

## CAPITAL STRUCTURE [Chapter 15 and Chapter 16]

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### I. Introduction

Capital Structure Policy involves a trade-off between risk and return

- 1) Using more debt raises the riskiness of the firm's earnings stream.
- 2) However, a higher debt ration generally leads to a higher expected rate of return.
- II Higher risk tends to lower a stock price, but a higher expected return raises it.
- II Therefore the optimal capital structure strikes a balance between risk and return so as to maximize a firm's stock price.

<sup>TM</sup> We focus on impact of capital structure changes on the:

- 1) value of the firm
- 2) value of existing bonds

- MISCELLANEOUS : IN THIS SECTION, S=E AND D=B AND USED INTERCHANGABLY.

## II. Capital Structure & Firm Value WITHOUT Taxes

### A. Modigliani and Miller Proposition I [*without taxes*]

<sup>TM</sup> The value of the firm is unaffected by its choice of capital structure under perfect capital markets.

Note: **Perfect capital markets** - no taxes, no transaction costs, no bankruptcy costs, investors can borrow and lend at same rate as firms, free access to all information, etc.

#### 1. Arbitrage proof

- Assume two firms have identical assets that produce the same stream of operating profit and differ only in their capital structure.

Firm U is unlevered (i.e., no debt):  $V_U = E_U$

Firm L is levered (debt) :  $V_L = E_L + D_L$

Inv. Strategy #1		Inv. Strategy #2	
II Buy 10% of $E_L$		II Buy 10% of $E_U$ & Borrow 10% of $D_L$	
\$ Inv.	\$ Return	\$ Inv.	\$ Return
0.1 $E_L$	0.1(profit-interest)	0.1 $E_U$	0.1(profit)
		-0.1 $D_L$	-0.1(interest)
Total	0.1( $V_L - D_L$ )	0.1( $V_U - D_L$ )	0.1(profit-interest)

#### 2) Proof also works if two strategies are:

- 1] Purchase 10% of unlevered firm's equity
- 2] Purchase 10% of levered firm's equity & lend 10% of  $D_L$  (or buy 10% of levered firm's debt)

B. Modigliani and Miller Proposition II [*without taxes*]

- <sup>TM</sup> The expected rate of return on the common stock of a levered firm increases in proportion to the debt equity ratio.  
[The expected r.of.r on stock = the cost of equity = the required return on equity]
- <sup>TM</sup> Even though leverage does not affect firm value, it does affect risk and return of equity.
- <sup>TM</sup> In other words, the firm's overall cost of capital cannot be reduced as debt is substitute for equity, even though debt appears to be cheaper than equity. The reason for this is that, as firm adds debt, the remaining equity becomes more risky. As this risk rises, the cost of equity rises as a result [why?, you knew this already]. The increase in the cost of remaining equity offsets the higher proportion of the firm financed by low-cost debt. In fact, MM prove that the two effects exactly offset each other so that both the value of the firm and the firm's overall cost of capital are invariant to leverage.

B. Modigliani and Miller Proposition II [*without taxes*] --- Continued

## 1. Leverage and required return (SML)

$$r_S = r_f + (r_M - r_f) \beta_S$$

Substitute:

$$(1) \beta_S = \beta_A + \left(\frac{B}{S}\right) [\beta_A - \beta_B]$$

$$(2) r_A = r_f + (r_M - r_f) \beta_A$$

$$(3) r_B = r_f + (r_M - r_f) \beta_B$$

Simplify:

$$r_S = r_A + \left(\frac{B}{S}\right) [r_A - r_B]$$

Proof (for the curious only):

$$r_S = r_f + (r_M - r_f) \beta_S$$

$$\Pi \text{ substituting } \beta_S = \beta_A + \left(\frac{B}{S}\right) [\beta_A - \beta_B]$$

$$= r_f + (r_M - r_f) \left[ \beta_A + \left(\frac{B}{S}\right) [\beta_A - \beta_B] \right]$$

$\Pi$  using distributive property

$$= [r_f + (r_M - r_f) \beta_A] + \left(\frac{B}{S}\right) [(r_M - r_f) \beta_A - (r_M - r_f) \beta_B]$$

$\Pi$  substitute  $r_A = r_f + (r_M - r_f) \beta_A$ ; add and subtract  $r_f$

$$= r_A + \left(\frac{B}{S}\right) [(r_f + (r_M - r_f) \beta_A) - (r_f + (r_M - r_f) \beta_B)]$$

$\Pi$  substitute:  $r_A = r_f + (r_M - r_f) \beta_A$  and  $r_B = r_f + (r_M - r_f) \beta_B$

$$= r_A + \left(\frac{B}{S}\right) [r_A - r_B]$$

<sup>TM</sup> As debt (B) increases, required return on equity (S) increases

- The expected return on a portfolio is equal to a weighted average of the expected returns on the individual holdings. Therefore the expected return on a portfolio consisting of debt and equity is

$$r_A = \left( \frac{B}{B+S} \cdot r_D \right) + \left( \frac{S}{B+S} \cdot r_S \right)$$

