Estimating Riskfree Rates and Risk Premiums

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Estimating Inputs: Discount Rates

- **Critical ingredient** in discounted cashflow valuation. Errors in estimating the discount rate or mismatching cashflows and discount rates can lead to serious errors in valuation.
- At an intuitive level, the discount rate used should be consistent with both the **riskiness** and the **type of cashflow** being discounted.
  - Equity versus Firm: If the cash flows being discounted are cash flows to equity, the appropriate discount rate is a cost of equity. If the cash flows are cash flows to the firm, the appropriate discount rate is the cost of capital.
  - Currency: The currency in which the cash flows are estimated should also be the currency in which the discount rate is estimated.
  - Nominal versus Real: If the cash flows being discounted are nominal cash flows (i.e., reflect expected inflation), the discount rate should be nominal

Cost of Equity

- The cost of equity should be higher for riskier investments and lower for safer investments
- While risk is usually defined in terms of the variance of actual returns around an expected return, risk and return models in finance assume that the risk that should be rewarded (and thus built into the discount rate) in valuation should be the risk perceived by the marginal investor in the investment
- Most risk and return models in finance also assume that the marginal investor is well diversified, and that the only risk that he or she perceives in an investment is risk that cannot be diversified away (I.e, market or non-diversifiable risk)

The Cost of Equity: Competing Models

Model	*Expected Return*	*Inputs Needed*
CAPM	$E(R) = R_f + \beta (R_m - R_f)$	Riskfree Rate Beta relative to market portfolio Market Risk Premium
APM	$E(R) = R_f + \Sigma_{j=1} \beta_j (R_j - R_f)$	Riskfree Rate; # of Factors; Betas relative to each factor Factor risk premiums
Multi factor	$E(R) = R_f + \Sigma_{j=1,,N} \beta_j (R_j - R_f)$	Riskfree Rate; Macro factors Betas relative to macro factors Macro economic risk premiums
Proxy	$E(R) = a + \Sigma_{j=1..N} b_j Y_j$	Proxies Regression coefficients

The CAPM: Cost of Equity

- Consider the standard approach to estimating cost of equity:

  Cost of Equity = R_f + Equity Beta * ($E(R_m)$ - R_f)

where,

R_f = Riskfree rate

$E(R_m)$ = Expected Return on the Market Index (Diversified Portfolio)

- In practice,
  - Short term government security rates are used as risk free rates
  - Historical risk premiums are used for the risk premium
  - Betas are estimated by regressing stock returns against market returns

Short term Governments are not riskfree

- On a riskfree asset, the actual return is equal to the expected return. Therefore, there is no variance around the expected return.
- For an investment to be riskfree, then, it has to have
  - No default risk
  - No reinvestment risk
- Thus, the riskfree rates in valuation will depend upon when the cash flow is expected to occur and will vary across time
- A simpler approach is to match the duration of the analysis (generally long term) to the duration of the riskfree rate (also long term)
- In emerging markets, there are two problems:
  - The government might not be viewed as riskfree (Brazil, Indonesia)
  - There might be no market-based long term government rate (China)

Estimating a Riskfree Rate

- Estimate a range for the riskfree rate in local terms:
  - Approach 1: Subtract default spread from local government bond rate:

  Government bond rate in local currency terms - Default spread for Government in local currency
  - Approach 2: Use forward rates and the riskless rate in an index currency (say Euros or dollars) to estimate the riskless rate in the local currency.
- Do the analysis in real terms (rather than nominal terms) using a real riskfree rate, which can be obtained in one of two ways –
  - from an inflation-indexed government bond, if one exists
  - set equal, approximately, to the long term real growth rate of the economy in which the valuation is being done.
- Do the analysis in another more stable currency, say US dollars.

A Simple Test

- You are valuing Ambev, a Brazilian company, in U.S. dollars and are attempting to estimate a riskfree rate to use in the analysis. The riskfree rate that you should use is
  - The interest rate on a Brazilian Real denominated long term Government bond
  - The interest rate on a US $ denominated Brazilian long term bond (C-Bond)
  - The interest rate on a US $ denominated Brazilian Brady bond (which is partially backed by the US Government)
  - The interest rate on a US treasury bond

Everyone uses historical premiums, but..

