Class #13: Risk 1
“Cost of Capital”

Road Map: Where do things fit?

- Valuation Fundamentals:
  - DCF Analysis
  - Comparative Analysis
  - Abnormal Earnings Valuation
  - Cash Flow Analysis
- Where Now?
  - Properly calculating cost of capital:
    - Equity (CAPM, 3-Factor Model, Implied Cost of Capital)
    - Cost of Capital: International Companies
    - Debt
    - Enterprise

Approaches to Calculating Equity Cost of Capital (Discount Rate)

- CAPM – based on historical information
  - What if risk has changed?
  - Recent change in capital structure?
- Application:
  - Discounting the cash flows (earnings) available to equityholders.
  - Which cashflows? Answer: The FCF's after all other parties have been paid (lenders, taxes, etc)

Calculation of CAPM discount rate

- CAPM: $E(R) = R_f + \beta^*(R_m - R_f)$
  - Expected return is increasing in systematic risk!
  - What is "Beta"?
    - $Cov(R_{stock}, R_{market} - R_f)/Var(R_{market} - R_f)$
    - Usually = $Cov(R_{stock}, R_{market})/Var(R_{market})$
    - Think of it as "Co-wiggling"
- According to this model, why does the systematic risk only matter?

Where do we get the information?

- Where do we get Beta?
  - KEY ISSUE! This is an estimate from historical data
  - Estimation period is typically 60 months
  - Why not longer? Why not shorter?
  - Sources: Bloomberg, Analysts, Yahoo! Finance, or estimate it yourself!
- Where do we get R_F?
  - Federal Reserve Bank of St. Louis: research.stlouisfed.org/fred/data/irates.html

Example of CAPM Calculation:

- What is Equity Cost of Capital for Microsoft?
  - Beta = 1.49
  - R_f = 4.87% (20 year treasury bond)
  - $(R_m - R_f)$ = 7.95%
  - $E(R) = R_f + \beta*(R_m-R_f)$
    $= 4.87\% + 1.49*(7.95\%)$
    $=16.7\%$

Is the CAPM correct?

- Facts: Even after accounting for Beta risk:
  - Small stocks tend to have higher returns than big stocks.
  - Firms with high **B/M** ratios have higher returns.
- Maybe the CAPM is a not perfect model:
  - Other sources of risk beyond single risk factor?
  - Maybe small stocks have greater systematic risk?
    - Is there a "size risk factor"?
  - Are firms that are near financial distress riskier?
    - Is there a financial distress factor?

The Fama-French 3-factor model

- Origins:
  - Fama and French, 1993, "Common Risk Factors in the Returns on Stocks and Bonds," *Journal of Financial Economics*, for a complete description.
- An "extension" of the CAPM:
  - $R_{stock} = R_f + \beta*(R_m-R_f) + \beta_{SIZE}*(R_{SMB}) + \beta_{BM}*(R_{HML})$
  - Every stock has different market β, β_{SIZE}, β_{BM}
- Where do we get (R_m-R_f), R_{SMB}, R_{HML}?
  - Homepage of Professor Ken French:
    - http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

Fama-French Factor Returns

- What are long-run average values of these factors?
- Long-run average (R_m-R_f) = 7.95% per year
- Long-run average R_{SMB} = 3.32% per year
- Long-run average R_{HML} = 5.05% per year

Example Calculation of 3-factor Cost of Capital

- Microsoft:
  - Market Beta = 0.98
  - Size Beta = -0.40 (!)
  - HML Beta = -1.24 (!)
    - $R_{stock}=R_f + \beta*(R_m-R_f) +\beta_{SIZE}*(R_{SMB}) + \beta_{BM}*(R_{HML})$

      $= 4.87\%+0.98*7.95\%+(-0.4)*3.32\%+$

      $(-1.24)*5.05\%$

      $= \underline{5.1\%}$!!!!!

