DISCOUNT RATES

The D in the DCF..

Estimating Inputs: Discount Rates

- While discount rates obviously matter in DCF valuation, they don't matter as much as most analysts think they do.
- 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

Risk in the DCF Model

Expectation of cash flows across all scenarios, good and bad. Incorporates all risks that affect the asset / business.

$$\frac{\text{Expected Cash Flows}}{\text{Risk Adjusted Discount Rate}}$$

Discount rate should reflect the risk perceived by the marginal investor in the company

Risk Adjusted Cost of equity	=	Risk free rate in the currency of analysis	+	Relative risk of company/equity in questiion	X	Equity Risk Premium required for average risk equity

Not all risk is created equal…

- Estimation versus Economic uncertainty
  - Estimation uncertainty reflects the possibility that you could have the "wrong model" or estimated inputs incorrectly within this model.
  - Economic uncertainty comes the fact that markets and economies can change over time and that even the best models will fail to capture these unexpected changes.
- Micro uncertainty versus Macro uncertainty
  - Micro uncertainty refers to uncertainty about the potential market for a firm's products, the competition it will face and the quality of its management team.
  - Macro uncertainty reflects the reality that your firm's fortunes can be affected by changes in the macro economic environment.
- Discrete versus continuous uncertainty
  - Discrete risk: Risks that lie dormant for periods but show up at points in time. (Examples: A drug working its way through the FDA pipeline may fail at some stage of the approval process or a company in Venezuela may be nationalized)
  - Continuous risk: Risks changes in interest rates or economic growth occur continuously and affect value as they happen.

Risk and Cost of Equity: The role of the marginal investor

- Not all risk counts: While the notion that the cost of equity should be higher for riskier investments and lower for safer investments is intuitive, what risk should be built into the cost of equity is the question.
- Risk through whose eyes? 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
- The diversification effect: 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). In effect, it is primarily economic, macro, continuous risk that should be incorporated into the cost of equity.

The Cost of Equity: Competing " Market Risk" Models

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

Classic Risk & Return: Cost of Equity

- In the CAPM, the cost of equity:

  Cost of Equity = Riskfree Rate + Equity Beta * (Equity Risk Premium)

- In APM or Multi-factor models, you still need a risk free rate, as well as betas and risk premiums to go with each factor.
- To use any risk and return model, you need
  - A risk free rate as a base
  - A single equity risk premium (in the CAPM) or factor risk premiums, in the the multi-factor models
  - A beta (in the CAPM) or betas (in multi-factor models)

Discount Rates: I

The Risk Free Rate

The Risk Free Rate: Laying the Foundations

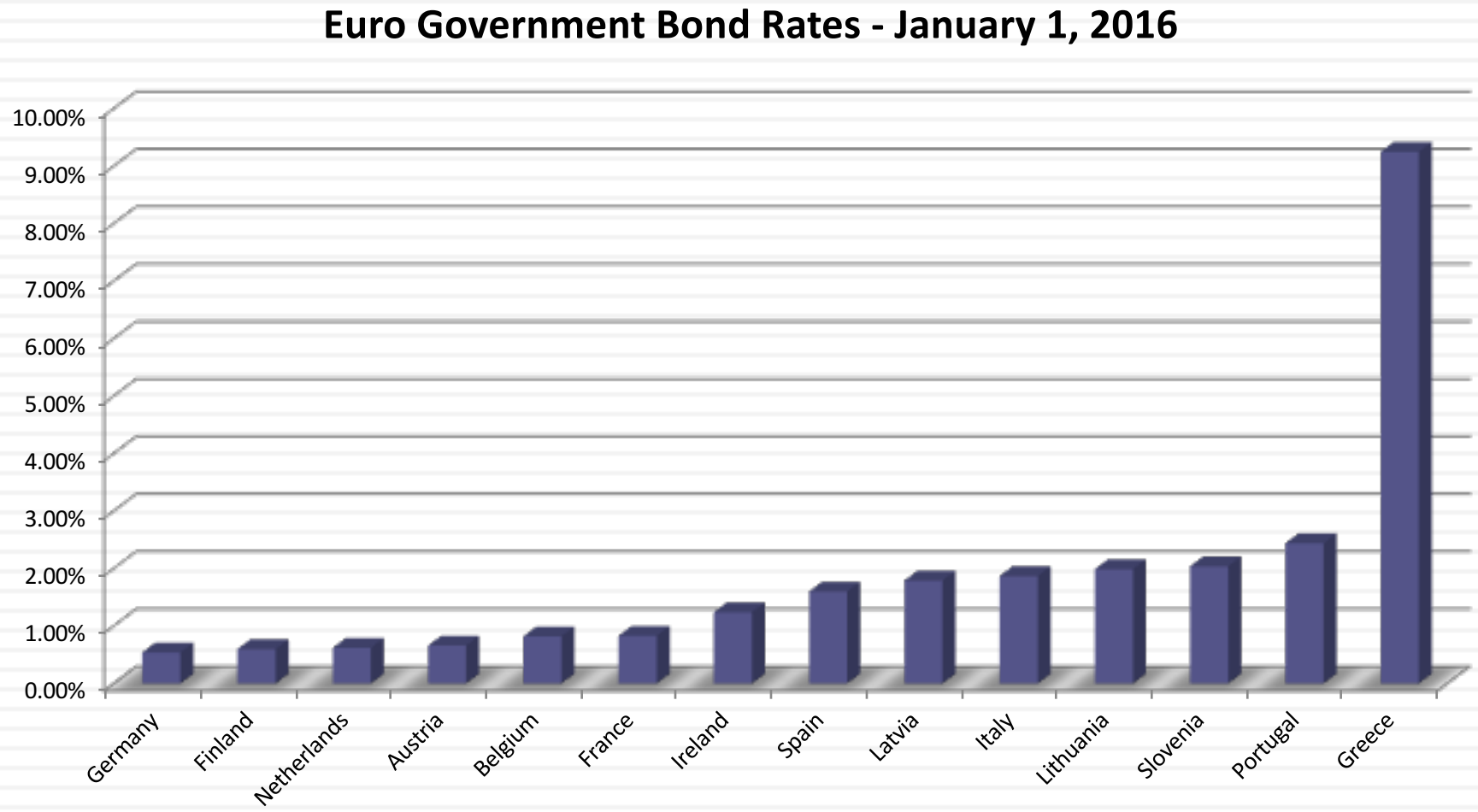
- On a riskfree investment, the actual return is equal to the expected return. Therefore, there is no variance around the expected return.
- For an investment to be riskfree, then, it has to have
  - No default risk
  - No reinvestment risk
- It follows then that if asked to estimate a risk free rate:

1. Time horizon matters: Thus, the riskfree rates in valuation will depend upon when the cash flow is expected to occur and will vary across time.
2. Currencies matter: A risk free rate is currency-specific and can be very different for different currencies.
3. Not all government securities are riskfree: Some governments face default risk and the rates on bonds issued by them will not be riskfree.

Test 1: A riskfree rate in US dollars!

- In valuation, we estimate cash flows forever (or at least for very long time periods). The right risk free rate to use in valuing a company in US dollars would be
  a. A three-month Treasury bill rate (0.2%)
  b. A ten-year Treasury bond rate (2%)
  c. A thirty-year Treasury bond rate (3%)
  d. A TIPs (inflation-indexed treasury) rate (1%)
  e. None of the above
- What are we implicitly assuming about the US treasury when we use any of the treasury numbers?

Test 2: A Riskfree Rate in Euros



Test 3: A Riskfree Rate in Indian Rupees

- The Indian government had 10-year Rupee bonds outstanding, with a yield to maturity of about 7.73% on January 1, 2016.
- In January 2016, the Indian government had a local currency sovereign rating of Baa3. The typical default spread (over a default free rate) for Baa3 rated country bonds in early 2016 was 2.44%. The riskfree rate in Indian Rupees is
  a. The yield to maturity on the 10-year bond (7.73%)
  b. The yield to maturity on the 10-year bond + Default spread (10.17%)
  c. The yield to maturity on the 10-year bond – Default spread (5.29%)
  d. None of the above

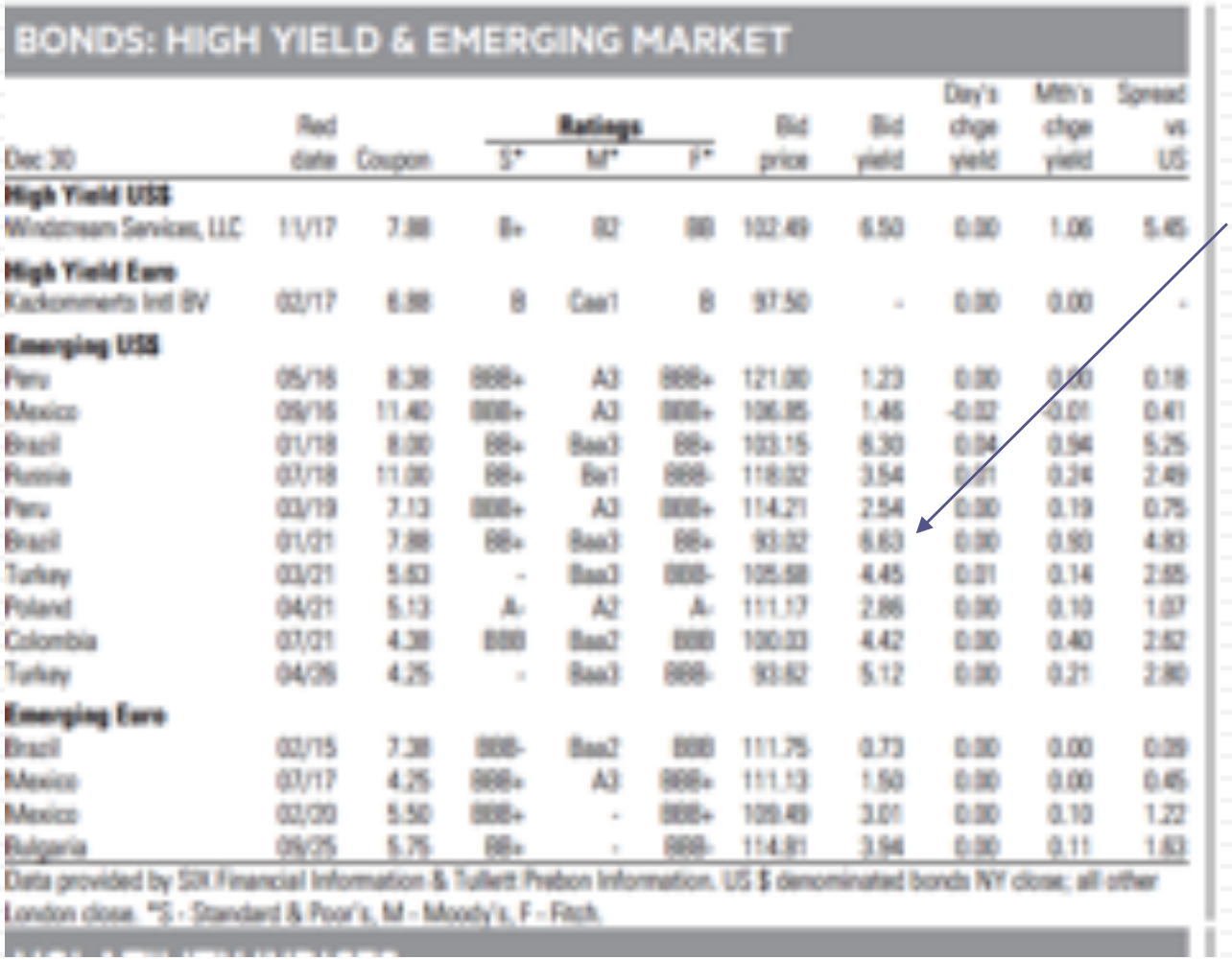
Sovereign Default Spread: Three paths to the same destination…

- Sovereign dollar or euro denominated bonds: Find sovereign bonds denominated in US dollars, issued by an emerging sovereign.
  - Default spread = Emerging Govt Bond Rate (in US $) – US Treasury Bond rate with same maturity.
- CDS spreads: Obtain the traded value for a sovereign Credit Default Swap (CDS) for the emerging government.
  - Default spread = Sovereign CDS spread (with perhaps an adjustment for CDS market frictions).
- Sovereign-rating based spread: For countries which don't issue dollar denominated bonds or have a CDS spread, you have to use the average spread for other countries with the same sovereign rating.

Local Currency Government Bond Rates – January 2016

Currency	Govt Bond rate (12/31/15)	Currency	Govt Bond rate (12/31/15)
Australian $	2.88%	Malyasian Ringgit	4.19%
Brazilian Reai	16.51%	Mexican Peso	6.31%
British Pound	1.96%	Nigerian Naira	11.09%
Bulgarian Lev	2.62%	Norwegian Krone	1.48%
Canadian $	1.39%	NZ $	3.58%
Chilean Peso	4.75%	Pakistani Rupee	9.00%
Chinese Yuan	2.84%	Peruvian Sol	6.96%
Colombian Peso	8.27%	Phillipine Peso	4.10%
Croatian Kuna	4.02%	Polish Zloty	2.94%
Czech Koruna	0.55%	Romanian Leu	3.77%
Danish Krone	0.94%	Russian Ruble	9.74%
Euro	0.63%	Singapore $	2.61%
HK $	1.59%	South African Rand	10.16%
Hungarian Forint	3.42%	Swedish Krona	0.99%
Iceland Krona	5.88%	Swiss Franc	-0.06%
Indian Rupee	7.73%	Taiwanese $	1.02%
Indonesian Rupiah	8.87%	Thai Baht	2.52%
Israeli Shekel	2.09%	Turkish Lira	10.42%
Japanese Yen	0.27%	US $	2.27%
Kenyan Shilling	13.39%	Venezuelan Bolivar	18.00%
Korean Won	2.09%	Vietnamese Dong	7.05%

Approach 1: Default spread from Government Bonds



BONDS: HIGH YIELD & EMERGING MARKET

Dec 30	Red date	Coupon	Ratings S*	M*	F*	Bid price	Bid yield	Day's chge yield	Mth's chge yield	Spread vs US
High Yield US$										
Windstream Services, LLC	11/17	7.88	B+	B2	BB	102.49	6.50	0.00	1.06	5.45
High Yield Euro										
Kackonmerts Intl BV	02/17	6.88	B	Caa1	B	97.50	-	0.00	0.00	-
Emerging US$										
Peru	05/16	8.38	BBB+	A3	BBB+	121.00	1.23	0.00	0.00	0.18
Mexico	09/16	11.40	BBB+	A3	BBB+	106.85	1.46	-0.02	-0.01	0.41
Brazil	01/18	8.00	BB+	Baa3	BB+	103.15	6.30	0.04	0.94	5.25
Russia	07/18	11.00	BB+	Ba1	BBB-	118.02	3.54	0.01	0.24	2.49
Peru	03/19	7.13	BBB+	A3	BBB+	114.21	2.54	0.00	0.19	0.75
Brazil	01/21	7.88	BB+	Baa3	BB+	93.02	6.63	0.00	0.50	4.83
Turkey	03/21	5.63	-	Baa3	BBB-	105.68	4.45	0.01	0.14	2.65
Poland	04/21	5.13	A-	A2	A-	111.17	2.86	0.00	0.10	1.07
Colombia	07/21	4.38	BBB	Baa2	BBB	100.03	4.42	0.00	0.40	2.62
Turkey	04/26	4.25	-	Baa3	BBB-	93.62	5.12	0.00	0.21	2.80
Emerging Euro										
Brazil	02/15	7.38	BBB-	Baa2	BBB	111.75	0.73	0.00	0.00	0.09
Mexico	07/17	4.25	BBB+	A3	BBB+	111.13	1.50	0.00	0.00	0.45
Mexico	02/20	5.50	BBB+	-	BBB+	109.49	3.01	0.00	0.10	1.22
Bulgaria	09/25	5.75	BB+	-	BBB-	114.81	3.94	0.00	0.11	1.63

Data provided by SIX Financial Information & Tullett Prebon Information. US $ denominated bonds NY close; all other London close. *S - Standard & Poor's, M - Moody's, F - Fitch.

