

Monetary Economics

Cost of Capital

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Cost of Capital

- Value of firm and capital structure
- Cost of stock to a firm
 - CAPM
- Weighted-average cost of capital
- Leverage and risk
 - Modigliani and Miller

Value of Firm

- Value of all assets
 - Value of liabilities
- Value of firm to owners
 - Present value of cash flow to owners

$$V_{firm} = FCF_0 + \frac{FCF_1}{1 + \text{discount rate}} + \frac{FCF_2}{(1 + \text{discount rate})^2} + \dots$$

- *FCF* is free cash flow
 - Funds available to be paid to holders of the firm's liabilities
 - Expenditures on capital equipment are subtracted from *FCF*

Value of Firm

- Have

$$V_{firm} = FCF_0 + \frac{FCF_1}{1 + \text{discount rate}} + \frac{FCF_2}{(1 + \text{discount rate})^2} + \dots$$

- What is discount rate?
 - Discount rate is the cost of funds from those providing funds to the firm
 - Bondholders' discount rate is different than stockholders' discount rate
 - Holder of short-term bonds might have a different discount rate than holder of longer-term bonds

Risk, Cost of Capital and Capital Budgeting

- What discount rate to use?
- Opportunities available to investors
 - Firm can pay dividend or invest in project
 - Investors could put dividend in a firm with similar risk
 - Would get market expected return
- If the risk of a project is similar to rest of a firm's risk, expected return on firm represents risk of investment

Discount Rate and Weighted-average Cost of Capital

- Have

$$V_{firm} = FCF_0 + \frac{FCF_1}{1 + \text{discount rate}} + \frac{FCF_2}{(1 + \text{discount rate})^2} + \dots$$

- Discount rate used is the weighted-average cost of capital
- The weighted-average cost of capital (WACC) is the overall cost of capital (funds) when a mix of funds is used

Weighted-average Cost of Capital

- The weighted-average cost of capital is the cost of funds from each of the different sources used when more than one type of financing is used

Example of a Weighted-Average Cost of Capital

- AAA Firm uses 30 percent equity and 70 percent long-term bonds
- The cost of equity for AAA firm is 10 percent per year
- The interest rate on long-term bonds is 5 percent
- The weighted-average cost of capital is

$$.3 \cdot .10 + .7 \cdot .05 = .03 + .035 = .065$$

Example of a Weighted-Average Cost of Capital

- AAA Firm uses 50 percent equity and 50 percent long-term bonds
- The cost of equity for AAA firm is 10 percent per year
- The interest rate on long-term bonds is 5 percent
- The weighted-average cost of capital is

$$.5 \cdot .10 + .5 \cdot .05 = .05 + .025 = .075$$

Weighted-average Cost of Capital

- If the cost of capital from various sources is unaffected by changing fractions of debt and equity, AAA firm should finance by all debt and \$1 of equity

Weighted-average Cost of Capital

- If the cost of capital is unaffected by changing fractions of debt and equity, AAA Firm should finance by all debt and \$1 of equity
- Will have to consider how costs of funds change as the fraction of debt and equity change
- Will have to consider capital structure

A Firm with Only Equity

- Capital Asset Pricing Model (CAPM)
- Return on stock =
riskfree rate + risk premium + unsystematic risk

$$R_S = r + \beta(R_m - r) + \varepsilon_S$$

- R_S is the return on the individual stock
- r is the riskfree rate
- R_m is the return on the market portfolio
- $\beta(R_m - r)$ is the risk premium (systematic risk)
- ε_S is the unsystematic risk of the stock

A Firm with Only Equity

- CAPM
$$R_s = r + \beta(R_m - r) + \varepsilon_s$$

- Expected cost of equity capital is

$$ER_s = Er + \beta(ER_m - Er)$$

- E means expected
 - Idiosyncratic risk is unpredictable
- An estimate of the riskfree rate Er
- An estimate of the expected return on stocks in general, the market return ER_m
- Estimate of the stock's beta β

Numbers From Yahoo Finance

- Riskfree rate
 - Interest rate on U.S. Government securities
 - Nominally riskfree
 - 10-year government bonds are relatively liquid
- The expected return on stocks in general, the market return ER_m
 - Reasonable views about return over longer term
 - Look at averages and see how reliable they are
 - Maybe 8 or 6 percent

Numbers from Yahoo Finance

- Beta
 - Common practice is to estimate the CAPM equation using monthly data for the last 60 months

Current Values

- U.S. Treasury 10-year yield to maturity was 2.20 percent on September 11, 2015
- Estimate of market return
 - Malkiel 8 percent (p. 365)
 - Dwyer 6 percent
- Beta – depends on firm

Whole Foods Market, Inc.

