Chapter 14: Capital Structure in a Perfect Market

I. Overview

1. Capital structure: **mix of debt and equity issued by the firm to fund its assets**

   Note: usually use leverage ratios like debt/assets to measure the mix of debt and equity in a firm's capital structure

2. Basic question: Can a firm make stockholders better (or worse) off by changing its capital structure?

3. Perfect capital markets

   1) all securities are fairly priced
   2) there are no taxes or transaction costs
   3) the total cash flows generated by the firm's project is unaffected by how the firm raises the money to invest in the projects

4. Basic ideas: In perfect capital markets:

   1) capital structure has no impact on the firm's:

      - **total value**
      - **stock price**
      - **weighted average cost of capital**

   2) when leverage increases:

      a) **equity cost of capital rises**
      b) **expected return on equity rises**
      c) **a) and b) exactly offset**

5. Reason study a model with such unrealistic assumptions

   => starting point

   Ch 15: how do taxes change our conclusions?
   Ch 16: how do bankruptcy, conflicts of interest, and access to information change our conclusions?

II. Modigliani–Miller I: Leverage and Firm Value

A. Law of One Price

1) the total cash paid to a firm's investors (debt and equity) equals the total cash generated by the firm's assets
2) by the Law of One Price, the firm's debt and equity must have same value as the firm's assets
3) by assumption, capital structure has no impact on the total cash flow generated by firm's assets

=> **combining 2) and 3), a change in capital structure has no impact on the combined value of the firm's stock and bonds**

Note: **capital structure decisions only affect who gets the firm's cash flows**

B. Homemade Leverage

Basic idea: **investors can duplicate the impact of any capital structure on their own**

1. Creating an unlevered position in a firm with debt:

=> **when the firm has debt and equity, it has split its cash flows into two pieces**
=> **an investor can recombine the cash flows by purchasing both the firm's debt and its equity**
=> *just as if the firm never split them up*

2. Creating a levered position in a firm with no debt

Note: in a perfect market, investors can borrow at the same rate as firms

=> **an investor can split an unlevered firm's cash flow into two pieces through personal borrowing**
=> **the investor is left with exactly the same cash flows as if the firm had done the same amount of borrowing**
=> *it doesn't matter if the firm or the investor does the borrowing*

Ex. Assume a firm has assets with a market value of $2500 will generate a cash flow of either $100 or $150 per year.

1. Creating an unlevered position in the firm

   a. Assume the firm is 100% equity financed

      => firm's stock is worth $2500
      => cash flow paid out to stockholders = $100 or $150 per year
      Q: How create an unlevered investment in the firm's assets?
      => **buy the firm's equity**

      => amount of own money must invest: $**2500**
      => net annual cash flow to investor: $**100 or $150**

   b. Assume the firm has issued bonds worth $1000 at a 4% interest rate

      => firm's stock is worth $1500 = 2500 – 1000
      => annual interest paid by the firm = $40
      => cash flow paid out to stockholders = $60 = 100 – 40 or $110 = 150 – 40
      Q: How create an unlevered investment in the firm's assets?
      => **buy the firm's bonds and the firm's stock**

      => amount of own money must invest: **$2500** = **1000 + 1500**
      => net annual cash flow to investor: **$100 = 40 + 60 or $150 = 40 + 110**

   Note: **investment and possible cash flows are the same**

      => **investors wanting an unlevered position in the firm will be indifferent to whether or not the firm has debt**

2. Creating a levered position in the firm

   a. Assume the firm has issued bonds worth $1000 at a 4% interest rate

      => firm's stock is worth $1500 = 2500 – 1000
      => annual interest paid by the firm = $40
      => cash flow paid out to stockholders = $60 = 100 – 40 or $110 = 150 – 40

Q: How create a levered investment in the firm's assets?
=> **buy the firm's stock**

=> amount of own money must invest: **$1500**
=> net annual cash flow to investor: **$60 or $110**

b. Assume the firm is 100% equity financed

=> firm's stock is worth $2500
=> cash flow paid out to stockholders = $100 or $150 per year
Q: How create a levered investment in the firm's assets?
=> **borrow $1000 myself at 4% and buy the firm's equity for $2500**

=> amount of own money must invest: $**1500 = 2500 - 1000**
=> net annual cash flow to investor: **$60 = 100 – 40 or $110 = 150 – 40**

Note: **investment and possible cash flows are the same**

=> **investors wanting a levered position in the firm will be indifferent to whether or not the firm has debt**

C. Overall conclusion: **investors are indifferent to capital structure**

II. Modigliani-Miller II: Leverage and Risk

A. Intuition

1. Leverage, risk, and the cost of equity capital

When a firm has more leverage in its capital structure:

