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”?
    • $\text{Cov}(R_{stock}, R_{market} - R_f) / \text{Var}(R_{market} - R_f)$
    • Usually $= \text{Cov}(R_{stock}, R_{market}) / \text{Var}(R_{market})$
    • 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)
  - $(R_m - R_f) = 7.95\%$

- $E(R) = R_f + \beta(R_m - R_f)$
  - $= 4.87\% + 1.49 \times (7.95\%)$
  - $= 16.7\%$
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:

• 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 \( \beta \), \( \beta_{SIZE} \), \( \beta_{BM} \)

• 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](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 \((R_m - R_f) = 7.95\% \text{ per year}\)

• Long-run average \(R_{SMB} = 3.32\% \text{ per year}\)

• Long-run average \(R_{HML} = 5.05\% \text{ per year}\)
Example Calculation of 3-factor Cost of Capital

• Microsoft:
  – Market Beta = 0.98
  – Size Beta = -0.40 (!)
  – HML Beta = -1.24 (!)

• \( R_{stock} = R_f + \beta_s (R_m - R_f) + \beta_{SIZE} (R_{SMB}) + \beta_{BM} (R_{HML}) \)

\[
= 4.87\% + 0.98 \times 7.95\% + (-0.4) \times 3.32\% + (-1.24) \times 5.05\%
\]

\[
= 5.1\% !!!!
\]
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 an estimate of the “implied” cost of equity capital?

• Use Discounted FCF formula:
  \[ P_0 = \frac{CF_1}{1+r} + \frac{CF_2}{(1+r)^2} + \frac{CF_3}{[(r-g)(1+r)^2]} \]
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):
    • \( P_0 = \frac{CF_1}{(1+r)} + \frac{CF_2}{(1+r)^2} + \frac{CF_3}{(r-g)(1+r)^2} \)
Example of Implied Cost of Capital Calculation:

• Can also use the Residual Income Valuation Model (EBO Model, abnormal earnings model)
  – \( P_0 = BV_0 + \frac{AE_1}{(1+r)} + \frac{AE_2}{(1+r)^2} + \ldots \)
  – 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), \( \beta \) 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)
    • $\beta$ 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, $\beta$ 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: \( R_{\text{country}} = \alpha + \beta \times \text{Risk Rank} \)
  - 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:
  \[ R_{stock} = r_f + \beta \times (U.S. \text{ equity premium}) + SYS \]

  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