Chapter 14: Capital Structure in a Perfect Market

Fundamental Question: What is the best mix of debt and equity to fund a firm if markets are perfect?

Basic idea: With perfect capital markets, the choice of debt or equity financing will not affect the total value of a firm, its share price, or its cost of capital. As a result, firms and their stockholders are indifferent to choice of financing.

14.1 Equity Versus Debt Financing

Capital structure: relative proportions of a firm’s outstanding debt, equity, and other securities.

Leverage: degree to which firm uses debt to fund its assets.

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- Gross and operating profit: Note: focus is not really capital structure, but next video builds on it
- Basic capital structure differences

A. Financing a Firm with Equity

B. Financing a Firm with Debt and Equity

Key: firm’s total cash flows still equal the cash flows of the project (which issuing debt has not changed)

=> value of project and value of firm unchanged as issue debt to fund project

C. The Effect of Leverage on Risk and Return

Important: the increased risk stockholders face when firms issue debt occurs even when there is no risk of default

Concept Check: all

14.2 Modigliani-Miller I: Leverage, Arbitrage, and Firm Value

Key idea: leverage (use of debt as well as equity to finance firm) affects who gets the firm’s cash flows but not the cash flows themselves.
Perfect markets:

1) Investors and firms can trade the same set of securities at competitive market prices equal to the present value of their future cash flows.

2) There are no taxes, transaction costs, or issuance costs associated with security trading.

3) A firm’s financing decisions do not change the cash flows generated by its investments, nor do they reveal new information about them.

MM Proposition I: 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.

A. MM and the 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.

=> 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.

Note: The value of a levered firm differing from an otherwise equivalent unlevered firm creates an arbitrage opportunity.

See example 14.2

B. Homemade Leverage

Basic idea: investors are indifferent to firm’s capital structure since they can duplicate or undo any changes in capital structure on their own.

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

   => when the firm has issued 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 regardless of whether the firm is levered or unlevered

=> 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 can an investor 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 can an investor create a levered investment in the firm’s assets?
=> borrow $1000 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. The Market Value Balance Sheet

\[ MVE = MVA - MVL \] (14.1)

where:

\[ MVE = \text{market value of equity} \]
\[ MVA = \text{market value of assets} \]
\[ MVL = \text{market value of debt and other liabilities} \]
D. Application: A Leveraged Recapitalization

Note: Idea also applies to a firm issuing equity to retire debt.

Concept Check: 1, 3

14.3 Modigliani-Miller II: Leverage, Risk and the Cost of Capital

A. Leverage and the Equity Cost of Capital

1. Leverage and the Equity Cost of Capital

\[ E + D = U = A \]  

(14.2)

where:

- \( E \) = market value of levered equity
- \( D \) = market value of debt
- \( U \) = market value of equity if firm unlevered
- \( A \) = market value of firm’s assets

\[
\left( \frac{E}{E+D} \right) R_E + \left( \frac{D}{E+D} \right) R_D = R_U
\]

(14.3)

where:

- \( R_E \) = returns on levered equity
- \( R_D \) = returns on debt
- \( R_U \) = returns on unlevered equity

\( \Rightarrow \) if hold all the firm’s stock and bonds, earn same return as if owned equity of firm and it had no debt
\( \Rightarrow \) return on portfolio also equals \( R_A \): the return on the firm’s assets

\[
R_E = R_U + \frac{D}{E} (R_U - R_D)
\]

(14.4)

\( \Rightarrow \) when firm has leverage, return on equity becomes riskier:

1) if \( R_U > R_D \), then \( R_E > R_U \)
2) if \( R_U < R_D \), then \( R_E < R_U \)
\[ r_E = r_U + \frac{D}{E} (r_U - r_D) \]  

(14.5)

MM Proposition II: The cost of capital of levered equity increases with the firm’s market value debt-equity ratio.