The Brazil Default Spread

Brazil 2021 Bond: 6.83%

US 2021 T.Bond: 2.00%

Spread: 4.83%

Approach 2: CDS Spreads – January 2016

Country	CDS Spread	CDS Spread adj for US	Country	CDS Spread	CDS Spread adj for US	Country	CDS Spread	CDS Spread adj for US
Abu Dhabi	1.21%	0.82%	Hungary	2.15%	1.76%	Peru	2.45%	2.06%
Australia	0.73%	0.34%	Iceland	0.80%	0.41%	Philippines	1.73%	1.34%
Austria	0.51%	0.12%	India	2.11%	1.72%	Poland	1.22%	0.83%
Bahrain	3.91%	3.52%	Indonesia	3.25%	2.86%	Portugal	2.44%	2.05%
Belgium	0.71%	0.32%	Ireland	0.80%	0.41%	Qatar	1.32%	0.93%
Brazil	5.58%	5.19%	Israel	1.26%	0.87%	Romania	1.74%	1.35%
Bulgaria	2.20%	1.81%	Italy	1.54%	1.15%	Russia	3.48%	3.09%
Chile	1.66%	1.27%	Japan	0.93%	0.54%	Saudi Arabia	1.93%	1.54%
China	1.62%	1.23%	Kazakhstan	3.30%	2.91%	Slovakia	0.94%	0.55%
Colombia	3.02%	2.63%	Korea	0.79%	0.40%	Slovenia	1.68%	1.29%
Costa Rica	4.83%	4.44%	Latvia	1.29%	0.90%	South Africa	3.88%	3.49%
Croatia	3.39%	3.00%	Lebanon	4.87%	4.48%	Spain	1.44%	1.05%
Cyprus	3.10%	2.71%	Lithuania	1.29%	0.90%	Sweden	0.35%	0.00%
Czech Republic	0.93%	0.54%	Malaysia	2.50%	2.11%	Switzerland	0.42%	0.03%
Denmark	0.39%	0.00%	Mexico	2.30%	1.91%	Thailand	2.00%	1.61%
Egypt	5.27%	4.88%	Morocco	2.26%	1.87%	Tunisia	4.58%	4.19%
Estonia	0.85%	0.46%	Netherlands	0.37%	0.00%	Turkey	3.29%	2.90%
Finland	0.46%	0.07%	New Zealand	0.77%	0.38%	United Kingdom	0.42%	0.03%
France	0.60%	0.21%	Norway	0.35%	0.00%	United States	0.39%	0.00%
Germany	0.34%	0.00%	Pakistan	5.92%	5.53%	Vietnam	3.53%	3.14%
Hong Kong	0.78%	0.39%	Panama	2.33%	1.94%			

Approach 3: Typical Default Spreads: January 2016

Rating	Default Spread (1/1/16)
Aaa	0
Aa1	44
Aa2	55
Aa3	67
A1	78
A2	94
A3	133
Baa1	177
Baa2	211
Baa3	244
Ba1	277
Ba2	333
Ba3	399
B1	499
B2	610
B3	721
Caa1	831
Caa2	998
Caa3	1108
Ca	1330

Getting to a risk free rate in a currency: Example

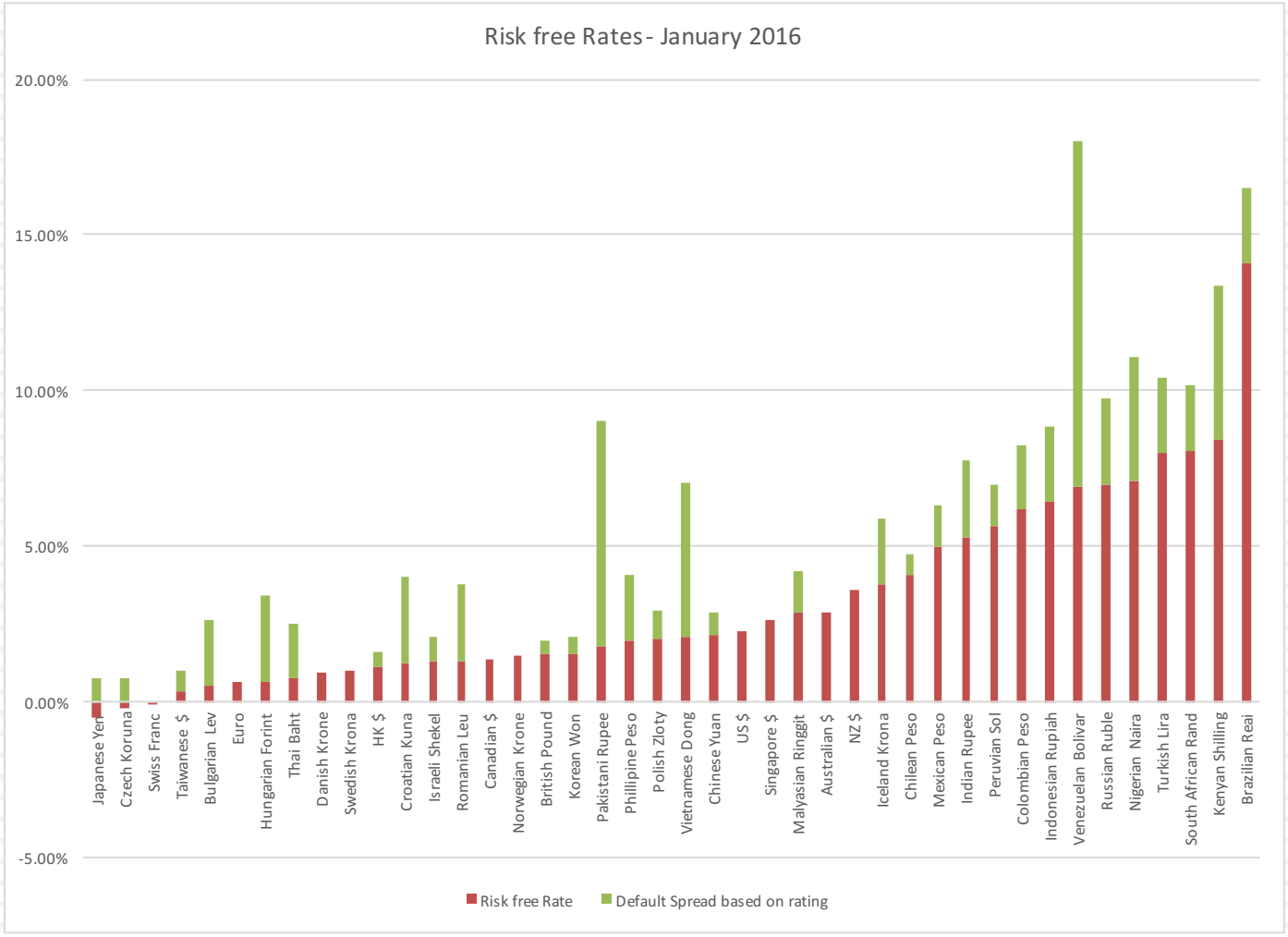
- The Brazilian government bond rate in nominal reais on January 1, 2016 was 16.51%. To get to a riskfree rate in nominal reais, we can use one of three approaches.
  - Approach 1: Government Bond spread
    - The 2021 Brazil bond, denominated in US dollars, has a spread of 4.83% over the US treasury bond rate.
    - Riskfree rate in $R = 16.51% - 4.83% = 11.68%
  - Approach 2: The CDS Spread
    - The CDS spread for Brazil, adjusted for the US CDS spread was 5.19%.
    - Riskfree rate in $R = 16.51% - 5.19% = 11.32%
  - Approach 3: The Rating based spread
    - Brazil has a Baa3 local currency rating from Moody's. The default spread for that rating is 2.44%
    - Riskfree rate in $R = 16.51% - 2.44% = 14.07%

Test 4: A Real Riskfree Rate

- In some cases, you may want a riskfree rate in real terms (in real terms) rather than nominal terms.
- To get a real riskfree rate, you would like a security with no default risk and a guaranteed real return. Treasury indexed securities offer this combination.
- In January 2016, the yield on a 10-year indexed treasury bond was 0.75%. Which of the following statements would you subscribe to?
  a. This (0.75%) is the real riskfree rate to use, if you are valuing US companies in real terms.
  b. This (0.75%) is the real riskfree rate to use, anywhere in the world

  Explain.

Why do risk free rates vary across currencies? January 2016 Risk free rates



Risk free Rate: Don't have or trust the government bond rate?

1. Build up approach: The risk free rate in any currency can be written as the sum of two variables:

Risk free rate = Expected Inflation in currency + Expected real interest rate

The expected real interest rate can be computed in one of two ways: from the US TIPs rate or set equal to real growth in the economy. Thus, if the expected inflation rate in a country is expected to be 15% and the TIPs rate is 1%, the risk free rate is 16%.

2. US $ Rate & Differential Inflation: Alternatively, you can scale up the US $ risk free rate by the differential inflation between the US $ and the currency in question:

Risk free rate$_{Currency}$= $(1 + Riskfree\ rate_{US\ \$}) \frac{(1 + Expected\ Inflation_{Foreign\ Currency})}{(1 + Expected\ Inflation_{US\ \$})} - 1$

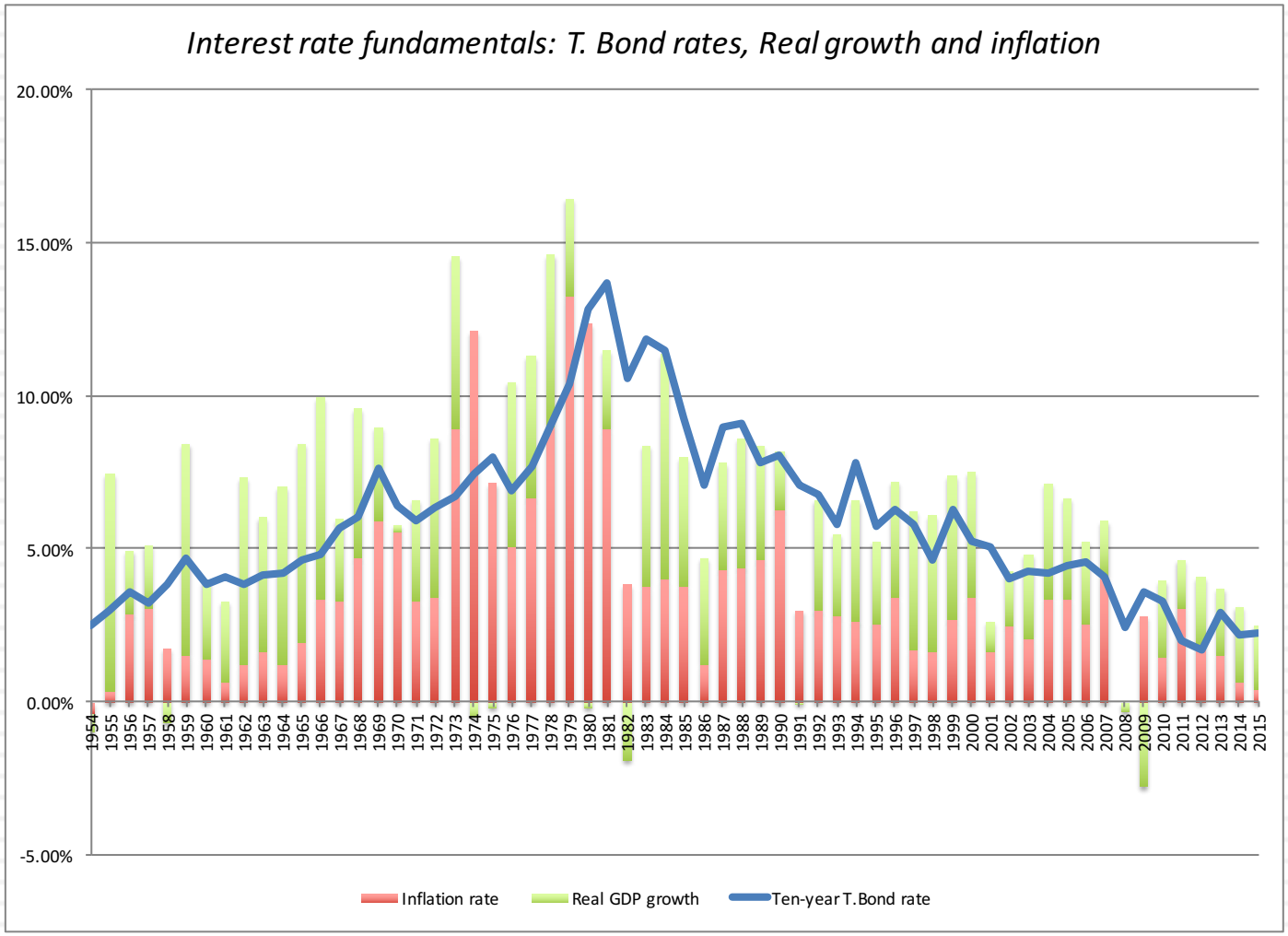
Thus, if the US $ risk free rate is 2.00%, the inflation rate in the foreign currency is 15% and the inflation rate in US $ is 1.5%, the foreign currency risk free rate is as follows:

Risk free rate = $(1.02)\frac{(1.15)}{(1.015)} - 1 = 15.57\%$

One more test on riskfree rates…

- On January 1, 2016, the 10-year treasury bond rate in the United States was 2.27%, a historic low. Assume that you were valuing a company in US dollars then, but were wary about the risk free rate being too low. Which of the following should you do?
  a. Replace the current 10-year bond rate with a more reasonable normalized riskfree rate (the average 10-year bond rate over the last 30 years has been about 5-6%)
  b. Use the current 10-year bond rate as your riskfree rate but make sure that your other assumptions (about growth and inflation) are consistent with the riskfree rate
  c. Something else…

Some perspective on risk free rates



Negative Interest Rates?

- In 2016, there were at least three currencies (Swiss Franc, Japanese Yen, Euro) with negative interest rates. Using the fundamentals (inflation and real growth) approach, how would you explain negative interest rates?
- How negative can rates get? (Is there a bound?)
- Would you use these negative interest rates as risk free rates?
  - If no, why not and what would you do instead?
  - If yes, what else would you have to do in your valuation to be internally consistent?

Discount Rates: II

The Equity Risk Premium

The ubiquitous historical risk premium

- The historical premium is the premium that stocks have historically earned over riskless securities.
- While the users of historical risk premiums act as if it is a fact (rather than an estimate), 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:

	Arithmetic Average		*Geometric Average*	
	Stocks - T. Bills	Stocks - T. Bonds	Stocks - T. Bills	Stocks - T. Bonds
1928-2015	7.92%	6.18%	6.05%	4.54%
Std Error	*2.15%*	*2.29%*		
1966-2015	6.05%	3.89%	4.69%	2.90%
Std Error	*2.42%*	*2.74%*		
2006-2015	7.87%	3.88%	6.11%	2.53%
Std Error	*6.06%*	*8.66%*		

The perils of trusting the past…….

- Noisy estimates: Even with long time periods of history, the risk premium that you derive will have substantial standard error. For instance, if you go back to 1928 (about 80 years of history) and you assume a standard deviation of 20% in annual stock returns, you arrive at a standard error of greater than 2%:

  Standard Error in Premium = 20%/√80 = 2.26%

- Survivorship Bias: Using historical data from the U.S. equity markets over the twentieth century does create a sampling bias. After all, the US economy and equity markets were among the most successful of the global economies that you could have invested in early in the century.

Risk Premium for a Mature Market? Broadening the sample to 1900-2015

Country	Geometric ERP	Arithmetic ERP	Standard Error
Australia	5.00%	6.60%	1.70%
Austria	2.60%	21.50%	14.30%
Belgium	2.40%	4.50%	2.00%
Canada	3.30%	4.90%	1.70%
Denmark	2.30%	3.80%	1.70%
Finland	5.20%	8.80%	2.80%
France	3.00%	5.40%	2.10%
Germany	5.10%	9.10%	2.70%
Ireland	2.80%	4.80%	1.80%
Italy	3.10%	6.50%	2.70%
Japan	5.10%	9.10%	3.00%
Netherlands	3.30%	5.60%	2.10%
New Zealand	4.00%	5.50%	1.70%
Norway	2.30%	5.20%	2.60%
South Africa	5.40%	7.20%	1.80%
Spain	1.80%	3.80%	1.90%
Sweden	3.10%	5.40%	2.00%
Switzerland	2.10%	3.60%	1.60%
U.K.	3.60%	5.00%	1.60%
U.S.	4.30%	6.40%	1.90%
Europe	3.20%	4.50%	1.50%
World-ex U.S.	2.80%	3.90%	1.40%
World	3.20%	4.40%	1.40%

The simplest way of estimating an additional country risk premium: The country default spread

- Default spread for country: In this approach, the country equity risk premium is set equal to the default spread for the country, estimated in one of three ways:
  - The default spread on a dollar denominated bond issued by the country. (In January 2016, that spread was 4.83% for the Brazilian $ bond)
  - The sovereign CDS spread for the country. In January 2016, the ten year CDS spread for Brazil, adjusted for the US CDS, was 5.19%.
  - The default spread based on the local currency rating for the country. Brazil's sovereign local currency rating is Baa3 and the default spread for a Baa3 rated sovereign was about 2.44% in January 2016.
- Add the default spread to a "mature" market premium: This default spread is added on to the mature market premium to arrive at the total equity risk premium for Brazil, assuming a mature market premium of 6.00%.
  - Country Risk Premium for Brazil = 2.44%
  - Total ERP for Brazil = 6.00% + 2.44% = 8.44%