Implied Cost of Capital

- Let's assume that the stock market has set the stock price correctly.
- Can we use this price information (plus information about future cashflows/earnings) to obtain a estimate of the "implied" cost of equity capital?
- Use Discounted FCF formula:
  - $P_0 = CF_1/(1+r) + CF_2/(1+r)^2 + CF_3/[(r-g)(1+r)^2]$

Example of Implied Cost of Capital Calculation

- Microsoft:
  - Earnings per share 2003: $1.02/share
  - Earnings per share 2004: $1.08/share
  - 5-year growth rate: 15%
  - Current Stock Price = $24.25/share
  - Use standard DCF model (see handout):
    - $P_0 = CF_1/(1+r) + CF_2/(1+r)^2 + CF_3/[(r-g)(1+r)^2]$

Example of Implied Cost of Capital Calculation:

- Can also use the Residual Income Valuation Model (EBO Model, abnormal earnings model)
  - $P_0 = BV_0 + AE_1/(1+r) + AE_2/(1+r)^2 + \ldots$
  - Key is the terminal value

International Cost of Capital Models

- World CAPM or Multifactor Model (Sharpe-Ross)
  - World CAPM:
    - $R_{stock} - R_f = \beta^*(R_{world} - R_f)$
    - R_{world} is a world index (ie MSCI World Index), β uses R_{world}
- Segmented/Integrated CAPM (Bekaert-Harvey)
- Credit Rating (Erb-Harvey-Viskanta)
- Country Spread Model

International Cost of Capital: Segmented/Integrated CAPM

- Developed by Bekaert and Harvey (1995)
  - If country's stock market is integrated with rest of world, then World CAPM holds:
    - $R_{stock} - R_f = \beta^*(R_{world} - R_f)$
    - R_{world} is a world index (ie Morgan Stanley Capital World Index)
    - http://www.msci.com/equity/index.html
    - β calculation is based on uses R_{world}
  - If country's stock market is segmented from the rest of world, then local CAPM holds:
    - $R_{stock} - R_f = \beta^*(R_{country} - R_f)$
    - $R_{country}$ is a country's stock index, β uses $R_{country}$
  - If country is going through process of integration, a combination of two holds.

International Cost of Capital: Segmented/Integrated CAPM

- Expected return is related to both covariance with world and local indices
- Weights (world versus local beta) determined by proxy for degree of integration (like size of trade sector & ratio of stock market capitalization to total GDP)
- Downside:
  - Hard to implement
  - Only appropriate for countries with equity markets.

International Cost of Capital: Credit Rating Model

- **Developed by Erb, Harvey, and Viskanta**
- **Uses country credit rating as a measure of systematic risk:**
  - "*Institutional Investor*" magazine has rankings of country credit risk on scale of 0-100.
  - Run regression: $R_{countyr} = \alpha + \beta$*Risk Rank
  - Estimate "average" cost-of capital in each country.
  - Can use in 136 countries (even countries without equity markets).
  - Impressive fit to the data.
- **Assumes country credit rating is a good measure of risk**
  - Political risk, expropriation risk, exchange rate controls and volatility, etc.

International Cost of Capital: Country Spread Model (Goldman Model)

- **Can be used for individual stocks**
- **Steps:**
  - Estimate foreign company beta by regressing

    $R_{stock} = \alpha + \beta * R_M$

    (where R_M is return on S&P500 - standard CAPM)
  - Then, calculate predicted cost of capital using a modified CAPM:

    $R_{stock} = r_f + \beta * (\text{U.S. equity premium}) + SYS$

    where: U.S. Equity premium is historical $(R_M - R_f)$

    SYS is the country's Sovereign Yield Spread
  - Sovereign Yield Spread is difference between country's government bond yield (bonds denominated in U.S. dollars) and U.S. treasury bond yield.

Where Next

- No Class this Thursday, April 3.
- Assignment #2 will be handed out next Tuesday
  - Direct calculations of cost of capital for your project company (part 2) using various methods
- Next Class: Accounting Trading Strategies