- The historical premium is the premium that stocks have historically earned over riskless securities.
- Practitioners never seem to agree on the premium; it is sensitive to
  - How far back you go in history…
  - Whether you use T.bill rates or T.Bond rates
  - Whether you use geometric or arithmetic averages.
- For instance, looking at the US:

Historical period	*Stocks - T.Bills*		*Stocks - T.Bonds*	
	Arith	*Geom*	*Arith*	*Geom*
1928-2000	8.41%	7.17%	6.53%	5.51%
1962-2000	6.41%	5.25%	5.30%	4.52%
1990-2000	11.42%	7.64%	12.67%	7.09%

If you choose to use historical premiums….

- Go back as far as you can. A risk premium comes with a standard error. Given the annual standard deviation in stock prices is about 25%, the standard error in a historical premium estimated over 25 years is roughly:

  $$\text{Standard Error in Premium} = 25\%/\sqrt{25} = 25\%/5 = 5\%$$

- Be consistent in your use of the riskfree rate. Since we argued for long term bond rates, the premium should be the one over T.Bonds
- Use the geometric risk premium. It is closer to how investors think about risk premiums over long periods.

Country Risk Premiums

- Historical risk premiums are almost impossible to estimate with any precision in markets with limited history - this is true not just of emerging markets but also of many Western European markets.
- For such markets, we can estimate a modified historical premium beginning with the U.S. premium as the base:
  - *Relative Equity Market approach*: The country risk premium is based upon the volatility of the market in question relative to U.S market.

  Country risk premium = Risk Premium$_{US}$ * $\sigma_{\text{Country Equity}}$ / $\sigma_{\text{US Equity}}$
  - *Country Bond approach*: In this approach, the country risk premium is based upon the default spread of the bond issued by the country.

  Country risk premium = Risk Premium$_{US}$ + Country bond default spread
  - *Combined approach*: In this approach, the country risk premium incorporates both the country bond spread and equity market volatility.

Step 1: Assessing Country Risk Using Country Ratings: Latin America - March 2001

Country	*Rating*	*Typical Spread*	*Market Spread*
Argentina	B1	450	563
Bolivia	B1	450	551
Brazil	B1	450	537
Colombia	Ba2	300	331
Ecuador	Caa2	750	787
Guatemala	Ba2	300	361
Honduras	B2	550	581
Mexico	Baa3	145	235
Paraguay	B2	550	601
Peru	Ba3	400	455
Uruguay	Baa3	145	193
Venezuela	B2	550	631

Step 2: From Bond Default Spreads to Equity Spreads

- Country ratings measure default risk. While default risk premiums and equity risk premiums are highly correlated, one would expect equity spreads to be higher than debt spreads.
  - One way to adjust the country spread upwards is to use information from the US market. In the US, the equity risk premium has been roughly twice the default spread on junk bonds.
  - Another is to multiply the bond spread by the relative volatility of stock and bond prices in that market. For example,
    - Standard Deviation in Bovespa (Equity) = 32.6%
    - Standard Deviation in Brazil C-Bond = 17.1%
    - Adjusted Equity Spread = 5.37% (32.6/17.1%) = 10.24%
- Ratings agencies make mistakes. They are often late in recognizing and building in risk.

Another Example: Assessing Country Risk Using Currency Ratings: Western Europe

Country	*Rating*	*Typical Spread*	*Actual Spread*
Austria	Aaa	0	
Belgium	Aaa	0	
Denmark	Aaa	0	
Finland	Aaa	0	
France	Aaa	0	
Germany	Aaa	0	
Greece	A3	95	50
Ireland	AA2	65	35
Italy	Aa3	70	30
Netherlands	Aaa	0	
Norway	Aaa	0	
Portugal	A3	95	55
Spain	Aa1	60	30
Sweden	Aa1	60	25
Switzerland	Aaa	0	

Greek Country Risk Premium

- Country ratings measure default risk. While default risk premiums and equity risk premiums are highly correlated, one would expect equity spreads to be higher than debt spreads.
  - One way to adjust the country spread upwards is to use information from the US market. In the US, the equity risk premium has been roughly twice the default spread on junk bonds.
  - Another is to multiply the bond spread by the relative volatility of stock and bond prices in that market. For example,
    - Standard Deviation in Greek ASE(Equity) = 40.5%
    - Standard Deviation in Greek GDr Bond = 26.1%
    - Adjusted Equity Spread = 0.95% (40.5%/26.1%) = 1.59%
- Ratings agencies make mistakes. They are often late in recognizing and building in risk.