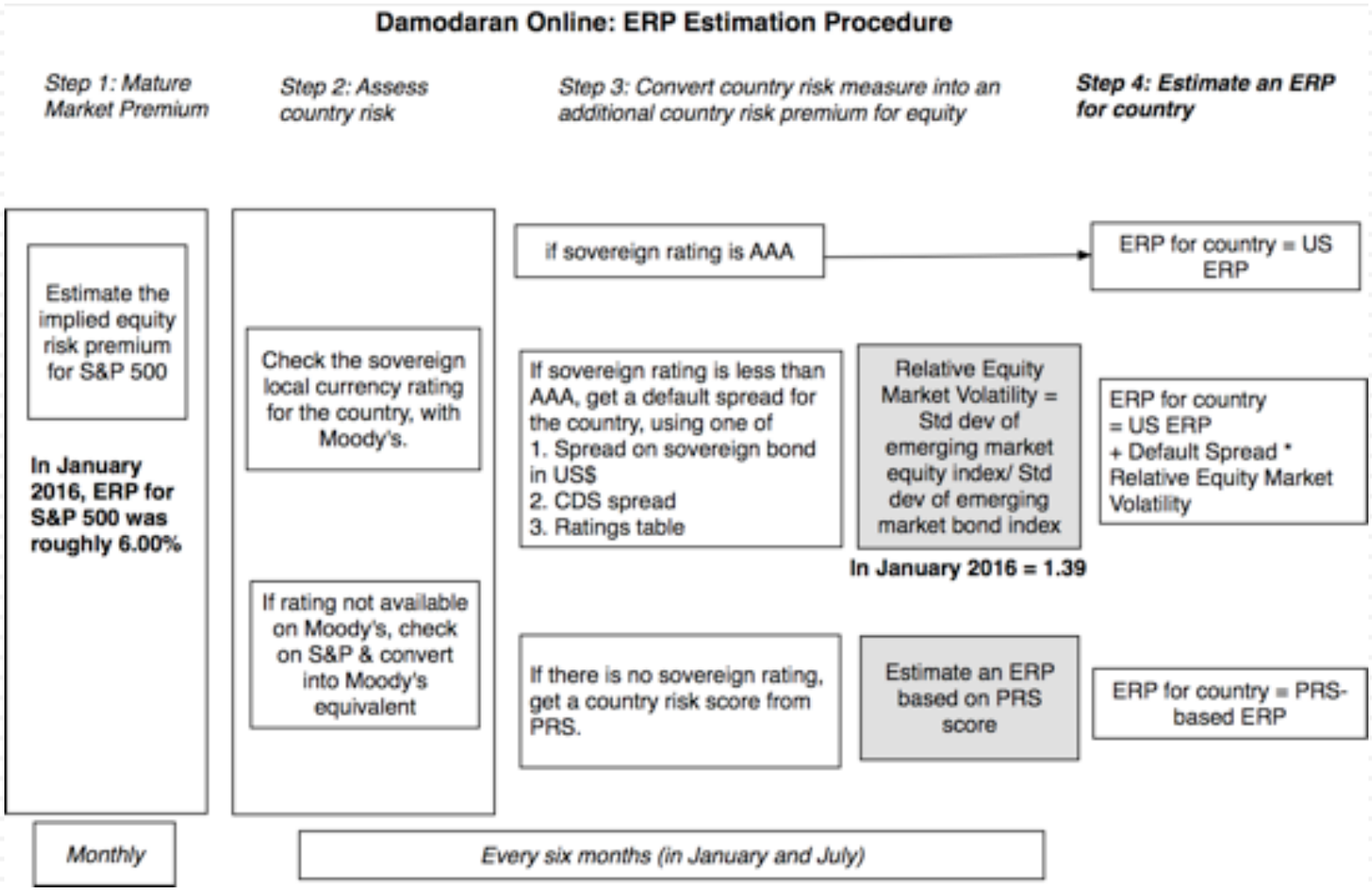
An equity volatility based approach to estimating the country total ERP

- This approach draws on the standard deviation of two equity markets, the emerging market in question and a base market (usually the US). The total equity risk premium for the emerging market is then written as:
  - Total equity risk premium = Risk Premium$_{US}$ * $\sigma_{\text{Country Equity}}$ / $\sigma_{\text{US Equity}}$
- The country equity risk premium is based upon the volatility of the market in question relative to U.S market.
  - Assume that the equity risk premium for the US is 6.00%.
  - Assume that the standard deviation in the Bovespa (Brazilian equity) is 30% and that the standard deviation for the S&P 500 (US equity) is 18%.
  - Total Equity Risk Premium for Brazil = 6.00% (30%/18%) = 10.0%
  - Country equity risk premium for Brazil = 10.00% - 6.00% = 4.00%

A melded approach to estimating the additional 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.
- Another is to multiply the bond default spread by the relative volatility of stock and bond prices in that market. Using this approach for Brazil in January 2016, you would get:
  - Country Equity risk premium = Default spread on country bond* $\sigma_{\text{Country Equity}} / \sigma_{\text{Country Bond}}$
    - Standard Deviation in Bovespa (Equity) = 30%
    - Standard Deviation in Brazil government bond = 20%
    - Default spread for Brazil= 2.44%
  - Brazil Country Risk Premium = 2.44% (30%/20%) = 3.66%
  - Brazil Total ERP = Mature Market Premium + CRP = 6.00% + 3.66% = 9.66%

A Template for Country Risk



ERP : Jan 2016

Andorra	9.28%	3.28%	Jersey (States of)	6.59%	0.59%
Austria	6.00%	0.00%	Liechtenstein	6.00%	0.00%
Belgium	6.90%	0.90%	Luxembourg	6.00%	0.00%
Cyprus	12.71%	6.71%	Malta	7.79%	1.79%
Denmark	6.00%	0.00%	Netherlands	6.00%	0.00%
Finland	6.00%	0.00%	Norway	6.00%	0.00%
France	6.74%	0.74%	Portugal	9.72%	3.72%
Germany	6.00%	0.00%	Spain	8.84%	2.84%
Greece	20.90%	14.90%	Sweden	6.00%	0.00%
Guernsey	6.59%	0.59%	Switzerland	6.00%	0.00%
Iceland	8.84%	2.84%	Turkey	9.28%	3.28%
Ireland	8.38%	2.38%	United Kingdom	6.59%	0.59%
Isle of Man	6.59%	0.59%	**Western Europe**	**7.16%**	**1.16%**
Italy	8.84%	2.84%			

Canada	6.00%	0.00%
US	6.00%	0.00%
North America	**6.00%**	**0.00%**

Caribbean	**14.61%**	**8.61%**

Argentina	17.17%	11.17%
Belize	19.42%	13.42%
Bolivia	11.37%	5.37%
Brazil	9.28%	3.28%
Chile	6.90%	0.90%
Colombia	8.84%	2.84%
Costa Rica	9.72%	3.72%
Ecuador	15.70%	9.70%
El Salvador	11.37%	5.37%
Guatemala	9.72%	3.72%
Honduras	15.70%	9.70%
Mexico	7.79%	1.79%
Nicaragua	14.20%	8.20%
Panama	8.84%	2.84%
Paraguay	9.72%	3.72%
Peru	7.79%	1.79%
Suriname	11.37%	5.37%
Uruguay	8.84%	2.84%
Venezuela	20.90%	14.90%
Latin America	**10.42%**	**4.42%**

Country	*ERP*	*CRP*
Angola	10.48%	4.48%
Botswana	7.26%	1.26%
Burkina Faso	15.70%	9.70%
Cameroon	14.20%	8.20%
Cape Verde	14.20%	8.20%
Congo (DR	15.70%	9.70%
Congo (Republic)	11.37%	5.37%
Côte d'Ivoire	11.37%	5.37%
Egypt	15.70%	9.70%
Ethiopia	12.71%	6.71%
Gabon	11.37%	5.37%
Ghana	15.70%	9.70%
Kenya	12.71%	6.71%
Morocco	9.72%	3.72%
Mozambique	14.20%	8.20%
Namibia	9.28%	3.28%
Nigeria	11.37%	5.37%
Rwanda	12.71%	6.71%
Senegal	12.71%	6.71%
South Africa	8.84%	2.84%
Tunisia	11.37%	5.37%
Uganda	12.71%	6.71%
Zambia	14.20%	8.20%
Africa	**11.76%**	**5.76%**

Albania	12.71%	6.71%
Armenia	11.37%	5.37%
Azerbaijan	9.28%	3.28%
Belarus	17.17%	11.17%
Bosnia	15.70%	9.70%
Bulgaria	8.84%	2.84%
Croatia	9.72%	3.72%
Czech Republic	7.05%	1.05%
Estonia	7.05%	1.05%
Georgia	11.37%	5.37%
Hungary	9.72%	3.72%
Kazakhstan	8.84%	2.84%
Latvia	7.79%	1.79%
Lithuania	7.79%	1.79%
Macedonia	11.37%	5.37%
Moldova	15.70%	9.70%
Montenegro	11.37%	5.37%
Poland	7.26%	1.26%
Romania	9.28%	3.28%
Russia	9.72%	3.72%
Serbia	12.71%	6.71%
Slovakia	7.26%	1.26%
Slovenia	9.28%	3.28%
Ukraine	20.90%	14.90%
Eastern Europe & Russia	**9.65%**	**3.65%**

Abu Dhabi	6.74%	0.74%
Bahrain	9.28%	3.28%
Israel	7.05%	1.05%
Jordan	12.71%	6.71%
Kuwait	6.74%	0.74%
Lebanon	14.20%	8.20%
Oman	7.05%	1.05%
Qatar	6.74%	0.74%
Ras Al Khaimah	7.26%	1.26%
Saudi Arabia	6.90%	0.90%
Sharjah	7.79%	1.79%
United Arab Emirates	6.74%	0.74%
Middle East	**7.11%**	**1.11%**

Frontier Markets (not rated)

Algeria	63.0	12.71%	6.71%	Malawi	57.0	17.17%	11.17%
Brunei	72.8	8.84%	2.84%	Mali	62.5	12.71%	6.71%
Gambia	62.0	14.20%	8.20%	Myanmar	63.3	12.71%	6.71%
Guinea	53.8	17.17%	11.17%	Niger	51.0	17.17%	11.17%
Guinea-Bissau	62.3	12.71%	6.71%	Sierra Leone	56.5	17.17%	11.17%
Guyana	63.5	12.71%	6.71%	Somalia	42.5	20.90%	14.90%
Haiti	57.0	17.17%	11.17%	Sudan	48.3	20.90%	14.90%
Iran	67.8	10.48%	4.48%	Syria	35.8	25.00%	19.00%
Iraq	56.0	17.17%	11.17%	Tanzania	63.0	12.71%	6.71%
Korea, D.P.R.	56.0	17.17%	11.17%	Togo	63.8	12.71%	6.71%
Liberia	50.5	17.17%	11.17%	Yemen, Republic	50.3	17.17%	11.17%
Libya	52.8	17.17%	11.17%	Zimbabwe	54.5	17.17%	11.17%
Madagascar	61.3	14.20%	8.20%				

Bangladesh	11.37%	5.37%
Cambodia	14.20%	8.20%
China	6.90%	0.90%
Fiji	12.71%	6.71%
Hong Kong	6.59%	0.59%
India	9.28%	3.28%
Indonesia	9.28%	3.28%
Japan	7.05%	1.05%
Korea	6.74%	0.74%
Macao	6.74%	0.74%
Malaysia	7.79%	1.79%
Mauritius	8.38%	2.38%
Mongolia	14.20%	8.20%
Pakistan	15.70%	9.70%
Papua New Guine	12.71%	6.71%
Philippines	8.84%	2.84%
Singapore	6.00%	0.00%
Sri Lanka	12.71%	6.71%
Taiwan	6.90%	0.90%
Thailand	8.38%	2.38%
Vietnam	12.71%	6.71%
Asia	**7.49%**	**1.49%**

Australia	6.00%	0.00%
Cook Islands	12.71%	6.71%
New Zealand	6.00%	0.00%
Australia & NZ	**6.00%**	**0.00%**

Black #: Total ERP
Red #: Country risk premium
AVG: GDP weighted average

From Country Equity Risk Premiums to Corporate Equity Risk premiums

- Approach 1: Assume that every company in the country is equally exposed to country risk. In this case,
  - E(Return) = Riskfree Rate + CRP + Beta (Mature ERP)
  - 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 (Mature ERP+ CRP)
- 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+ 🚲 (Mature ERP) + ✦ (CRP)

Mature ERP = Mature market Equity Risk Premium

CRP = Additional country risk premium

Approaches 1 & 2: Estimating country risk premium exposure

- Location based CRP: The standard approach in valuation is to attach a country risk premium to a company based upon its country of incorporation. Thus, if you are an Indian company, you are assumed to be exposed to the Indian country risk premium. A developed market company is assumed to be unexposed to emerging market risk.
- Operation-based CRP: There is a more reasonable modified version. The country risk premium for a company can be computed as a weighted average of the country risk premiums of the countries that it does business in, with the weights based upon revenues or operating income. If a company is exposed to risk in dozens of countries, you can take a weighted average of the risk premiums by region.

Operation based CRP: Single versus Multiple Emerging Markets

- Single emerging market: Embraer, in 2004, reported that it derived 3% of its revenues in Brazil and the balance from mature markets. The mature market ERP in 2004 was 5% and Brazil's CRP was 7.89%.

	Revenues	Total ERP	CRP
US and other mature markets	97%	5.00%	0.00%
Brazil	3%	12.89%	8%
Embraer		**5.24%**	**0.24%**

- Multiple emerging markets: Ambev, the Brazilian-based beverage company, reported revenues from the following countries during 2011.

	Revenues	%	Total ERP	CRP
Argentina	19	9.31%	15.00%	9.00%
Bolivia	4	1.96%	10.88%	4.88%
Brazil	130	63.73%	8.63%	2.63%
Canada	23	11.27%	6.00%	0.00%
Chile	7	3.43%	7.05%	1.05%
Ecuador	6	2.94%	12.75%	6.75%
Paraguay	3	1.47%	12.00%	6.00%
Peru	12	5.88%	9.00%	3.00%
Ambev	**204**		**9.11%**	**3.11%**

Extending to a multinational: Regional breakdown Coca Cola's revenue breakdown and ERP in 2012

Region	*Revenues*	*Total ERP*	*CRP*
Western Europe	19%	6.67%	0.67%
Eastern Europe & Russia	5%	8.60%	2.60%
Asia	15%	7.63%	1.63%
Latin America	15%	9.42%	3.42%
Australia	4%	6.00%	0.00%
Africa	4%	9.82%	3.82%
North America	40%	6.00%	0.00%
Coca Cola	100%	7.14%	1.14%

Things to watch out for

1. Aggregation across regions. For instance, the Pacific region often includes Australia & NZ with Asia
2. Obscure aggregations including Eurasia and Oceania

Two problems with these approaches..

- Focus just on revenues: To the extent that revenues are the only variable that you consider, when weighting risk exposure across markets, you may be missing other exposures to country risk. For instance, an emerging market company that gets the bulk of its revenues outside the country (in a developed market) may still have all of its production facilities in the emerging market.
- Exposure not adjusted or based upon beta: To the extent that the country risk premium is multiplied by a beta, we are assuming that beta in addition to measuring exposure to all other macro economic risk also measures exposure to country risk.

A Production-based ERP: Royal Dutch Shell in 2015

Country	*Oil & Gas Production*	*% of Total*	*ERP*
Denmark	17396	3.83%	6.20%
Italy	11179	2.46%	9.14%
Norway	14337	3.16%	6.20%
UK	20762	4.57%	6.81%
Rest of Europe	*874*	*0.19%*	*7.40%*
Brunei	823	0.18%	9.04%
Iraq	20009	4.40%	11.37%
Malaysia	22980	5.06%	8.05%
Oman	78404	17.26%	7.29%
Russia	22016	4.85%	10.06%
Rest of Asia & ME	*24480*	*5.39%*	*7.74%*
Oceania	*7858*	*1.73%*	*6.20%*
Gabon	12472	2.75%	11.76%
Nigeria	67832	14.93%	11.76%
Rest of Africa	6159	1.36%	12.17%
USA	104263	22.95%	6.20%
Canada	8599	1.89%	6.20%
Brazil	13307	2.93%	9.60%
Rest of Latin America	*576*	*0.13%*	*10.78%*
Royal Dutch Shell	**454326**	**100.00%**	**8.26%**

Approach 3: Estimate a lambda for country risk

- Country risk exposure is affected by where you get your revenues and where your production happens, but there are a host of other variables that also affect this exposure, including:
  - Use of risk management products: Companies can use both options/futures markets and insurance to hedge some or a significant portion of country risk.
  - Government "national" interests: There are sectors that are viewed as vital to the national interests, and governments often play a key role in these companies, either officially or unofficially. These sectors are more exposed to country risk.
- It is conceivable that there is a richer measure of country risk that incorporates all of the variables that drive country risk in one measure. That way my rationale when I devised "lambda" as my measure of country risk exposure.

