CHAPTER 17

# DOES DEBT POLICY MATTER?

## Topics Covered

17-2

- The Effect of Financial Leverage in a Competitive Tax-Free Environment
- Financial Risk and Expected Returns
- The Weighted Average Cost of Capital
- A Final Word on After Tax WACC

## M&M (Debt Policy Doesn't Matter)

17-3

- Modigliani & Miller
  - When there are no taxes and capital markets function well, it makes no difference whether the firm borrows or individual shareholders borrow. Therefore, the market value of a company does not depend on its capital structure.

## M&M (Debt Policy Doesn't Matter)

17-4

**Assumptions**

- By issuing 1 security rather than 2, company diminishes investor choice. This does not reduce value if:
  - Investors do not need choice, OR
  - There are sufficient alternative securities
- Capital structure does not affect cash flows, e.g...
  - No taxes
  - No bankruptcy costs
  - No effect on management incentives

## M&M (Debt Policy Doesn't Matter)

17-5

| Dollar Investment | Dollar Return |
|---|---|
| $.01V_U$ | $.01\times$ profits |

| | Dollar Investment | Dollar Return |
|---|---|---|
| Debt | $.01D_L$ | $.01\times$ interest |
| Equity | $.01E_L$ | $.01\times$ (profits - interest) |
| Total | $.01(D_L + E_L)$ $= .01V_L$ | $.01\times$ profits |

## M&M (Debt Policy Doesn't Matter)

17-6

| Dollar Investment | Dollar Return |
|---|---|
| $.01E_L$ $= .01(V_L - D_L)$ | $.01\times$ (profits - interest) |

| | Dollar Investment | Dollar Return |
|---|---|---|
| Borrowing | $-.01D_L$ | $-.01\times$ interest |
| Equity | $.01V_U$ | $.01\times$ profits |
| Total | $.01(V_U + D_L)$ | $.01\times$ (profits - interest) |

## M&M (Debt Policy Doesn't Matter)

17-7

***Example*** *- Macbeth Spot Removers - All Equity Financed*

Data

| | |
|---|---|
| Number of shares | 1,000 |
| Price per share | $10 |
| Market value of shares | $10,000 |

Outcomes

| | A | B | C | D |
|---|---|---|---|---|
| Operating income | $500 | 1,000 | 1,500 | 2,000 |
| Earnings per share | $.50 | 1.00 | 1.50 | 2.00 |
| Return on shares (%) | 5 % | 10 | 15 | 20 |

Expected outcome

## M&M (Debt Policy Doesn't Matter)

17-8

***Example***

*50% debt*

Data

| | |
|---|---|
| Number of shares | 500 |
| Price per share | $10 |
| Market value of shares | $ 5,000 |
| Market value of debt | $ 5,000 |

Outcomes

| | A | B | C | *D* |
|---|---|---|---|---|
| Operating income | $500 | 1,000 | 1,500 | 2,000 |
| Interest | $500 | 500 | 500 | 500 |
| Equity earnings | $0 | 500 | 1,000 | 1,500 |
| Earnings per share | $0 | 1 | 2 | 3 |
| ***Return on shares (%)*** | ***0%*** | ***10*** | ***20*** | ***30*** |

## M&M (Debt Policy Doesn't Matter)

17-9

***Example*** *- Macbeth's*

*- All equity financed*

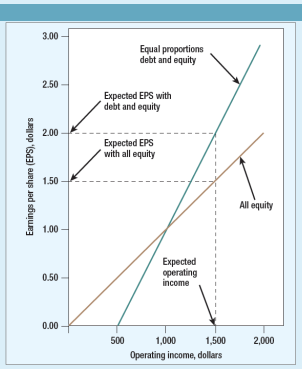
*- Debt replicated by investors*

Outcomes

| | A | B | C | D |
|---|---|---|---|---|
| Earnings on two shares | $1.00 | 2.00 | 3.00 | 4.00 |
| LESS : Interest @ 10% | $1.00 | 1.00 | 1.00 | 1.00 |
| Net earnings on investment | $ 0 | 1.00 | 2.00 | 3.00 |
| ***Return on $10 investment (%)*** | ***0%*** | ***10*** | ***20*** | ***30*** |

## Borrowing and EPS at Macbeth

17-10




## No Magic in Financial Leverage

17-11

**MM's Proposition I**

If capital markets are doing their job, firms cannot increase value by tinkering with capital structure.