=> cost of capital for equity rises

=> **the firm promises more of its first, least risky cash flows to bondholders**
=> **stockholders left with increasingly risky cash flows**

2. Leverage and expected return

=> stockholder expected returns rise with leverage

=> **the firm will be able to borrow at a rate that is less than expected return on their investments**
=> reason: bondholders promised the first, safest cash that the firm earns
=> **the firm earns a spread on every dollar it borrows and invests**
=> reason: firm will be able to borrow at a lower rate than it will expect to earn

B. Math

Note: to prove the increase in E(R) and r offset, must use math

Note: See Chapter 14 supplement for development of the math

Let:

E = market value of the firm's outstanding equity
D = market value of the firm's outstanding debt
β_E = beta of firm's levered equity
β_D = beta of firm's debt
β_U = beta of firm's unlevered equity (if it has no debt) = beta of firm's assets = β_A
r_E = cost of capital for firm's levered equity
r_D = cost of capital for firm's debt
r_U = cost of capital for firm's unlevered equity = cost of capital for firm's assets = r_A

1. Leverage, risk, and the cost of equity capital

$$\beta_E = \beta_U + \frac{D}{E}(\beta_U - \beta_D) \qquad (14.10)$$

$$r_E = r_U + \frac{D}{E}(r_U - r_D) \qquad (14.5)$$

=> **as leverage increases, D rises and E falls**

=> $\boldsymbol{\frac{D}{E}}$ **rises**

Note: $\beta_D < \beta_U$ and $r_d < r_U$

Reason: debt holders get the assets' first, least risky cash flows

=> impact on β_E and r_E as leverage increases: **both rise**

2. Leverage and expected return

$$E(R_E) = E(R_U) + \left(\frac{D}{E}\right)(E(R_U) - E(R_D)) \quad (14.A)$$

=> as leverage increases, $\frac{D}{E}$ rises
=> in equilibrium, $E(R_D) < E(R_U)$

=> impact on $E(R_E)$ as leverage increases: **rises**

3. Leverage, expected return, and cost of capital

Key: **leverage impacts equity's expected return and equity's cost of capital in exactly the same way**

=> **leverage does not make stockholders better or worse off**

C. Weighted Average Cost of Capital

1. All equity firms

=> all free cash flows are paid to the firm's stockholders
=> the risk of a firm's equity equals the risk of the firm's assets

$$\Rightarrow r_U = r_A \quad (14.6)$$

2. Firms with debt and equity in their capital structure

Let: r_{WACC} = firm's weighted average cost of capital

$$r_{WACC} = \left(\frac{E}{D+E}\right) r_E + \left(\frac{D}{D+E}\right) r_D = r_U = r_A \quad (14.7) \text{ and } (14.8)$$

Key: In perfect markets, the firm's weighted average cost of capital does not change as the firm changes its capital structure

Example: Assume a firm's assets have a beta of 1.2, that the risk-free rate is 4% and that the market risk premium is 5%. 1) What is the firm's cost of capital if it is funded with $1100 of equity? 2) What is the firm's weighted average cost of capital if it is funded with $300 of risk-free debt and $800 of equity?

1) $\boldsymbol{r_A}$ = .10 = **.04 + 1.2(.05) = $\boldsymbol{r_U}$**
Note: this is the cost of capital for the firm's assets and unlevered equity
2) $\boldsymbol{\beta_E} = 1.2 + \left(\frac{300}{800}\right)(1.2 - 0) = 1.65$: ***Equation 14.10 (p. 5)***

Note: this is the beta of levered equity

r_E = .1225= **.04 + 1.65(.05)**

Note: this is the cost of capital for levered equity in Eq. 12.4

$r_{WACC} = \left(\frac{800}{1100}\right).1225 + \left(\frac{300}{1100}\right).04 = (.73).1225 + (.27).04 = .1 = r_U = r_A$

Note: if firm holds cash and risk-free securities, use firm's net debt for "D"
Net debt = debt - cash and risk-free securities held by the firm

3. Using the weighted average cost of capital

Main use => estimating the cost of capital for a project

1) project has the same risk as the firm's existing assets

=> **use firm's weighted average cost of capital as discount rate on the project**

2) project's risk differs from the firm's existing assets

=> **use weighted average cost of capital of firms with the same risk as the project**

III. Implications of Modigliani and Miller beyond Capital Structure

Key => **with perfect capital markets, financial transactions neither add nor destroy value, but simply repackage risk and return**

=> if financial transaction appears to create value:

a) **exploiting some market imperfection**
b) **too good to be true**

=> **to tell the difference, make sure understand source of market imperfection**