A Revenue-based Lambda

- 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$_{average\ firm}$

- Consider two firms – Tata Motors and Tata Consulting Services, both Indian companies. In 2008-09, Tata Motors got about 91.37% of its revenues in India and TCS got 7.62%. The average Indian firm gets about 80% of its revenues in India:

  $\lambda_{Tata\ Motors}$= 91%/80% = 1.14

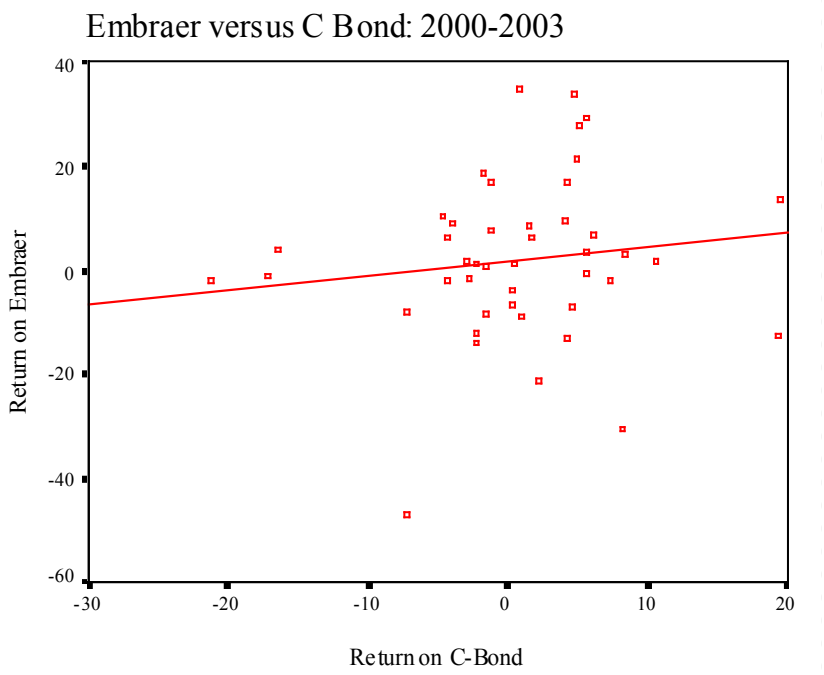
  λ_{TCS}= 7.62%/80% = 0.09

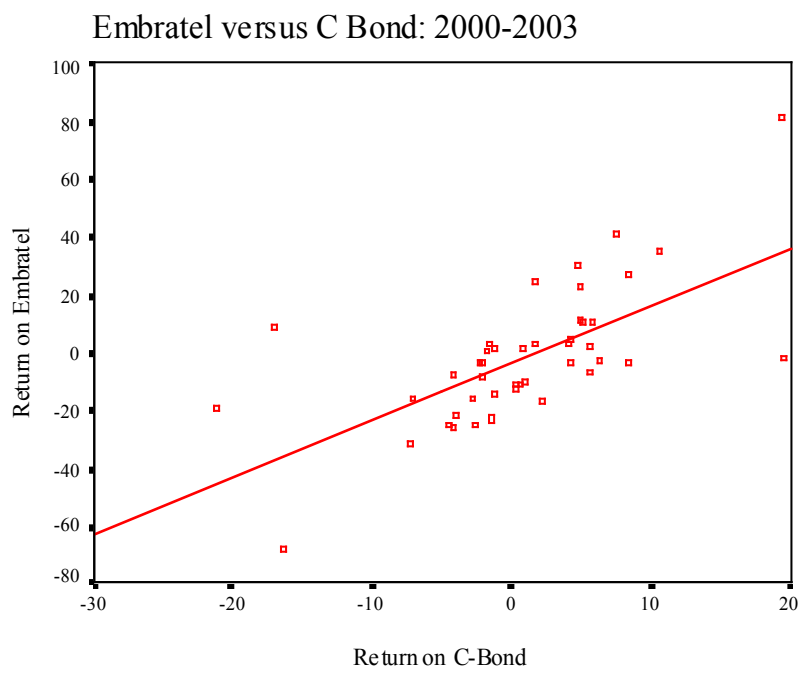
- There are two implications
  - A company's risk exposure is determined by where it does business and not by where it is incorporated.
  - Firms might be able to actively manage their country risk exposures

A Price/Return based Lambda

$$\text{Return}_{\text{Embraer}} = 0.0195 + \mathbf{0.2681}\ \text{Return}_{\text{C Bond}}$$

$$\text{Return}_{\text{Embratel}} = -0.0308 + \mathbf{2.0030}\ \text{Return}_{\text{C Bond}}$$





Estimating a US Dollar Cost of Equity for Embraer - September 2004

- Assume that the beta for Embraer is 1.07, and that the US $ riskfree rate used is 4%. Also assume that the risk premium for the US is 5% and the country risk premium for Brazil is 7.89%. Finally, assume that Embraer gets 3% of its revenues in Brazil & the rest in the US.
- There are five estimates of $ cost of equity for Embraer:
  - Approach 1: Constant exposure to CRP, Location CRP
    - E(Return) = 4% + 1.07 (5%) + 7.89% = 17.24%
  - Approach 2: Constant exposure to CRP, Operation CRP
    - E(Return) = 4% + 1.07 (5%) + (0.03*7.89% +0.97*0%)= 9.59%
  - Approach 3: Beta exposure to CRP, Location CRP
    - E(Return) = 4% + 1.07 (5% + 7.89%)= 17.79%
  - Approach 4: Beta exposure to CRP, Operation CRP
    - E(Return) = 4% + 1.07 (5% +(0.03*7.89%+0.97*0%)) = 9.60%
  - Approach 5: Lambda exposure to CRP
    - E(Return) = 4% + 1.07 (5%) + 0.27(7.89%) = 11.48%

Valuing Emerging Market Companies with significant exposure in developed markets

- The conventional practice in investment banking is to add the country equity risk premium on to the cost of equity for every emerging market company, notwithstanding its exposure to emerging market risk. Thus, in 2004, Embraer would have been valued with a cost of equity of 17-18% even though it gets only 3% of its revenues in Brazil. As an investor, which of the following consequences do you see from this approach?

a. Emerging market companies with substantial exposure in developed markets will be significantly over valued by equity research analysts.

b. Emerging market companies with substantial exposure in developed markets will be significantly under valued by equity research analysts.

Can you construct an investment strategy to take advantage of the misvaluation? What would need to happen for you to make money of this strategy?

Implied Equity Premiums

- Let's start with a general proposition. If you know the price paid for an asset and have estimates of the expected cash flows on the asset, you can estimate the IRR of these cash flows. If you paid the price, this is what you have priced the asset to earn (as an expected return).
- If you assume that stocks are correctly priced in the aggregate and you can estimate the expected cashflows from buying stocks, you can estimate the expected rate of return on stocks by finding that discount rate that makes the present value equal to the price paid. Subtracting out the riskfree rate should yield an implied equity risk premium.
- This implied equity premium is a forward looking number and can be updated as often as you want (every minute of every day, if you are so inclined).

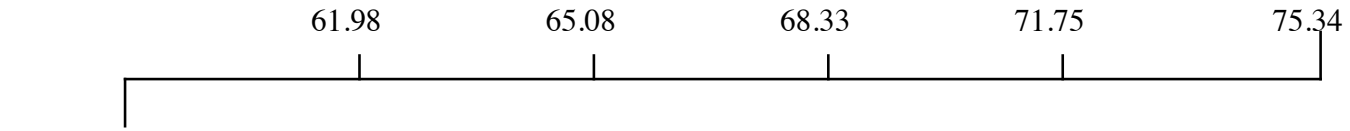
Implied Equity Premiums: January 2008

- We can use the information in stock prices to back out how risk averse the market is and how much of a risk premium it is demanding.

Between 2001 and 2007 dividends and stock buybacks averaged 4.02% of the index each year.

Analysts expect earnings to grow 5% a year for the next 5 years. We will assume that dividends & buybacks will keep pace.. Last year's cashflow (59.03) growing at 5% a year

After year 5, we will assume that earnings on the index will grow at 4.02%, the same rate as the entire economy (= riskfree rate).



January 1, 2008
S&P 500 is at 1468.36
4.02% of 1468.36 = 59.03

- If you pay the current level of the index, you can expect to make a return of 8.39% on stocks (which is obtained by solving for r in the following equation)

$$1468.36 = \frac{61.98}{(1+r)} + \frac{65.08}{(1+r)^2} + \frac{68.33}{(1+r)^3} + \frac{71.75}{(1+r)^4} + \frac{75.34}{(1+r)^5} + \frac{75.35(1.0402)}{(r-.0402)(1+r)^5}$$

- Implied Equity risk premium = Expected return on stocks - Treasury bond rate = 8.39% - 4.02% = 4.37%

A year that made a difference.. The implied premium in January 2009

Year	Market value of index	Dividends	Buybacks	Cash to equity	Dividend yield	Buyback yield	Total yield
2001	1148.09	15.74	14.34	30.08	1.37%	1.25%	2.62%
2002	879.82	15.96	13.87	29.83	1.81%	1.58%	3.39%
2003	1111.91	17.88	13.70	31.58	1.61%	1.23%	2.84%
2004	1211.92	19.01	21.59	40.60	1.57%	1.78%	3.35%
2005	1248.29	22.34	38.82	61.17	1.79%	3.11%	4.90%
2006	1418.30	25.04	48.12	73.16	1.77%	3.39%	5.16%
2007	1468.36	28.14	67.22	95.36	1.92%	4.58%	6.49%
2008	903.25	28.47	40.25	68.72	3.15%	4.61%	7.77%
Normalized	903.25	28.47	24.11	52.584	3.15%	2.67%	5.82%

In 2008, the actual cash returned to stockholders was 68.72. However, there was a 41% dropoff in buybacks in Q4. We reduced the total buybacks for the year by that amount.

Analysts expect earnings to grow 4% a year for the next 5 years. We will assume that dividends & buybacks will keep pace..
Last year's cashflow (52.58) growing at 4% a year

After year 5, we will assume that earnings on the index will grow at 2.21%, the same rate as the entire economy (= riskfree rate).

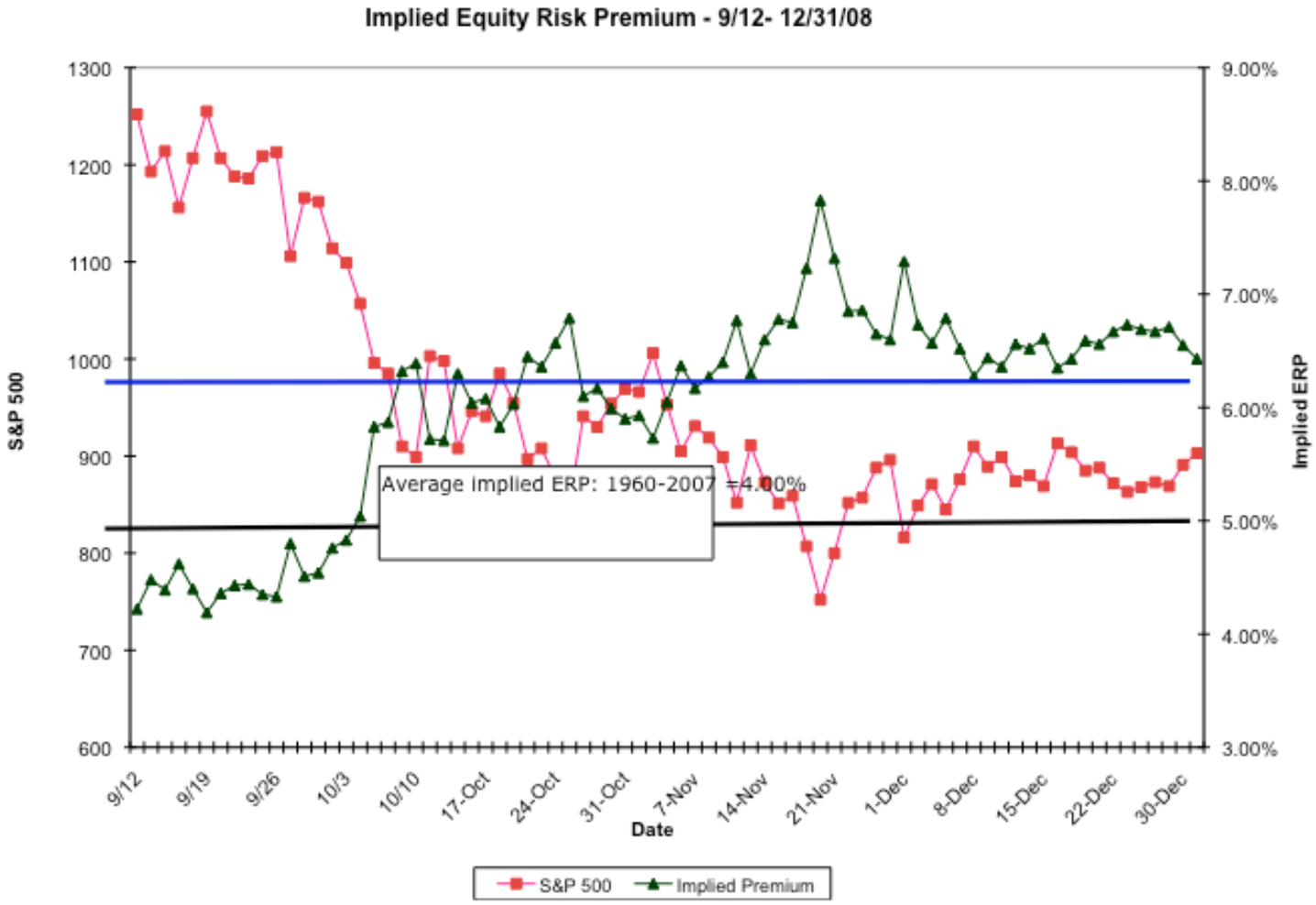
54.69 56.87 59.15 61.52 63.98

$$903.25 = \frac{54.69}{(1+r)} + \frac{56.87}{(1+r)^2} + \frac{59.15}{(1+r)^3} + \frac{61.52}{(1+r)^4} + \frac{63.98}{(1+r)^5} + \frac{63.98(1.0221)}{(r-.0221)(1+r)^5}$$

January 1, 2009
S&P 500 is at 903.25
Adjusted Dividends & Buybacks for 2008 = 52.58

Expected Return on Stocks (1/1/09) = 8.64%
Riskfree rate = 2.21%
Equity Risk Premium = 6.43%

The Anatomy of a Crisis: Implied ERP from September 12, 2008 to January 1, 2009



An Updated Equity Risk Premium: January 2016

Base year cash flow (last 12 mths)
Dividends (TTM): 42.66
+ Buybacks (TTM): 63.43
= Cash to investors (TTM): **106.09**

Payout ratio assumed to stay stable. 106.09 growing @ 5.55% a year

Expected growth in next 5 years
Top down analyst estimate of earnings growth for S&P 500: **5.55%**

	Last 12 mths	1	2	3	4	5	Terminal Year
Dividends + Buybacks	106.09	$111.99	$118.21	$124.77	$131.70	$139.02	142.17

Earnings and Cash flows grow @2.27% (set equal to risk free rate) a year forever.

S&P 500 on 1/1/16= 2043.94

$$2043.94 = \frac{111.99}{(1+r)} + \frac{118.21}{(1+r)^2} + \frac{124.77}{(1+r)^3} + \frac{131.70}{(1+r)^4} + \frac{139.02}{(1+r)^5} + \frac{142.17}{(r-.0227)(1+r)^5}$$

You have to solve for the discount rate (r). I used the solver or Goal seek function in Excel

r = Implied Expected Return on Stocks = 8.39%

Minus

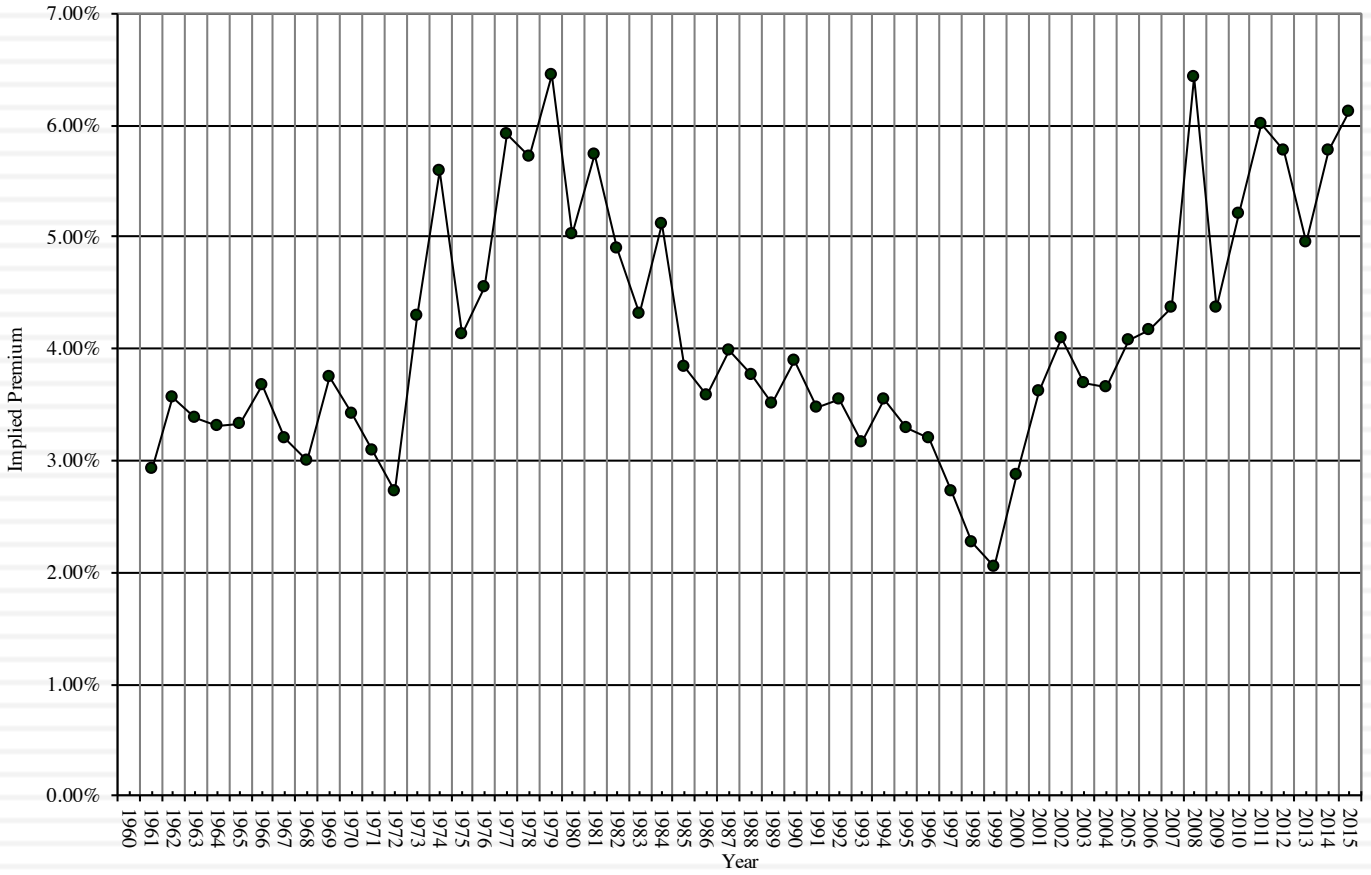
Risk free rate = T.Bond rate on 1/1/16= 2.27%

Equals

Implied Equity Risk Premium (1/1/16) = 8.39% - 2.27% = 6.12%

Implied Premiums in the US: 1960-2015

Implied Premium for US Equity Market: 1960-2015



A Buyback Adjusted Version of the US ERP

Base Year Earnings = 104.48
Base Year ROE = 14.18%

104.48 growing @ 5.55% a year

Expected growth in next 5 years
Top down analyst estimate of earnings growth for S&P 500: **5.55%**

Base year cash flow (last 12 mths)
Dividends (TTM): 42.66
+ Buybacks (TTM): 63.43
= Cash to investors (TTM): **106.09**
Payout Ratio = **101.54%**

Payout Ratio adjusts in linear steps to sustainable payout

Payout Ratio in stable growth
Growth rate = 2.27% a year forever
ROE = 14.18%
Sustainable Payout = 1 - .0227/.1418 = **83.99%**

	Last 12 months	1	2	3	4	5	*Terminal Year*
Earnings	104.48	110.29	116.41	122.88	129.70	136.91	140.01
Payout Ratio	101.54%	98.03%	94.52%	91.01%	87.50%	83.99%	83.99%
Cash Paid out	106.09	$ 108.12	$ 110.03	$ 111.83	$ 113.49	$ 114.99	117.60

Earnings and Cash flows grow @2.27% (set equal to risk free rate) a year forever.