*V* is independent of the debt ratio.

**An Everyday Analogy**

It should cost no more to assemble a chicken than to buy one whole

## Proposition I and Macbeth

17-12

***Example*** *- Macbeth continued*

| | Current Structure : All Equity | Proposed Structure : Equal Debt and Equity |
|---|---|---|
| Expected earnings per share ($) | 1.50 | 2.00 |
| Price per share ($) | 10 | 10 |
| Expected return per share (%) | 15 | 20 |

## Leverage and Returns

17-13

$$\text{Expected return on assets} = r_A = \frac{\text{expected operating income}}{\text{market value of all securities}}$$

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

## M&M Proposition II

17-14

***Example* - Macbeth continued**

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

$$r_E = r_A = \frac{\text{expected operating income}}{\text{market value of all securities}}$$
$$= \frac{1500}{10{,}000} = .15$$

## M&M Proposition II

17-15

***Example* - Macbeth continued**

$$r_E = r_A = \frac{\text{expected operating income}}{\text{market value of all securities}}$$
$$= \frac{1500}{10{,}000} = .15$$

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

$$r_E = .15 + (.15 - .10)\frac{5000}{5000}$$
$$= .20 \text{ or } 20\%$$

## Leverage and Risk

17-16

***Example*** *- Macbeth continued*

Leverage increases the risk of Macbeth shares

| | | Operating $1,500 to | Income $500 | Change |
|---|---|---|---|---|
| All equity | Earnings per share ($) | 1.50 | 0.50 | -$1.00 |
| | Return on shares | 15% | 5% | -10% |
| 50 % debt : | Earnings per share ($) | 2 | 0 | -$2.00 |
| | Return on shares | 20% | 0 | -20% |

## Leverage and Returns

17-17

***Example*** *- Market Value Balance Sheet*

| | | | |
|---|---|---|---|
| Asset value | 100 | Debt (*D*) | 30 |
| | | Equity (*E*) | 70 |
| Asset value | 100 | Firm value (*V*) | 100 |

$r_d$ = 7.5%

$r_e$ = 15%

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

$$r_A = \left(.075 \times \frac{30}{100}\right) + \left(.15 \times \frac{70}{100}\right) = 12.75\%$$

## Leverage and Returns

17-18

***Example*** *- Market Value Balance Sheet*

What happens to $R_e$ when debt costs rise?

| | | | |
|---|---|---|---|
| Asset value | 100 | Debt (*D*) | 40 |
| | | Equity (*E*) | 60 |
| Asset value | 100 | Firm value (*V*) | 100 |

$r_d$ = 7.5% changes to 7.875%

$r_e$ = ??

$$.1275 = \left(.07875 \times \frac{40}{100}\right) + \left(r_e \times \frac{60}{100}\right)$$

$$r_e = 16.0\%$$

## Leverage and Returns

17-19

$$B_A = \left(B_D \times \frac{D}{V}\right) + \left(B_E \times \frac{E}{V}\right)$$

$$B_E = B_A + \frac{D}{V}(B_A - B_D)$$

## WACC

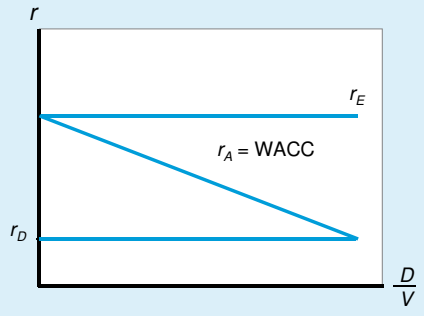
17-20

WACC is the traditional view of capital structure, risk and return.

$$\text{WACC} = r_A = \left(r_D \times \frac{D}{V}\right) + \left(r_E \times \frac{E}{V}\right)$$