From Country Spreads to Corporate Risk premiums

- Approach 1: Assume that every company in the country is equally exposed to country risk. In this case,

  E(Return) = Riskfree Rate + Country Spread + Beta (US premium)

  Implicitly, this is what you are assuming when you use the local Government's dollar borrowing rate as your riskfree rate.
- Approach 2: Assume that a company's exposure to country risk is similar to its exposure to other market risk.

  E(Return) = Riskfree Rate + Beta (US premium + Country Spread)
- Approach 3: Treat country risk as a separate risk factor and allow firms to have different exposures to country risk (perhaps based upon the proportion of their revenues come from non-domestic sales)

  E(Return)=Riskfree Rate+ β (US premium) + λ (Country Spread)

Estimating Company Exposure to Country Risk

- Different companies should be exposed to different degrees to country risk. For instance, a Brazilian firm that generates the bulk of its revenues in the United States should be less exposed to country risk in Brazil than one that generates all its business within Brazil.
- The factor "λ" measures the relative exposure of a firm to country risk. One simplistic solution would be to do the following:

  λ = % of revenues domestically$_{firm}$/ % of revenues domestically$_{avg\ firm}$

  For instance, if a firm gets 35% of its revenues domestically while the average firm in that market gets 70% of its revenues domestically

  $$\lambda = 35\%/\ 70\ \% = 0.5$$

- There are two implications
  - A company's risk exposure is determined by where it does business and not by where it is located
  - Firms might be able to actively manage their country risk exposures

Estimating E(Return) for Embraer

- Assume that the beta for Embraer is 0.88, and that the riskfree rate used is 4.5%. (Real Riskfree Rate)
- Approach 1: Assume that every company in the country is equally exposed to country risk. In this case,

E(Return) =4.5% + 10.24% + 0.88 (5.51%) = 19.59%

- Approach 2: Assume that a company's exposure to country risk is similar to its exposure to other market risk.

E(Return) = 4.5% + 0.88 (5.51%+ 10.24%) = 18.36%

- Approach 3: Treat country risk as a separate risk factor and allow firms to have different exposures to country risk (perhaps based upon the proportion of their revenues come from non-domestic sales)

E(Return)= 4.5% + 0.88 (5.51%) + 0.50 (10.24%) = 14.47%

Embraer is less exposed to country risk than the typical Brazilian firm since much of its business is overseas.

Implied Equity Premiums

- If we use a basic discounted cash flow model, we can estimate the implied risk premium from the current level of stock prices.
- For instance, if stock prices are determined by a variation of the simple Gordon Growth Model:
  - Value = Expected Dividends next year/ (Required Returns on Stocks - Expected Growth Rate)
  - Dividends can be extended to included expected stock buybacks and a high growth period.
  - Plugging in the current level of the index, the dividends on the index and expected growth rate will yield a "implied" expected return on stocks. Subtracting out the riskfree rate will yield the implied premium.
- This model can be extended to allow for two stages of growth - an initial period where the entire market will have earnings growth greater than that of the economy, and then a stable growth period.

Estimating Implied Premium for U.S. Market: Jan 1, 2001

- Level of the index = 1320
- Treasury bond rate = 5.10%
- Expected Growth rate in earnings (next 5 years) = 7.50% (Consensus estimate for S&P 500)
- Expected growth rate after year 5 = 5.50%
- Expected dividends + stock buybacks = 2.14% of index