- Estimate of beta for WFM from Google is 1.32
 - Was 0.57 a year ago and 0.98 two years ago
 - What happened?
- Riskfree rate is 2.20 percent and market return is 6 percent (D) or 8 percent (M)

$$E R_s = E r + \beta (E R_m - E r)$$

Amazon

- Estimate of beta for Amazon from Google is 1.35
 - Was 1.02 a year ago and 0.81 prior year
- Riskfree rate is 2.20 percent and market return is 8 percent

$$E R_s = E r + \beta (E R_m - E r)$$

Ford Motor Company

- Estimate of beta for Ford from Google is 1.37
 - Was 1.47 last year and 2.13 prior year
- Riskfree rate is 2.20 percent and market return is 6 percent (D) or 8 percent (M)

$$ER_s = Er + \beta(ER_m - Er)$$

Dollar General

- Estimate of beta for Dollar General from Google is 1.30
 - Was 0.31 last year and 0.19 prior year
- Riskfree rate is 2.20 percent and market return is 6 percent (D) or 8 percent (M)

$$E R_s = E r + \beta (E R_m - E r)$$

Krispy Kreme

- Estimate of beta for Krispy Kreme from Google is 2.41
- Riskfree rate is 2.20 percent and market return is 6 percent (D) or 8 percent (M)

$$E R_s = E r + \beta (E R_m - E r)$$

Differences Across Firms

- The differences in cost of equity capital across firms are entirely due to differences in beta

$$E R_s = E r + \beta (E R_m - E r)$$

- Riskfree rate is 2.20 percent per year
- Risk premium for the market is 8 minus 2.20 percent per year = 5.80 percent per year

Differences Across Firms

- Differences in cost of equity capital across firms are entirely due to differences in beta

$$E R_s = E r + \beta (E R_m - E r)$$

- Riskfree rate is 2.20 percent per year and risk premium for the market is 5.80 percent

Differences Across Firms

- Differences in cost of equity capital across firms are entirely due to differences in beta

$$E R_s = E r + \beta (E R_m - E r)$$

Firm	Beta	Risk premium	Expected return
Dollar General	1.30		
Amazon	1.35		
Whole Foods	1.32		
Ford	1.37		
Krispy Kreme	2.41		
Duke Energy	0.44		

Firms with Debt and Equity

- Issue of capital structure
- Firms decide how much debt and equity to have
- Shareholders are the owners legally, and if firms are attempting to maximize the value of the firm to owners,
- **Maximize value of shareholders' equity**

Capital Structure and Modigliani and Miller

- Modigliani-Miller Theorem
 - The value of the leveraged firm is the same as the value of the unleveraged firm
 - The return on stock increases with ratio of debt to equity due to increase in risk
- Things left out of theorem
 - Corporate taxes
 - Bankruptcy
 - Agency costs

Modigliani-Miller Theorem

- The value of the leveraged firm is the same as the value of the unleveraged firm
- Why?
 - Arbitrage argument – replication of position
 - Any leverage that the firm can do can be done by stockholders
 - Borrow to buy the stock
 - If a stockholder wants a less leveraged position than the firm has, they can buy some of the debt

Modigliani-Miller Theorem (2)

- Essentially, the firm is not accomplishing anything by its financial operations that cannot be accomplished by shareholders on their own
- Obviously not true always and everywhere

Assumptions in Modigliani-Miller Theorem

- Homogeneous Expectations
- Homogeneous Business Risk Classes
- Perpetual Cash Flows
- Perfect Capital Markets:
 - Perfect competition
 - Firms and investors borrow and lend at same rate
 - Equal access to all relevant information
 - No transaction costs
 - No taxes

Firms and Leverage

- How do firms choose leverage?
- Controversial

Cost of Bond Finance

- After-tax interest rate on similar debt

$$R_B^* = (1 - t) R_B$$

Weighted-average Cost of Capital

- Undertake an activity financed by \$B of debt and \$S of equity

$$WACC = zR_B^* + (1 - z)E R_S$$

- z is the fraction of the firm's assets financed by debt, $z = B / (B + S)$

Leverage and Financial Risk

- Leverage increases financial risk
- Financial risk is the volatility of payments to shareholders

Leverage and Financial Risk

- Changes in debt and equity can change the volatility of payments to shareholders
- If borrow, have to pay bondholders before shareholders
 - Suppose earnings are either 80, 100 or 120 per year
 - Suppose issue debt and must pay 30 per year
 - Now earnings after interest are either 50, 70 or 90
 - Average value of earnings went down from 100 to 70
 - Range of possible earnings still differs by 40
 - From 80 to 120
 - Now 50 to 90
 - Same possible changes in earnings on a smaller base
 - Could have same base and then range would increase

Firms and Leverage

- How do firms choose leverage?
- Controversial

Summary

- Value of firm and capital structure
- Cost of stock to a firm
 - CAPM
- Weighted-average cost of capital
- Leverage and risk
 - Modigliani and Miller