Math: Since \( r_D < r_U \), \( r_E \) rises as leverage rises

Reason \( r_D < r_U \): bondholders get the first and safest cash flow the firm produces

=> debt issued against a firm’s assets is less risky than the assets themselves

Intuition: as leverage rises, the firm promises more of its first, least risky cash flows to bondholders

=> stockholders left with increasingly risky cash flows

=> stockholders will demand a higher return to compensate them for the risk

2. Leverage and Expected Return on Equity

Note: We can look at the effect of leverage on expected return by taking the expected value of equation (14.4)

\[ E(R_E) = E(R_U) + \frac{D}{E} \left( E(R_U) - E(R_D) \right) \]  

(14.A)

a. Math:

=> as leverage increases, \( \frac{D}{E} \) rises

=> in equilibrium, \( E(R_D) < E(R_U) \)

=> \( E(R_E) \) rises as leverage increases

b. Intuition:

=> 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
3. Leverage, expected return, and cost of capital

Key: if compare (14.5) and (14.A), we see that 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
=> stockholder’s expected and required return move in lock-step as leverage changes

B. Capital Budgeting and the Weighted Average Cost of Capital

\[ r_U = \left( \frac{E}{E+D} \right) r_E + \left( \frac{D}{E+D} \right) r_D \]  \hspace{1cm} (14.6)

\[ r_{wacc} = r_U = r_A \] \hspace{1cm} (14.7)

=> with perfect capital markets, a firm’s WACC is unaffected by its capital structure and equals its unlevered equity cost of capital, which matches the cost of capital of its assets

Note: the unlevered equity cost of capital equals the cost of capital for the firm’s assets since all free cash flows are paid to the firm’s stockholders

C. Computing the WACC with Multiple Securities

D. Levered and Unlevered Betas

\[ \beta_U = \left( \frac{E}{E+D} \right) \beta_E + \left( \frac{D}{E+D} \right) \beta_D \] \hspace{1cm} (14.8)

where:

\( \beta_U \) = firm’s unlevered or asset beta
\( \beta_E \) = firm’s levered equity beta
\( \beta_D \) = firm’s debt beta

=> the beta of a portfolio of the firm’s securities equals the beta of the firm’s assets

=> security holders have a claim to all of the firm’s cash flows

\[ \beta_E = \beta_U + \frac{D}{E} (\beta_U - \beta_D) \] \hspace{1cm} (14.9)

Math: Since \( \beta_D < \beta_U \), \( \beta_E \) rises as leverage rises

Reason \( \beta_D < \beta_U \): same reason that \( r_d < r_u \)

=> bondholders get the first and safest cash flow the firm produces
=> debt issued against a firm’s assets is less risky than the assets themselves
Intuition:

- the firm can be viewed as a portfolio of cash flows
- when issue debt, it is like we split the portfolio into pieces
- the first and safest piece goes to bondholders
- the more debt issued, the more safe cash flows are funneled off to bondholders, leaving stockholders with an ever increasingly risky piece of the cash flows.

Ex. 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) \( r_A = .04 + 1.2(.05) = .10 = r_U \): Equation (10.11)
   
   Note: this is the cost of capital for the firm’s assets and unlevered equity

2) \( \beta_E = 1.2 + \left( \frac{300}{800} \right) (1.2 - 0) = 1.65 \) : Equation (14.9)
   
   Note: beta of levered equity

\( r_E = .04 + 1.65(.05) = .1225 \): Equation (10.11)

Note: cost of capital for levered equity

\( r_{WACC} = \left( \frac{800}{1100} \right) .1225 + \left( \frac{300}{1100} \right) .04 = .1 = r_U = r_A \): Equation (14.7)

Dr. Rich’s Video Solution

Concept Check: all

14.4 Capital Structure Fallacies

A. Leverage and Earnings per Share

B. Equity Issuances and Dilution

Concept Check: all

14.5 MM: Beyond the Propositions

1. One of first to apply Law of One Price to finance

2. Their papers marked the birth of modern finance
3. 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

Concept Check: all