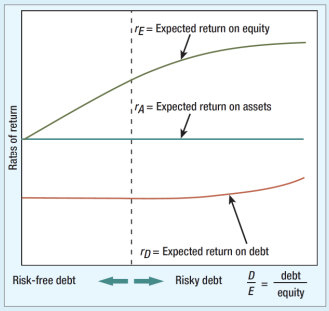
## WACC

17-21



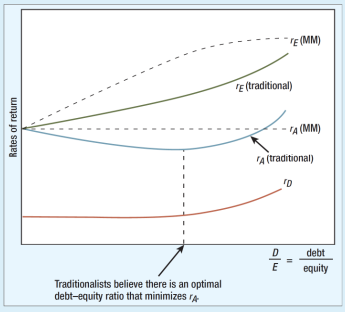
## M&M Proposition II

17-22




## WACC (traditional view)

17-23




## After-Tax WACC

17-24

- The tax benefit from interest expense deductibility must be included in the cost of funds
- This tax benefit reduces the effective cost of debt by a factor of the marginal tax rate

$$\text{WACC} = \left(r_D \times \frac{D}{V}\right) + \left(r_E \times \frac{E}{V}\right)$$

Old Formula

## After-Tax WACC

17-25

Tax-Adjusted Formula

$$\text{WACC} = r_D \times (1 - Tc) \times \left(\frac{D}{V}\right) + \left(r_E \times \frac{E}{V}\right)$$

## After-Tax WACC

17-26

***Example*** - *Union Pacific*

*The firm has a marginal tax rate of 35%. The cost of equity is 9.8% and the pretax cost of debt is 4.2%. Given the book and market value balance sheets, what is the tax-adjusted WACC?*

## After-Tax WACC

17-27

***Example*** - *Union Pacific*

Debt ratio = (*D*/*V*) = 9.4%

Equity ratio = (*E*/*V*) = 90.6%

$$\text{WACC} = r_D \times (1 - Tc) \times \left(\frac{D}{V}\right) + \left(r_E \times \frac{E}{V}\right)$$

## After-Tax WACC

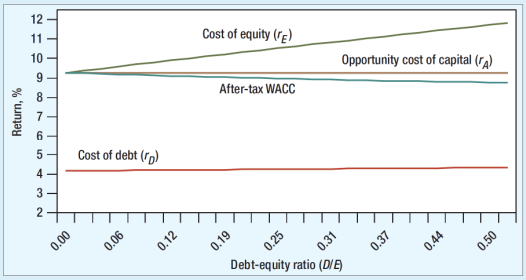
17-28

***Example*** *- Union Pacific*

$$\begin{aligned}\text{WACC} &= 4.2\times(1-.35)\times.094\times9.8+.906\\ &= 9.1\%\end{aligned}$$

## Union Pacific WACC

17-29




## After-Tax WACC

17-30

***Example*** *- Kate's Cafe*

*Kate's Café has a marginal tax rate of 35%. The cost of equity is 10.0% and the pretax cost of debt is 5.5%. Given the book and market value balance sheets, what is the tax adjusted WACC?*

## After-Tax WACC

17-31

***Example*** - *Kate's Cafe*

| *Balance Sheet (Market Value, billions)* | | | |
|---|---|---|---|
| Assets | 22.6 | 7.6 | Debt |
| | | 15 | Equity |
| Total assets | 22.6 | 22.6 | Total liabilities |

**MARKET VALUES**

## After-Tax WACC

17-32

***Example*** - *Kate's Cafe*

Debt ratio = ($D/V$) = 7.6/22.6= .34 or 34%

Equity ratio = ($E/V$) = 15/22.6 = .66 or 66%

$$\text{WACC} = r_D \times (1 - Tc) \times \left(\frac{D}{V}\right) + \left(r_E \times \frac{E}{V}\right)$$

## After-Tax WACC

17-33

***Example*** - *Kate's Cafe*

$$\text{WACC} = r_D \times (1 - Tc) \times \left(\frac{D}{V}\right) + \left(r_E \times \frac{E}{V}\right)$$

$$\begin{aligned}\text{WACC} &= .055 \times (1 - .35)(.34) + .10(.66) \\ &= .078 \\ &= 7.8\%\end{aligned}$$