S&P 500 on 1/1/16= 2043.94

$$2043.94 = \frac{108.12}{(1+r)} + \frac{110.03}{(1+r)^2} + \frac{111.83}{(1+r)^3} + \frac{113.49}{(1+r)^4} + \frac{114.99}{(1+r)^5} + \frac{117.60}{(r-.0227)(1+r)^5}$$

r = Implied Expected Return on Stocks = 7.43%

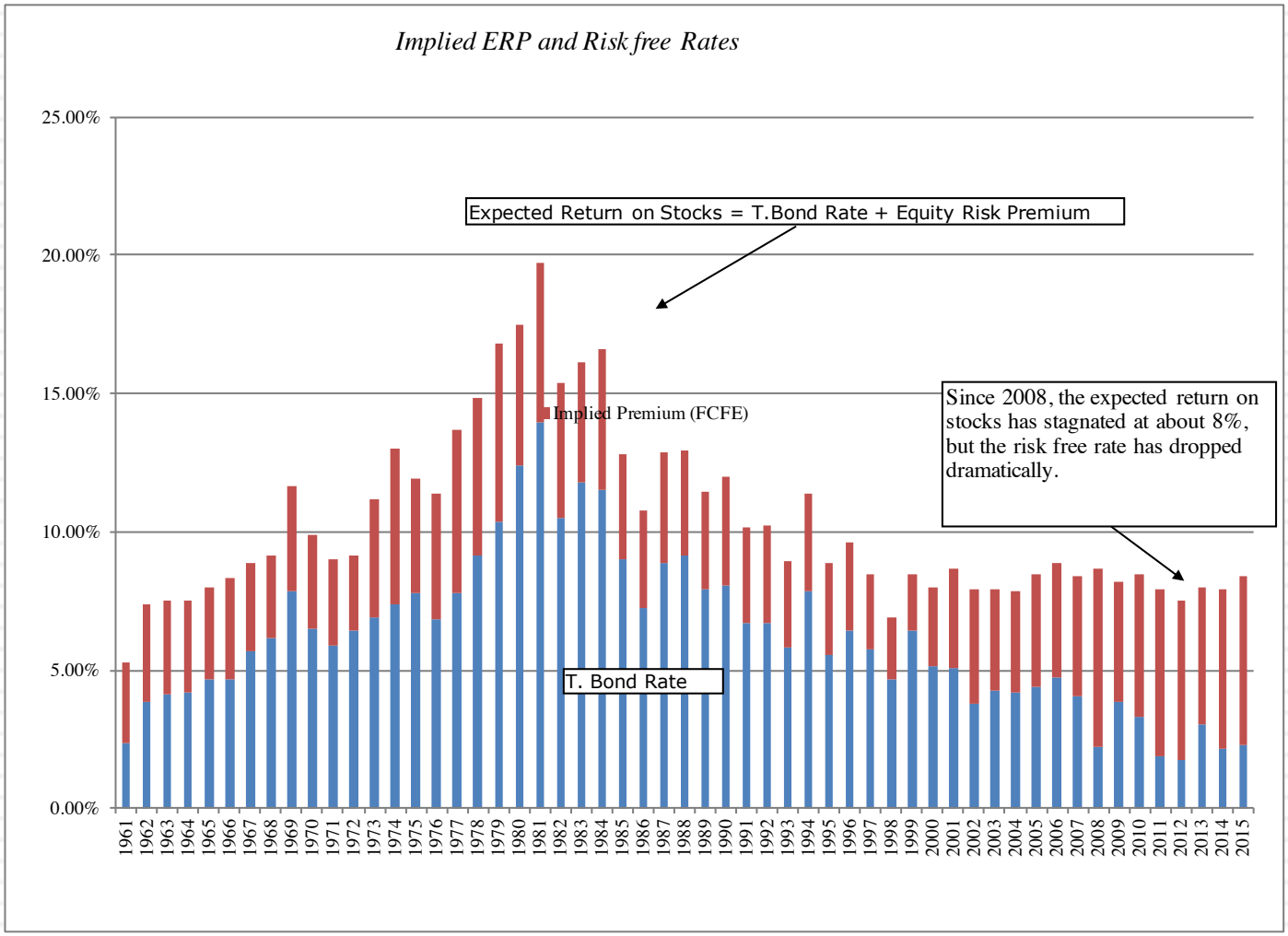
Minus

Risk free rate = T.Bond rate on 1/1/16= 2.27%

Equals

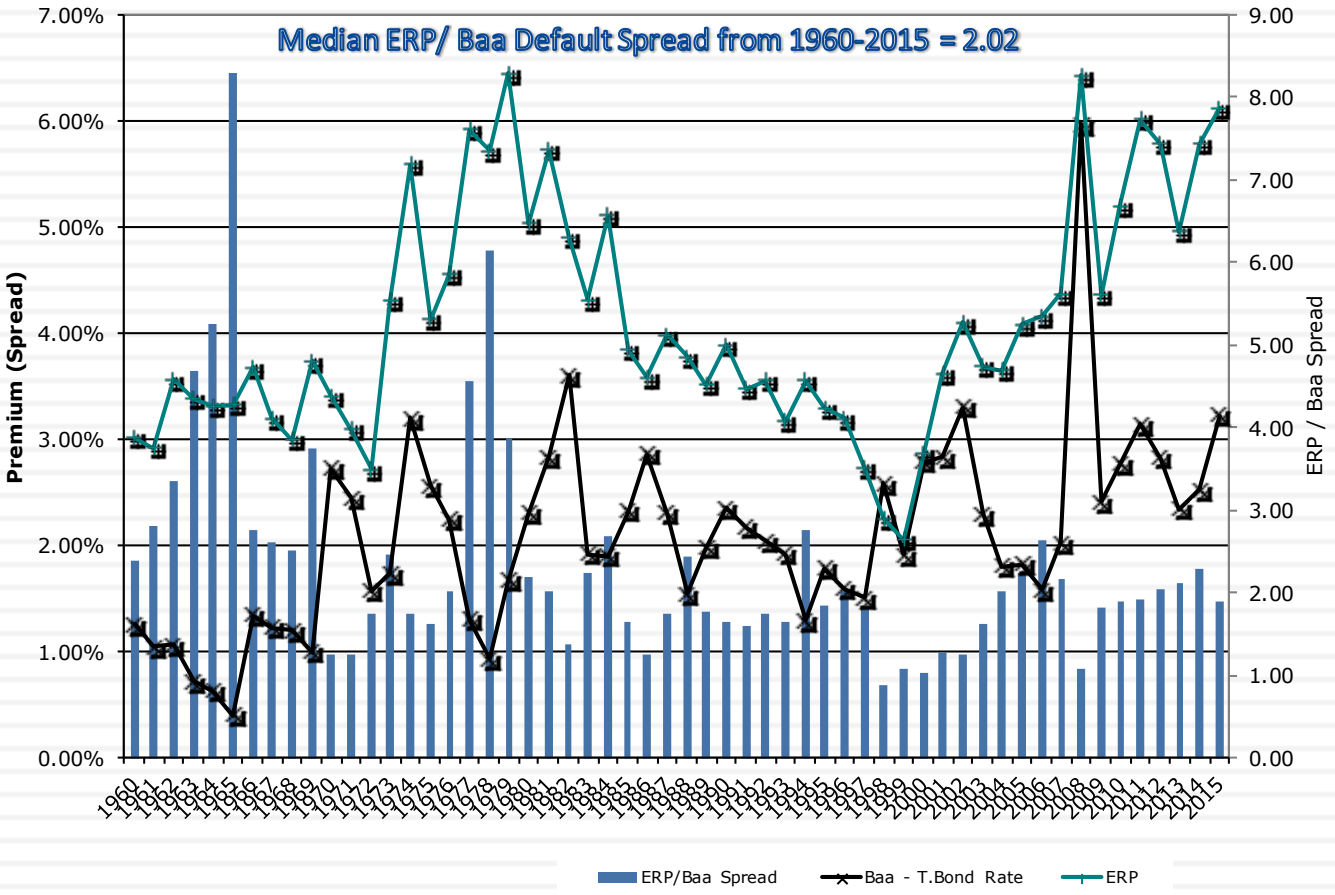
Implied Equity Risk Premium (1/1/16) = 7.43% - 2.27% = 5.16%

Implied Premium versus Risk Free Rate

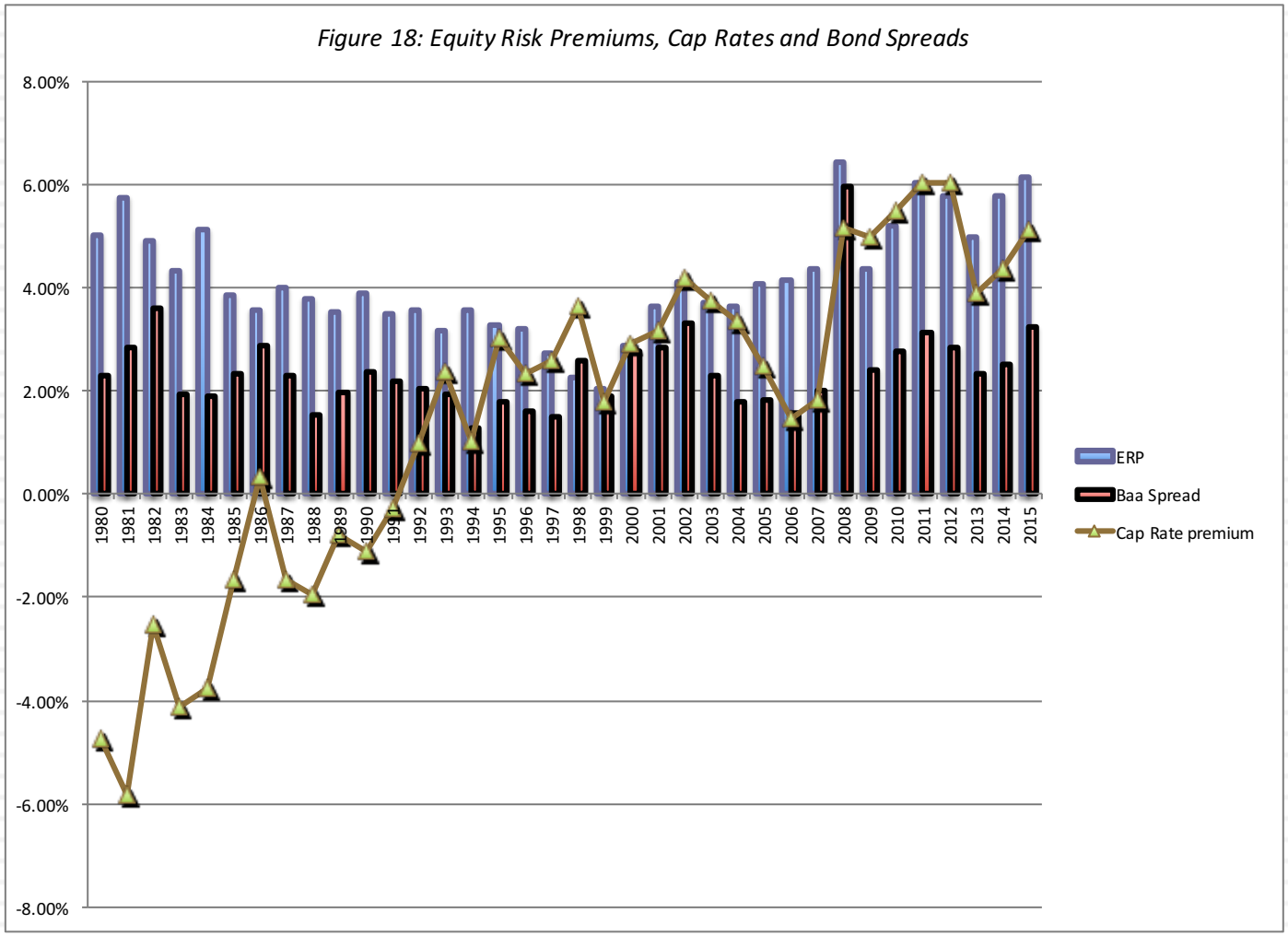


Equity Risk Premiums and Bond Default Spreads

Equity Risk Premiums and Bond Default Spreads



Equity Risk Premiums and Cap Rates (Real Estate)



Why implied premiums matter?

- In many investment banks, it is common practice (especially in corporate finance departments) to use historical risk premiums (and arithmetic averages at that) as risk premiums to compute cost of equity. If all analysts in the department used the arithmetic average premium (for stocks over T.Bills) for 1928-2015 of 7.92% to value stocks in January 2014, given the implied premium of 6.12%, what are they likely to find?

a. The values they obtain will be too low (most stocks will look overvalued)

b. The values they obtain will be too high (most stocks will look under valued)

c. There should be no systematic bias as long as they use the same premium to value all stocks.

Which equity risk premium should you use?

If you assume this	Premium to use
Premiums revert back to historical norms and your time period yields these norms	Historical risk premium
Market is correct in the aggregate or that your valuation should be market neutral	Current implied equity risk premium
Marker makes mistakes even in the aggregate but is correct over time	Average implied equity risk premium over time.