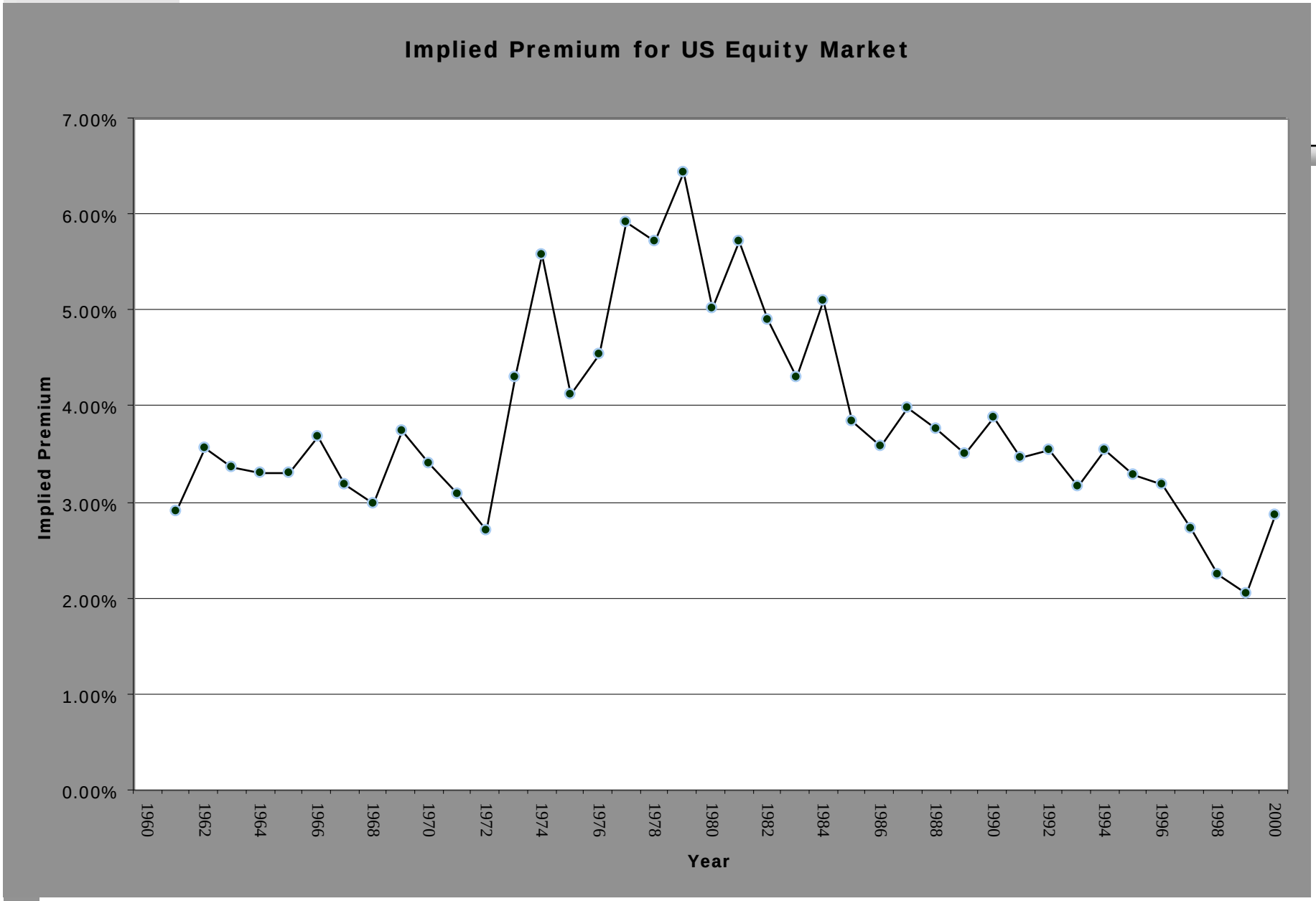
	Year 1	Year 2	Year 3	Year 4	Year 5
Expected Dividends =	$30.38	$32.66	$35.11	$37.75	$40.58
+ Stock Buybacks					

Expected dividends + buybacks in year 6 = 40.58 (1.055) = $ 42.78

$$1320 = 30.38/(1+r) + 32.66/(1+r)^2 + + 35.11/(1+r)^3 + 37.75/(1+r)^4 + (40.55+(42.78/(r-.055))/(1+r)^5$$

Solving for r, r = 7.97%. (Only way to do this is trial and error)

Implied risk premium = 7.97% - 5.10% = **2.87**%


Implied Premium for US Equity Market
7.00%
6.00%
5.00%
4.00%
3.00%
2.00%
1.00%
0.00%
Implied Premium
1960
1962
1964
1966
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
Year

Implied Premium for Brazilian Market: March 1, 2001

- Level of the Index = 16417
- Dividends on the Index = 4.40% of (Used weighted yield)
- Other parameters
  - Riskfree Rate = 4.5% (real riskfree rate)
  - Expected Growth
    - Next 5 years = 13.5% (Used expected real growth rate in Earnings)
    - After year 5 = 4.5% (real growth rate in long term)
- Solving for the expected return:
  - Expected return on Equity = 11.16%
  - Implied Equity premium = 11.16% -4. 5% = 6.66%

The Effect of Using Implied Equity Premiums on Value

- Embraer's value per share (using historical premium + country risk adjustment) = 11.22 BR
- Embraer's value per share (using implied equity premium of 6.66%) = 20.02 BR
- Embraer's stock price (at the time of the valuation) = 15.25 BR