From this equation, we can obtain the same relationship.

$$r_S = r_A + \left( \frac{B}{S} \right) [r_A - r_D]$$

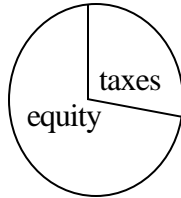
### ⓪ M&M Proposition II Without Corporate Taxes

- The company cost of capital is a weighted average of the expected returns on the debt and equity.
- The company cost of capital = expected return on assets.
- We know that changing the capital structure does *not* change the company cost of capital. [ but the changing the capital structure does change the required rate of return on individual securities ]
- As the leverage increases, the risk of debt increases.  
Thus, debtholders require a higher return on debt.  
™ Explain the expected return on debt.  
¶ Here the firm's bonds are assumed to be risk free at lower level of debt.
- The expected return on equity increases linearly as debt equity ratio increases.  
™ Explain the expected return on equity

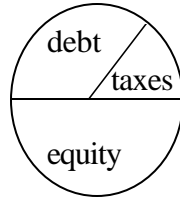
### III. Capital Structure & Firm Value WITH Corporate Taxes

#### A. BASIC IDEA

The basic intuition can be seen from pie charts below.



Unlevered



Levered

- Assuming the two pies should be the same size, the value is maximized for the capital structure paying the least in taxes.
- We will show that, due to tax system, the proportion of the pie allocated to taxes is less for the levered firm than it is for the unlevered firm.

™ Thus, managers should choose ?

B. M&M PROPOSITION I (WITH CORPORATE TAXES)

1. After-tax CF of firms (Assume perpetuity equal to EBIT)

a. Pure equity firm [**i.e., Unlevered**]

$$\begin{aligned} \text{ATCF} &= \text{CF to S/H} \\ &= \text{EBIT}(1-T_c) \end{aligned}$$

b. Firm with debt and equity in capital structure [**i.e., Levered**]

$$\begin{aligned} \text{ATCF} &= \text{CF paid to S/H} + \text{CF paid to B/H} \\ &= \text{EBIT}(1-T_c) + r_B \text{BT}_c \end{aligned}$$

- Note: As long as the firm expects to be in a positive tax bracket, we can assume that  $r_B \text{BT}_c$  has the same risk as the interest on debt. Thus, its value can be determined by discounting at  $r_B$ . Assuming that CF are perpetual, the present value of the tax shield is  $\text{BT}_c$

2. After-tax value of firms

$$V_U = \frac{\text{EBIT} (1 - T_c)}{r_u}$$

where  $r_U$  = after-tax risk adjusted discount rate for all equity firm

$$V_L = \frac{\text{EBIT} (1 - T_c)}{r_u} + \text{BT}_c = V_U + \text{BT}_c$$

**Ô M&M Proposition I With Corporate Taxes**

• EXAMPLE

The UH company is evaluating two financing plans under the following conditions.

- The expected EBIT is \$1 Million.
- The cost of debt is 10% for both plans
- The corporate tax rate,  $T_c$  is 34%.
- Unlevered firms in the same industry have a cost of capital of 20%

Question )

- What is the difference of total CFs under two financing plans? [\$ 136,000]
- Where does this difference come from?
- What is the value of the firm under each of the financing plan?

C. M&M PROPOSITION II (WITH CORPORATE TAXES)

- M&M Proposition II under no taxes posits a positive relationship between the expected return on equity and leverage. This result occurs because the risk of equity increases with leverage. The same intuition also holds in a world of corporate taxes. The exact formula is

$$r_S = r_A + \left(\frac{B}{S}\right) [r_A - r_D] [1 - T_c]$$

**⓪ M&M Proposition II With Corporate Taxes**

• THE DERIVATION OF MM II WITH CORPORATE TAXES. [OPTIONAL]

Given MM Proposition I under taxes, a levered firm's market value of balance sheet can be seen as

$V_U =$ Value of Unlevered Firm	$B =$ Debt
$T_c B =$ Tax Shield	$S =$ Equity

The value of the unlevered firm is simply the value of the assets without benefit of leverage. The balance sheet indicates that the firm's value increases by  $T_c B$  when debt is added.

The expected cash flow from left hand side of balance sheet can be seen as

$$V_U r_A + T_c B r_B$$

The expected cash flow to Stockholders and Bondholders can be seen as

$$S r_S + B r_B$$

The equation above reflects the fact that stock earns an expected return  $r_S$  and debt earns the interest rate  $r_B$

Because all CFs are paid out as dividends in our no growth perpetuity model, the CFs *going into the firm* are equal to those *going to stockholders and bondholders*.

