimistic managers will see their companies' stocks as underpriced and decide not to issue
  - Investors are reluctant to buy newly issued stocks

Pecking Order Theory (2)

- The problems caused by information asymmetries can be avoided if the company can finance with:
  - Internal funds first; and
  - Debt; and then
  - Equity
- Managers' preference for internal over external financing is the most important factor
- No clear target debt-to-equity ratio

Pecking Order Theory (3)

- This theory explains why the most profitable firms generally borrow less and less profitable firms tend to issue debt
- It is consistent with the fact, at least in the US, that most corporations finance the majority of new investment using internal funds, and most external financing comes from debt
- The pecking order theory seems to work best with mature firms but does not apply to young firms with valuable growth opportunities

Thank You!

Thank you for listening.

For issues or questions come to my office hours.

Or send me an email at **ce50@st-andrews.ac.uk**