Predictor	Correlation with implied premium next year	Correlation with actual return- next 5 years	Correlation with actual return – next 10 years
Current implied premium	0.750	0.475	0.541
Average implied premium: Last 5 years	0.703	0.541	0.747
Historical Premium	-0.476	-0.442	-0.469
Default Spread based premium	0.035	0.234	0.225

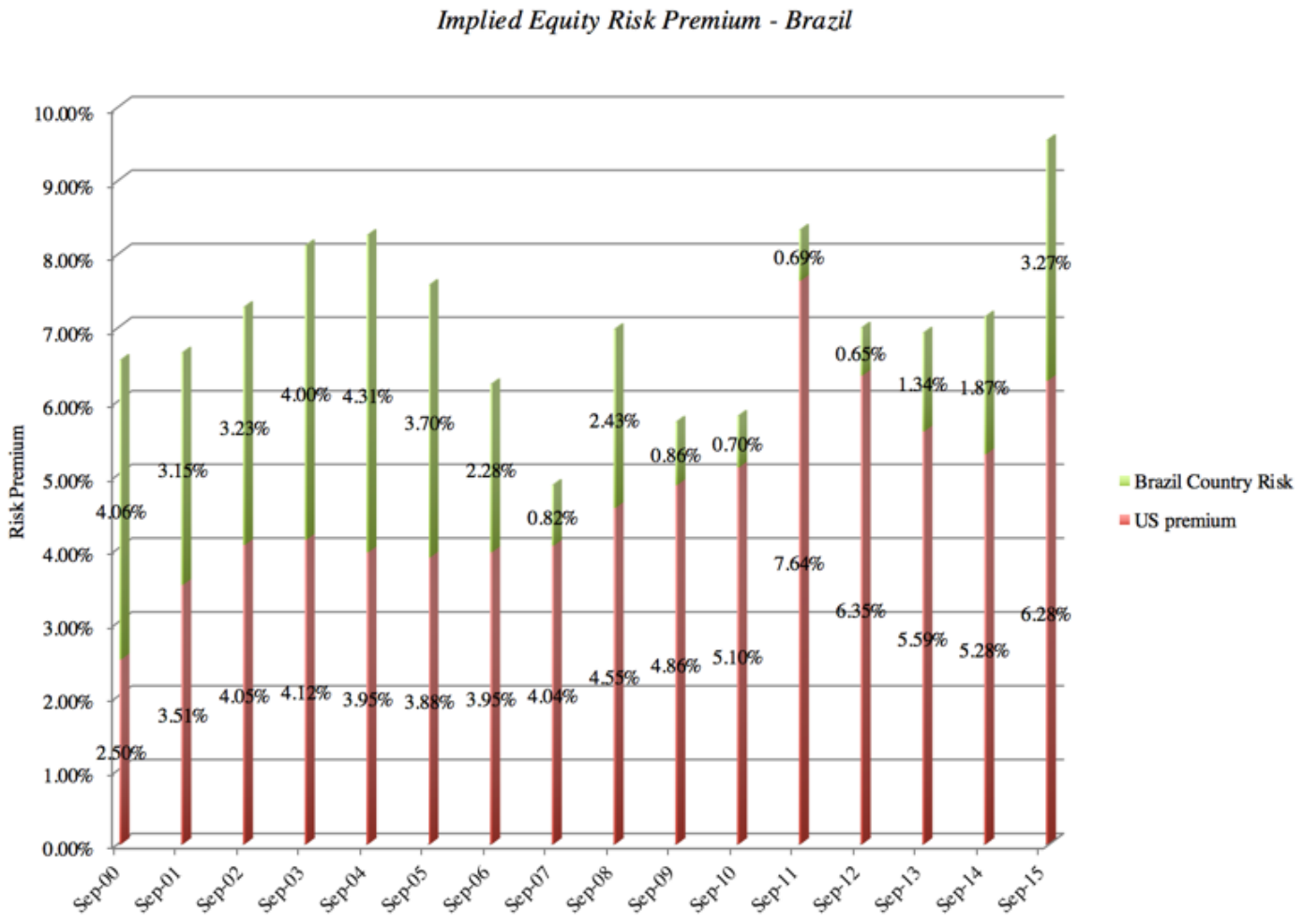
An ERP for the Sensex

- Inputs for the computation
  - Sensex on 9/5/07 = 15446
  - Dividend yield on index = 3.05%
  - Expected growth rate - next 5 years = 14%
  - Growth rate beyond year 5 = 6.76% (set equal to riskfree rate)
- Solving for the expected return:

$$15446 = \frac{537.06}{(1+r)} + \frac{612.25}{(1+r)^2} + \frac{697.86}{(1+r)^3} + \frac{795.67}{(1+r)^4} + \frac{907.07}{(1+r)^5} + \frac{907.07(1.0676)}{(r-.0676)(1+r)^5}$$

- Expected return on stocks = 11.18%
- Implied equity risk premium for India = 11.18% - 6.76% = 4.42%

Changing Country Risk: Brazil CRP & Total ERP from 2000 to 2015



The evolution of Emerging Market Risk

Start of year	PBV Developed	PBV Emerging	ROE Developed	ROE Emerging	US T.Bond rate	Growth Rate Developed	Growth Rate Emerging	Cost of Equity (Developed)	Cost of Equity (Emerging)	**Differential ERP**
2004	2.00	1.19	10.81%	11.65%	4.25%	3.75%	5.25%	7.28%	10.63%	**3.35%**
2005	2.09	1.27	11.12%	11.93%	4.22%	3.72%	5.22%	7.26%	10.50%	**3.24%**
2006	2.03	1.44	11.32%	12.18%	4.39%	3.89%	5.39%	7.55%	10.11%	**2.56%**
2007	1.67	1.67	10.87%	12.88%	4.70%	4.20%	5.70%	8.19%	10.00%	**1.81%**
2008	0.87	0.83	9.42%	11.12%	4.02%	3.52%	5.02%	10.30%	12.37%	**2.07%**
2009	1.20	1.34	8.48%	11.02%	2.21%	1.71%	3.21%	7.35%	9.04%	**1.69%**
2010	1.39	1.43	9.14%	11.22%	3.84%	3.34%	4.84%	7.51%	9.30%	**1.79%**
2011	1.12	1.08	9.21%	10.04%	3.29%	2.79%	4.29%	8.52%	9.61%	**1.09%**
2012	1.17	1.18	9.10%	9.33%	1.88%	1.38%	2.88%	7.98%	8.35%	**0.37%**
2013	1.56	1.63	8.67%	10.48%	1.76%	1.26%	2.76%	6.02%	7.50%	**1.48%**
2014	1.95	1.50	9.27%	9.64%	3.04%	2.54%	4.04%	6.00%	7.77%	**1.77%**
2015	1.88	1.56	9.69%	9.75%	2.17%	1.67%	3.17%	5.94%	7.39%	**1.45%**
2016	1.89	1.59	9.24%	10.16%	2.27%	1.77%	3.27%	5.72%	7.60%	**1.88%**

Discount Rates: III

Relative Risk Measures

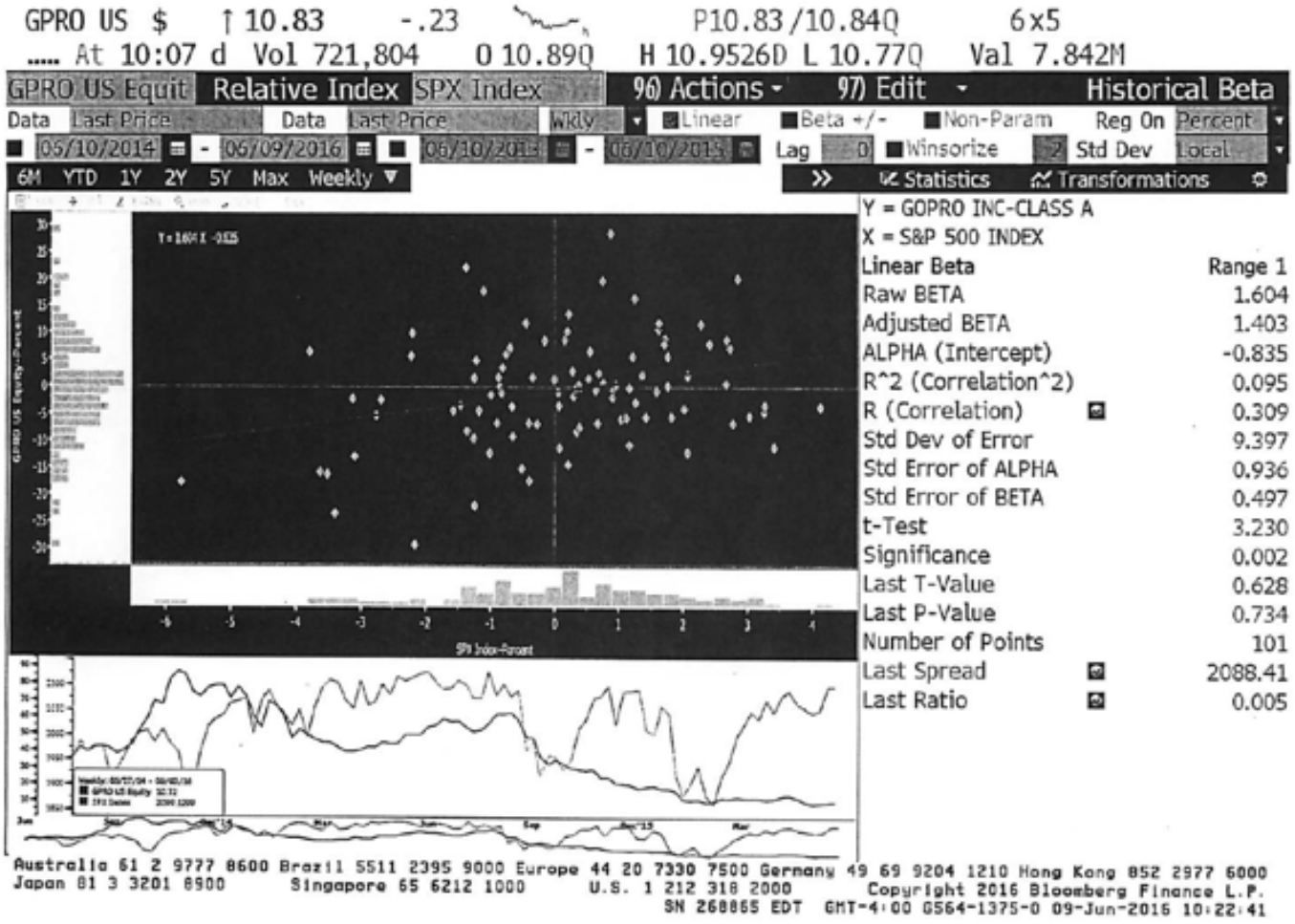
The CAPM Beta: The Most Used (and Misused) Risk Measure

- The standard procedure for estimating betas is to regress stock returns (Rj) against market returns (Rm) -

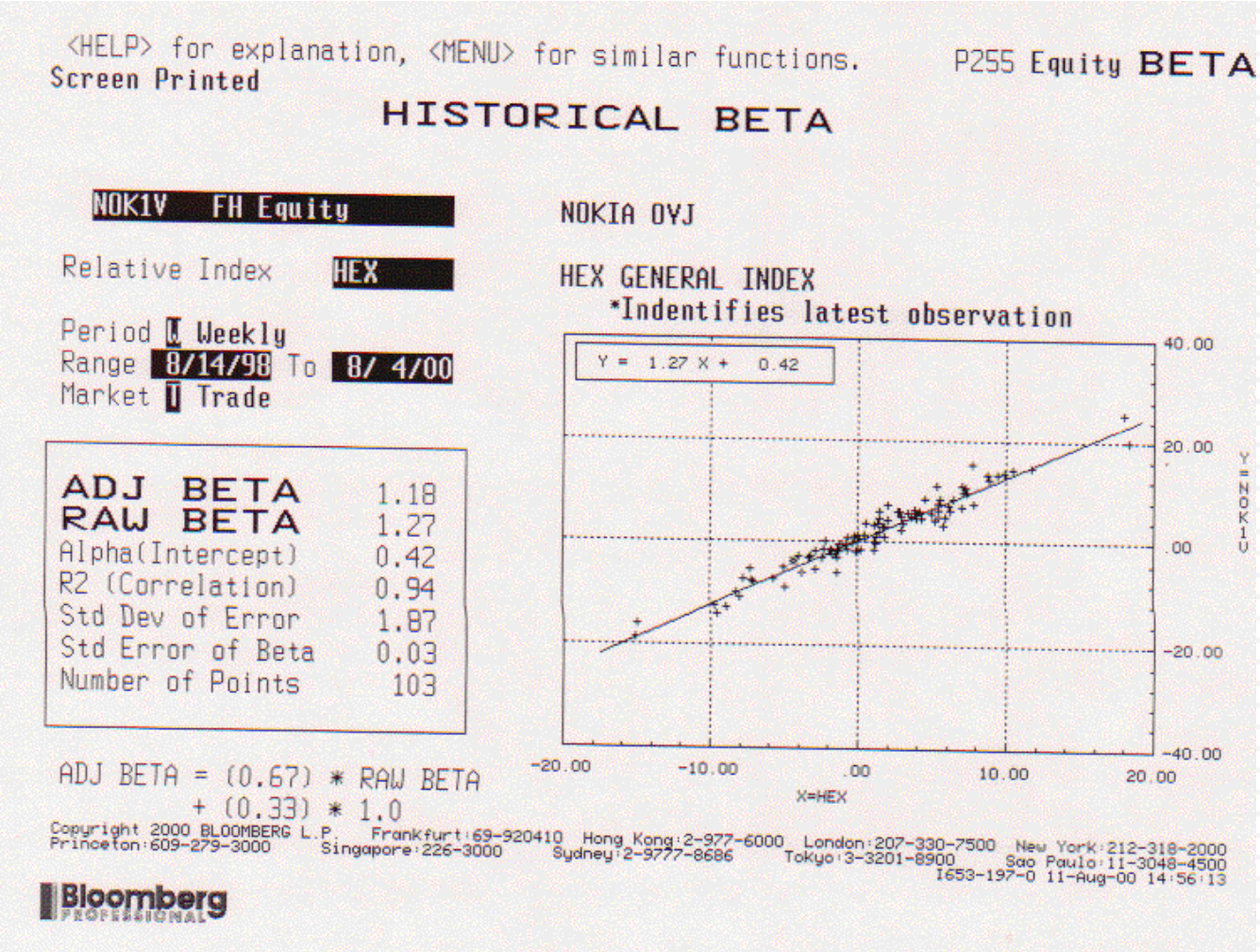
  Rj = a + b Rm

  where a is the intercept and b is the slope of the regression.
- The slope of the regression corresponds to the beta of the stock, and measures the riskiness of the stock.
- This beta has three problems:
  - It has high standard error
  - It reflects the firm's business mix over the period of the regression, not the current mix
  - It reflects the firm's average financial leverage over the period rather than the current leverage.

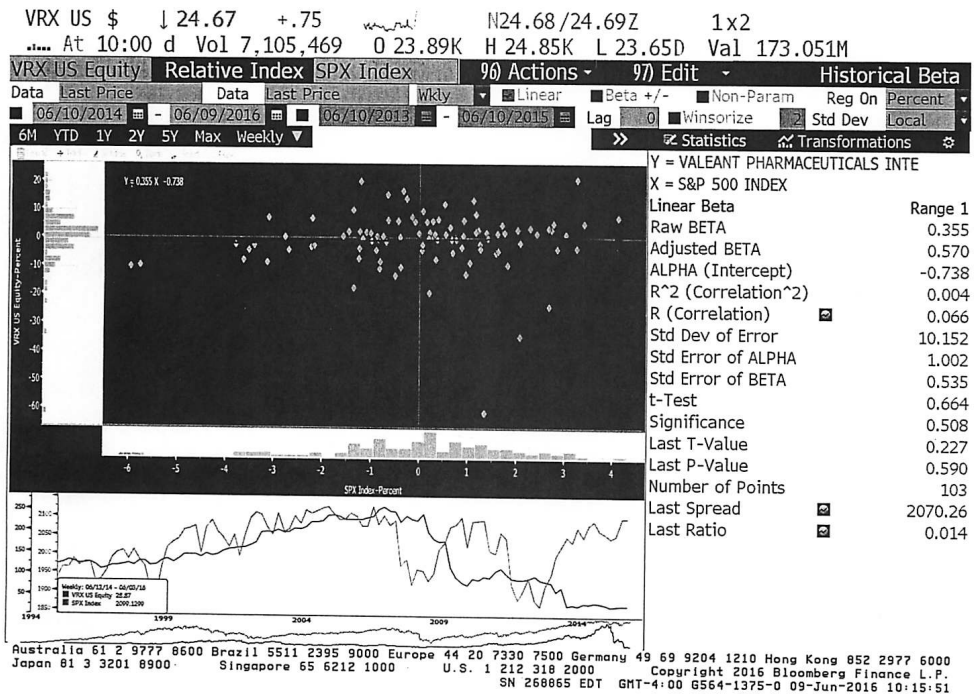
Unreliable, when it looks bad..



Or when it looks good..

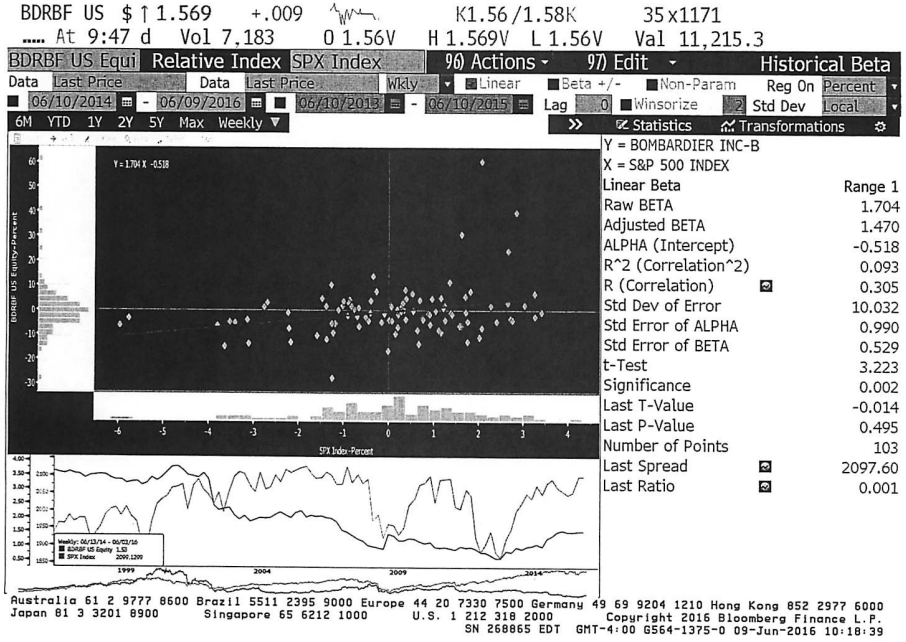


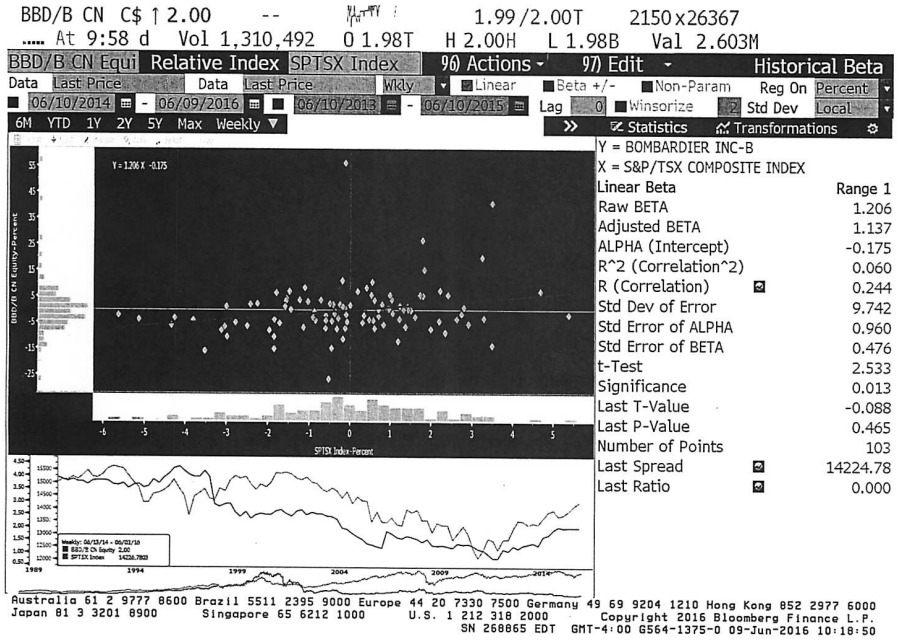
One slice of history..