By equating two equations above, we obtain

$$r_S = r_A + \left(\frac{B}{S}\right) [r_A - r_D] [1 - T_c]$$



## IV. Personal Taxes

Key <sup>TM</sup> So far, we have considered corporate taxes only.  
 What if we include the personal taxes?

### A. MILLER'S MODEL

$$V_L = V_U + \left( 1 - \frac{(1 - T_C)(1 - T_S)}{(1 - T_B)} \right) B$$

where:

$T_C$  = Corporate tax rate

$T_S$  = Personal tax rate on equity income

$T_B$  = Personal tax rate on regular income (including interest)

Proof

$$\text{CF to S/H} = (\text{EBIT} - r_B B)(1 - T_C)(1 - T_S)$$

$$\text{CF to B/H} = r_B B(1 - T_B)$$

$$\begin{aligned} \text{II CF to S/H and B/H} &= (\text{EBIT} - r_B B)(1 - T_C)(1 - T_S) + r_B B(1 - T_B) \\ &= \text{EBIT} (1 - T_C)(1 - T_S) + r_B B(1 - T_B) \left( 1 - \frac{(1 - T_C)(1 - T_S)}{(1 - T_B)} \right) \end{aligned}$$

$$\text{Since } V_U = \left( \frac{\text{CF}_A (1 - T_C)(1 - T_S)}{r_U (\text{AT})} \right)$$

$$\text{and } B = \frac{r_B B(1 - T_B)}{r_B (\text{AT})}$$

$$\text{TM } V_L = V_U + \left( 1 - \frac{(1 - T_C)(1 - T_S)}{(1 - T_B)} \right) B$$

$$V_L = V_U + \left( 1 - \frac{(1 - T_C)(1 - T_S)}{(1 - T_B)} \right) B$$

**Cases 1.  $T_S = T_B$**   
<sup>TM</sup>  $V_L = ?$

<sup>TM</sup> Hence, the introduction of personal taxes does not affect our valuation formula as long as the equity income are taxed identically to interest at the personal level.

**Case 2.  $(1 - T_C)(1 - T_S) = 1 - T_B$**

<sup>TM</sup>  $V_L = ?$

<sup>TM</sup> Hence, there is no gain from leverage at all. In other words, the value of the levered firm is equal to the value of the unlevered firm.

<sup>TM</sup> This lack of gain occurs because the lower corporate taxes for a levered firm are exactly offset by higher personal taxes.

**Case 3.  $(1 - T_C)(1 - T_S) > 1 - T_B$**

<sup>TM</sup>  $V_L = ?$

<sup>TM</sup> In this case,  $V_L < V_U$ . This happens because the personal tax rate on interest is much higher than the personal tax rate on equity income. In other words, the reduction in corporate taxes from leverage is more than offset by the increase in taxes from leverage at the personal level.

<sup>TM</sup> Ex)  $T_B = 50\%$ ,  $T_S = 18\%$ ,  $T_c = 34\%$

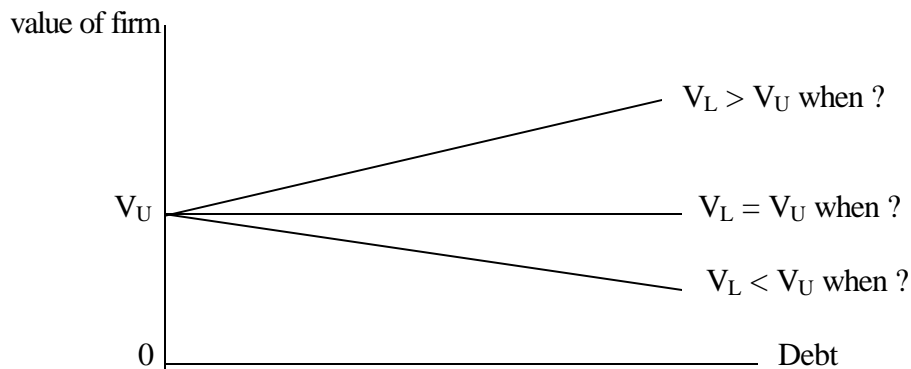
Reasons that taxes on equity income might be less than debt income [ $T_S < T_B$ ]

- 1) The personal tax rules favored equity because the low tax rate on capital gains.
- 2) The taxes on the capital gains can be deferred until shares are sold.

**Case 4.  $(1 - T_C)(1 - T_S) < 1 - T_B$**

<sup>TM</sup>  $V_L = ?$

<sup>TM</sup> In this case,  $V_L > V_U$ .



## V. Costs of Financial Distress

Key <sup>TM</sup> Financial distress occurs when promises to creditors are broken or honored with difficulty.