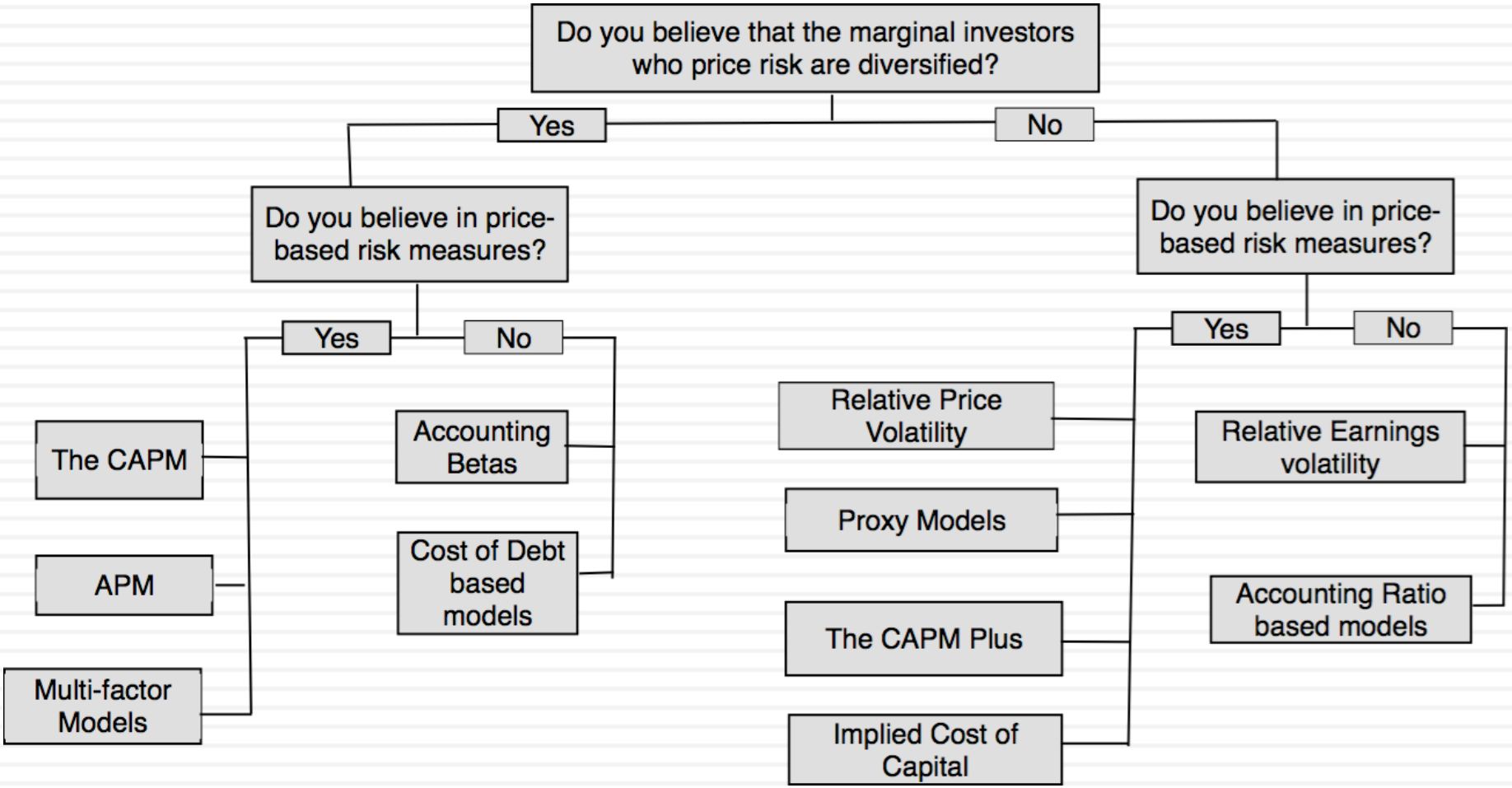
During this time period, Valeant was a stock under siege, without a CEO, under legal pressure & lacking financials.

And subject to game playing





Measuring Relative Risk: You don't like betas or modern portfolio theory? No problem.



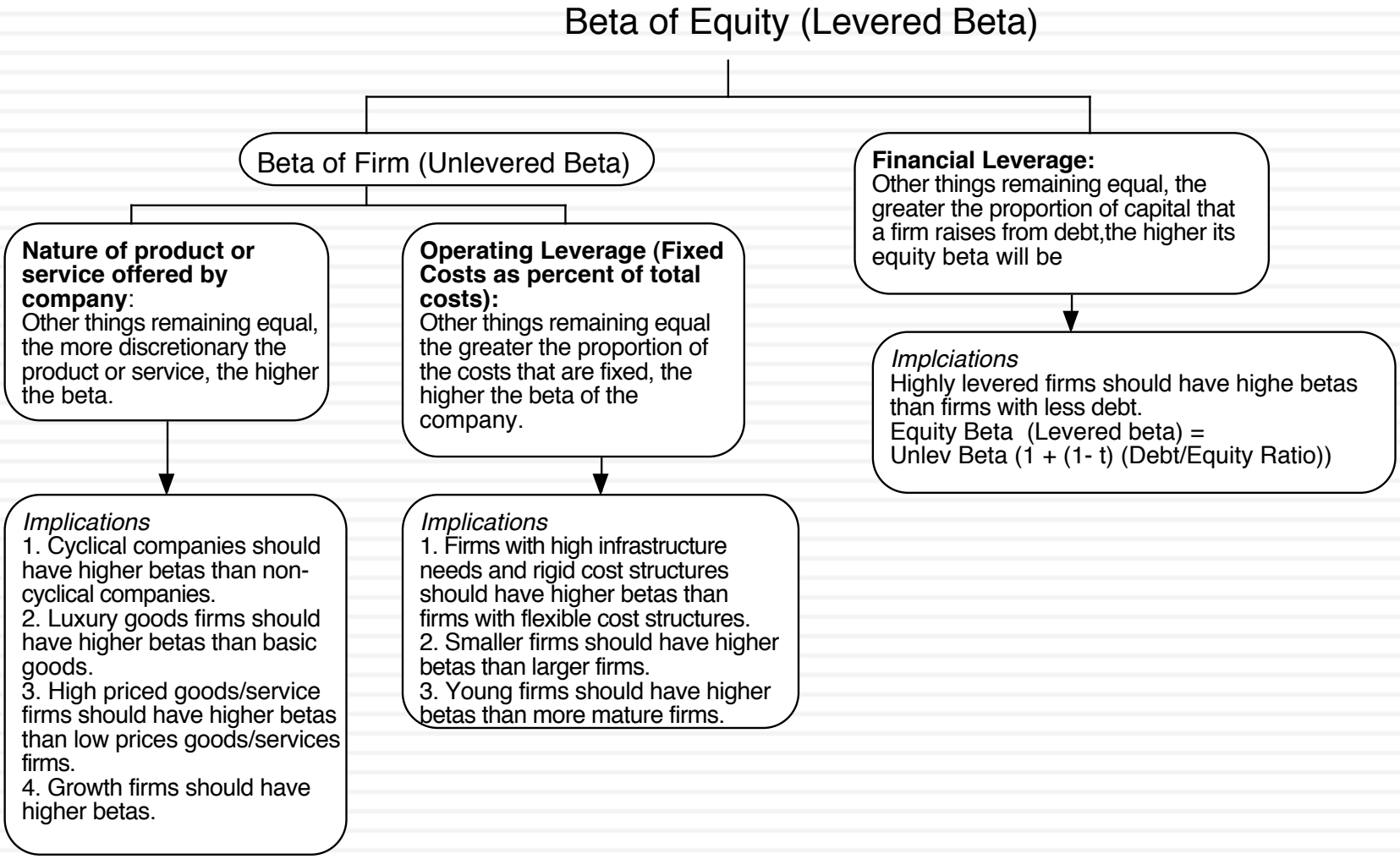
Don't like the diversified investor focus, but okay with price-based measures

1. Relative Standard Deviation
   - Relative Volatility = Std dev of Stock/ Average Std dev across all stocks
   - Captures all risk, rather than just market risk
2. Proxy Models
   - Look at historical returns on all stocks and look for variables that explain differences in returns.
   - You are, in effect, running multiple regressions with returns on individual stocks as the dependent variable and fundamentals about these stocks as independent variables.
   - This approach started with market cap (the small cap effect) and over the last two decades has added other variables (momentum, liquidity etc.)
3. CAPM Plus Models
   - Start with the traditional CAPM (Rf + Beta (ERP)) and then add other premiums for proxies.

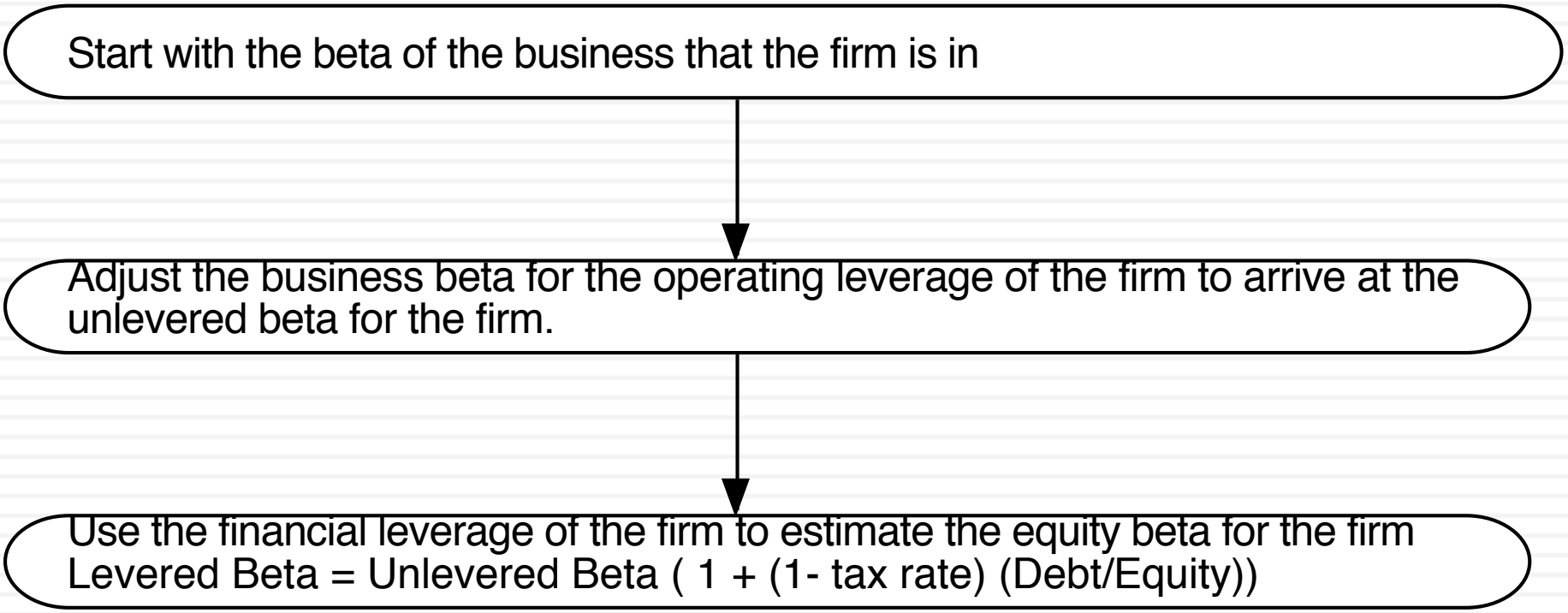
Don't like the price-based approach..

1. Accounting risk measures: To the extent that you don't trust market-priced based measures of risk, you could compute relative risk measures based on
   - Accounting earnings volatility: Compute an accounting beta or relative volatility
   - Balance sheet ratios: You could compute a risk score based upon accounting ratios like debt ratios or cash holdings (akin to default risk scores like the Z score)
2. Qualitative Risk Models: In these models, risk assessments are based at least partially on qualitative factors (quality of management).
3. Debt based measures: You can estimate a cost of equity, based upon an observable costs of debt for the company.
   - Cost of equity = Cost of debt * Scaling factor
   - The scaling factor can be computed from implied volatilities.

Determinants of Betas & Relative Risk



In a perfect world… we would estimate the beta of a firm by doing the following



Adjusting for operating leverage…

- Within any business, firms with lower fixed costs (as a percentage of total costs) should have lower unlevered betas. If you can compute fixed and variable costs for each firm in a sector, you can break down the unlevered beta into business and operating leverage components.
  - Unlevered beta = Pure business beta * (1 + (Fixed costs/ Variable costs))
- The biggest problem with doing this is informational. It is difficult to get information on fixed and variable costs for individual firms.
- In practice, we tend to assume that the operating leverage of firms within a business are similar and use the same unlevered beta for every firm.

Adjusting for financial leverage…

- Conventional approach: If we assume that debt carries no market risk (has a beta of zero), the beta of equity alone can be written as a function of the unlevered beta and the debt-equity ratio

  $\beta_L = \beta_u (1+ ((1-t)D/E))$

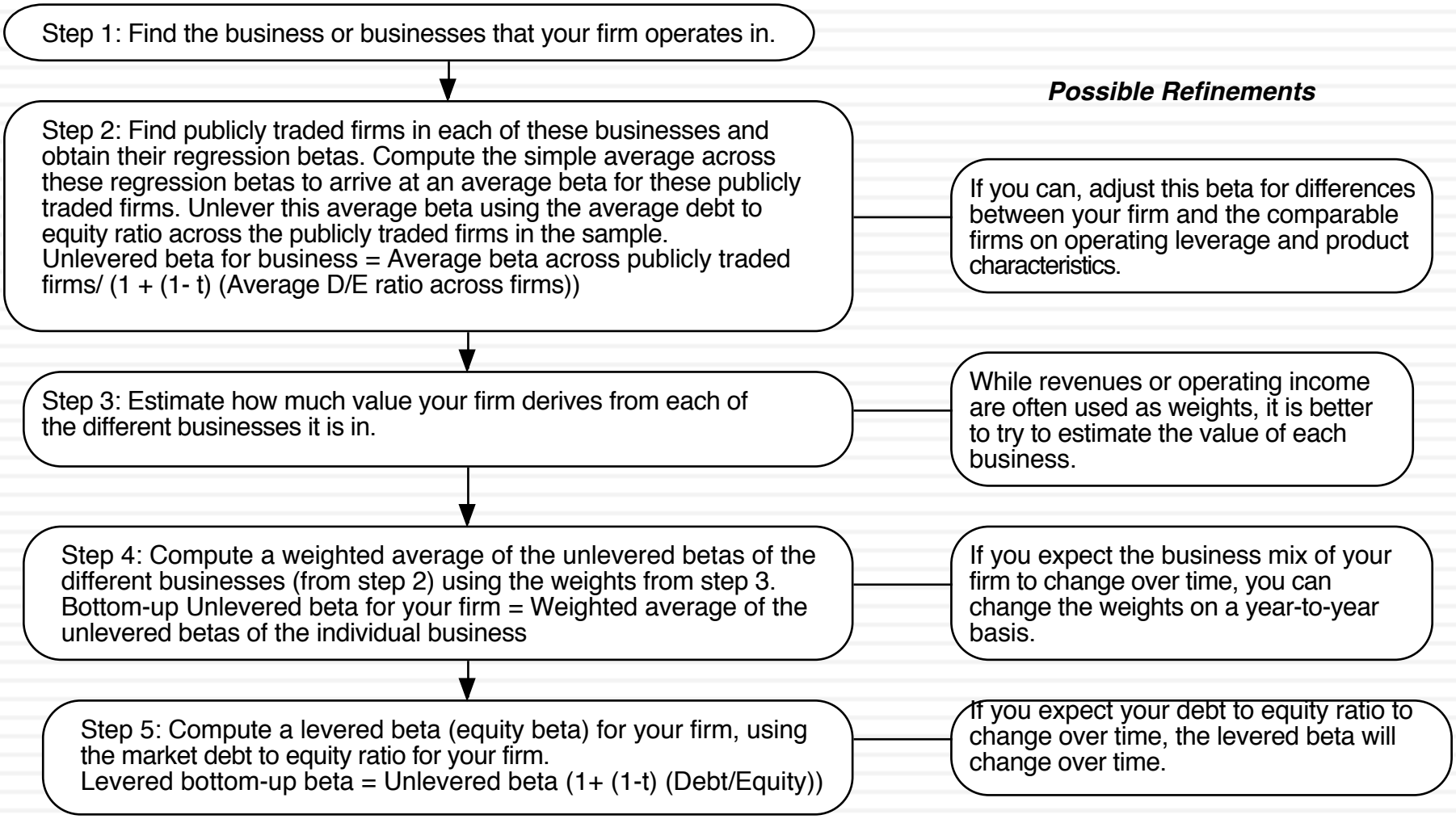
  In some versions, the tax effect is ignored and there is no (1-t) in the equation.