Result <sup>TM</sup> Investors know that levered firms may fall into financial distress, and they worry about it.

II That worry is reflected in the current market value of the levered firm's security.

Thus, the value of the firm can be broken down into three parts.

$\text{Value of the firm} = \text{Value if unlevered} + \text{PV (tax shield)} - \text{PV (costs of financial distress)}$
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The firm's debt-equity decision can be thought as a trade-off between interest tax shields and the cost of financial distress.

### A. Direct Costs of Financial Distress

<sup>TM</sup> Legal and administrative costs.

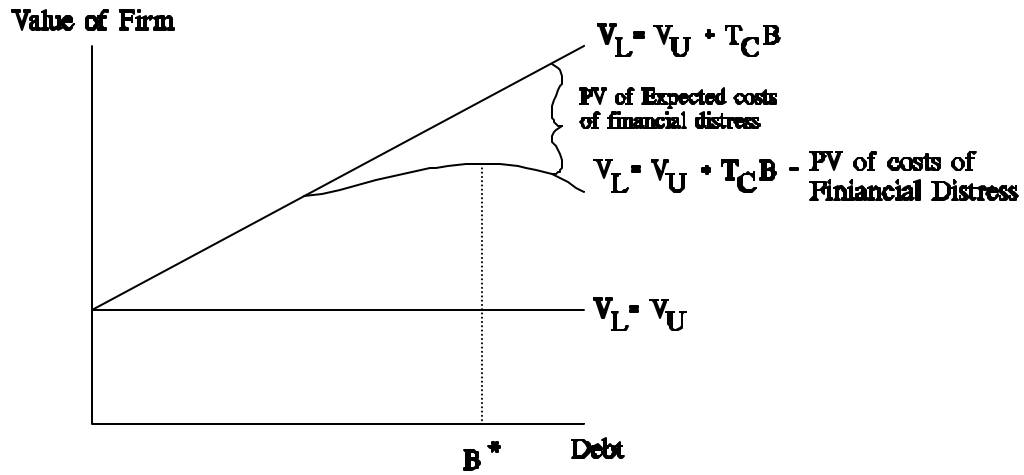
1. Bankruptcy - legal mechanism by which creditors take control of firm
2. Bankruptcy costs - costs stemming from bankruptcy proceedings
3. Impact on firm value  
<sup>TM</sup> Since bankruptcy eats up the asset value, it has negative impact on firm value.

### B. Indirect Costs of Financial Distress

1. Impaired ability to run business  
<sup>TM</sup> Bankruptcy hampers conduct with customers and suppliers. Sales are frequently lost because of both fear of impaired service and loss of trust.
2. Costs from S/H - B/H Conflict
  - a. Examples of conflict: risk shifting, underinvestment in positive NPV projects, dividends, increasing debt  
[EXAMPLE : Underinvestment in positive NPV projects]  
If there is a significant probability of bankruptcy, the stock holders will not invest in positive projects if the increase in value cannot prevent bankruptcy.
  - b. Response of bondholders: covenants, monitoring, convertible debt, higher interest rates

C. Costs of Financial Distress & Firm Value

Key <sup>TM</sup> As increase debt, chance of financial distress increases  $\Pi$  value of firm falls



## VI. Other Theories of & Issues in Capital Structure Theory

### A. Pecking Order Theory

1. Basic Idea : Asymmetric information affects the choice between internal and external financing and between new issues of debt and equity financing.  
™ This leads to a pecking order.
2. Investment is financed with a certain order.  
Internal funds. New issues of debt. New issues of equity.
3. Implications of Pecking Order [Read the contents on page 419]

## VII. Empirical Evidence on Capital Structure

™ No exact formula is available for evaluating the optimal debt-equity [i.e., leverage] ratio. Thus, we need to turn to evidence from the real world.

1. Most firms have low debt-equity ratio
  - ∏ It is clear that firms do not issue debt up to the point that tax shields are used up.  
There must be limits to the amount of debt firms can issue.
2. Most indentures include restrictive covenants and provisions for monitoring
  - ∏ Increasing debt to use the proceeds as a dividend is not possible.
3. Increases or decreases in financial leverage have an effect on stock returns.
4. There are differences in the capital structures of different industries.
  - ∏ Firms that have high proportions of intangible assets and growth opportunities tend to use less debt.
5. Firms with less-certain operating income will have a greater chance of experiencing financial distress and will issue less debt. [counter example : utility firms.]
6. The costs of financial distress depend on the types of assets that the firm has.
  - ∏ [firm with large investment in fixed assets VS. firm with large investment in R&D]

## VIII. Questions Assigned

Chapter 15 : Q1 – Q5 and Q14 – Q21

Chapter 16 : Q1 – Q6 , Q11 – Q14 and Q16 – Q17