- Debt Adjusted Approach: If beta carries market risk and you can estimate the beta of debt, you can estimate the levered beta as follows:

  $\beta_L = \beta_u (1+ ((1-t)D/E)) - \beta_{debt} (1-t) (D/E)$

  While the latter is more realistic, estimating betas for debt can be difficult to do.

Bottom-up Betas



Why bottom-up betas?

- The standard error in a bottom-up beta will be significantly lower than the standard error in a single regression beta. Roughly speaking, the standard error of a bottom-up beta estimate can be written as follows:

Std error of bottom-up beta = $$\frac{\text{Average Std Error across Betas}}{\sqrt{\text{Number of firms in sample}}}$$

- The bottom-up beta can be adjusted to reflect changes in the firm's business mix and financial leverage. Regression betas reflect the past.
- You can estimate bottom-up betas even when you do not have historical stock prices. This is the case with initial public offerings, private businesses or divisions of companies.

Estimating Bottom Up Betas & Costs of Equity: Vale

Business	*Sample*	*Sample size*	*Unlevered beta of business*	*Revenues*	*Peer Group EV/Sales*	*Value of Business*	*Proportion of Vale*
Metals & Mining	Global firms in metals & mining, Market cap>$1 billion	48	0.86	$9,013	1.97	$17,739	16.65%
Iron Ore	Global firms in iron ore	78	0.83	$32,717	2.48	$81,188	76.20%
Fertilizers	Global specialty chemical firms	693	0.99	$3,777	1.52	$5,741	5.39%
Logistics	Global transportation firms	223	0.75	$1,644	1.14	$1,874	1.76%
Vale Operations			*0.8440*	*$47,151*		*$106,543*	*100.00%*

Business	Unlevered beta	D/E ratio	Levered beta	Risk free rate	ERP	Cost of Equity
Metals & Mining	0.86	54.99%	1.1657	2.75%	7.38%	11.35%
Iron Ore	0.83	54.99%	1.1358	2.75%	7.38%	11.13%
Fertilizers	0.99	54.99%	1.3493	2.75%	7.38%	12.70%
Logistics	0.75	54.99%	1.0222	2.75%	7.38%	10.29%
Vale Operations	0.84	54.99%	1.1503	2.75%	7.38%	11.23%

Embraer's Bottom-up Beta

Business	Unlevered Beta	D/E Ratio	Levered beta
Aerospace	0.95	18.95%	1.07

- Levered Beta = Unlevered Beta (1 + (1- tax rate) (D/E Ratio)
  = 0.95 (1 + (1-.34) (.1895)) = 1.07

- Can an unlevered beta estimated using U.S. and European aerospace companies be used to estimate the beta for a Brazilian aerospace company?

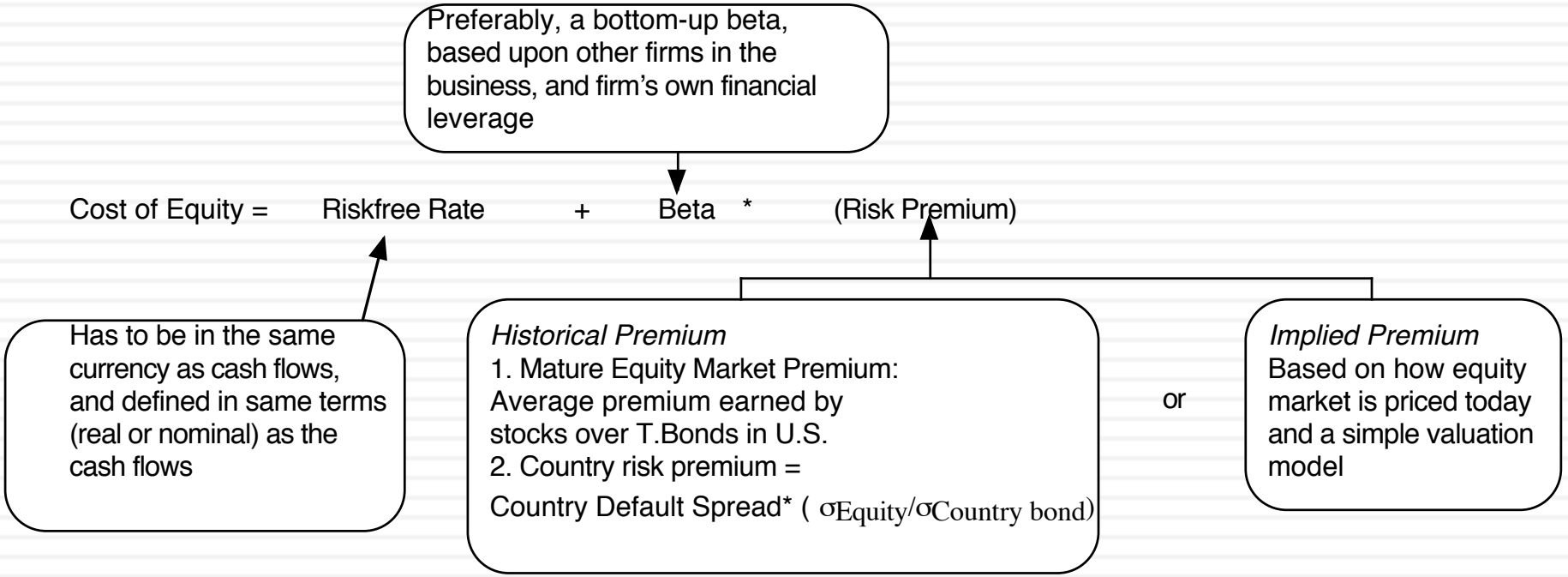
a. Yes
b. No

What concerns would you have in making this assumption?

Gross Debt versus Net Debt Approaches

- Analysts in Europe and Latin America often take the difference between debt and cash (net debt) when computing debt ratios and arrive at very different values.
- For Embraer, using the gross debt ratio
  - Gross D/E Ratio for Embraer = 1953/11,042 = 18.95%
  - Levered Beta using Gross Debt ratio = 1.07
- Using the net debt ratio, we get
  - Net Debt Ratio for Embraer = (Debt - Cash)/ Market value of Equity
    = (1953-2320)/ 11,042 = -3.32%
  - Levered Beta using Net Debt Ratio = 0.95 (1 + (1-.34) (-.0332)) = 0.93
- The cost of Equity using net debt levered beta for Embraer will be much lower than with the gross debt approach. The cost of capital for Embraer will even out since the debt ratio used in the cost of capital equation will now be a net debt ratio rather than a gross debt ratio.

The Cost of Equity: A Recap



Discount Rates: IV

Mopping up

Estimating the Cost of Debt

- The cost of debt is the rate at which you can borrow at currently, It will reflect not only your default risk but also the level of interest rates in the market.
- The two most widely used approaches to estimating cost of debt are:
  - Looking up the yield to maturity on a straight bond outstanding from the firm. The limitation of this approach is that very few firms have long term straight bonds that are liquid and widely traded
  - Looking up the rating for the firm and estimating a default spread based upon the rating. While this approach is more robust, different bonds from the same firm can have different ratings. You have to use a median rating for the firm
- When in trouble (either because you have no ratings or multiple ratings for a firm), estimate a synthetic rating for your firm and the cost of debt based upon that rating.

Estimating Synthetic Ratings

- The rating for a firm can be estimated using the financial characteristics of the firm. In its simplest form, the rating can be estimated from the interest coverage ratio

  Interest Coverage Ratio = EBIT / Interest Expenses

- For Embraer's interest coverage ratio, we used the interest expenses from 2003 and the average EBIT from 2001 to 2003. (The aircraft business was badly affected by 9/11 and its aftermath. In 2002 and 2003, Embraer reported significant drops in operating income)

  Interest Coverage Ratio = 462.1 /129.70 = 3.56

Interest Coverage Ratios, Ratings and Default Spreads: 2003 & 2004

If Interest Coverage Ratio is		Estimated Bond Rating	Default Spread(2003)	Default Spread(2004)
> 8.50	(>12.50)	AAA	0.75%	0.35%
6.50 - 8.50	(9.5-12.5)	AA	1.00%	0.50%
5.50 - 6.50	(7.5-9.5)	A+	1.50%	0.70%
4.25 - 5.50	(6-7.5)	A	1.80%	0.85%
3.00 - 4.25	(4.5-6)	A–	2.00%	1.00%
2.50 - 3.00	(4-4.5)	BBB	2.25%	1.50%
2.25- 2.50	(3.5-4)	BB+	2.75%	2.00%
2.00 - 2.25	((3-3.5)	BB	3.50%	2.50%
1.75 - 2.00	(2.5-3)	B+	4.75%	3.25%
1.50 - 1.75	(2-2.5)	B	6.50%	4.00%
1.25 - 1.50	(1.5-2)	B –	8.00%	6.00%
0.80 - 1.25	(1.25-1.5)	CCC	10.00%	8.00%
0.65 - 0.80	(0.8-1.25)	CC	11.50%	10.00%
0.20 - 0.65	(0.5-0.8)	C	12.70%	12.00%
< 0.20	(<0.5)	D	15.00%	20.00%

- The first number under interest coverage ratios is for larger market cap companies and the second in brackets is for smaller market cap companies. For Embraer , I used the interest coverage ratio table for smaller/riskier firms (the numbers in brackets) which yields a lower rating for the same interest coverage ratio.

Cost of Debt computations

- Companies in countries with low bond ratings and high default risk might bear the burden of country default risk, especially if they are smaller or have all of their revenues within the country.
- Larger companies that derive a significant portion of their revenues in global markets may be less exposed to country default risk. In other words, they may be able to borrow at a rate lower than the government.
- The synthetic rating for Embraer is A-. Using the 2004 default spread of 1.00%, we estimate a cost of debt of 9.29% (using a riskfree rate of 4.29% and adding in two thirds of the country default spread of 6.01%):

Cost of debt

= Riskfree rate + 2/3(Brazil country default spread) + Company default spread =4.29% + 4.00%+ 1.00% = 9.29%

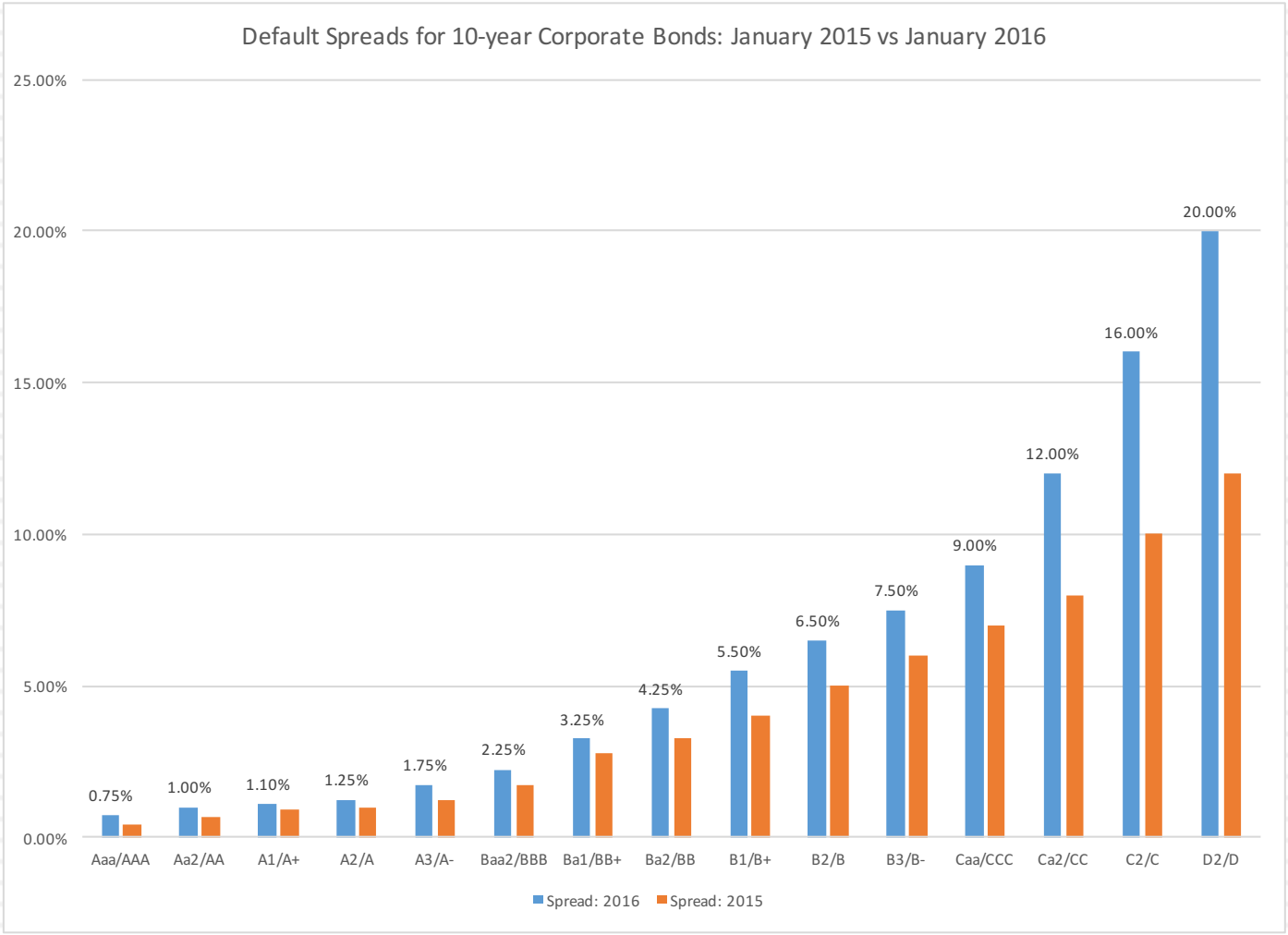
Synthetic Ratings: Some Caveats

- The relationship between interest coverage ratios and ratings, developed using US companies, tends to travel well, as long as we are analyzing large manufacturing firms in markets with interest rates close to the US interest rate
- They are more problematic when looking at smaller companies in markets with higher interest rates than the US. One way to adjust for this difference is modify the interest coverage ratio table to reflect interest rate differences (For instances, if interest rates in an emerging market are twice as high as rates in the US, halve the interest coverage ratio.

Default Spreads: The effect of the crisis of 2008.. And the aftermath

	Default spread over treasury					
Rating	1-Jan-08	12-Sep-08	12-Nov-08	1-Jan-09	1-Jan-10	1-Jan-11
Aaa/AAA	0.99%	1.40%	2.15%	2.00%	0.50%	0.55%
Aa1/AA+	1.15%	1.45%	2.30%	2.25%	0.55%	0.60%
Aa2/AA	1.25%	1.50%	2.55%	2.50%	0.65%	0.65%
Aa3/AA-	1.30%	1.65%	2.80%	2.75%	0.70%	0.75%
A1/A+	1.35%	1.85%	3.25%	3.25%	0.85%	0.85%
A2/A	1.42%	1.95%	3.50%	3.50%	0.90%	0.90%
A3/A-	1.48%	2.15%	3.75%	3.75%	1.05%	1.00%
Baa1/BBB+	1.73%	2.65%	4.50%	5.25%	1.65%	1.40%
Baa2/BBB	2.02%	2.90%	5.00%	5.75%	1.80%	1.60%
Baa3/BBB-	2.60%	3.20%	5.75%	7.25%	2.25%	2.05%
Ba1/BB+	3.20%	4.45%	7.00%	9.50%	3.50%	2.90%
Ba2/BB	3.65%	5.15%	8.00%	10.50%	3.85%	3.25%
Ba3/BB-	4.00%	5.30%	9.00%	11.00%	4.00%	3.50%
B1/B+	4.55%	5.85%	9.50%	11.50%	4.25%	3.75%
B2/B	5.65%	6.10%	10.50%	12.50%	5.25%	5.00%
B3/B-	6.45%	9.40%	13.50%	15.50%	5.50%	6.00%
Caa/CCC+	7.15%	9.80%	14.00%	16.50%	7.75%	7.75%
ERP	4.37%	4.52%	6.30%	6.43%	4.36%	5.20%

Updated Default Spreads - January 2016



Subsidized Debt: What should we do?

- Assume that the Brazilian government lends money to Embraer at a subsidized interest rate (say 6% in dollar terms). In computing the cost of capital to value Embraer, should be we use the cost of debt based upon default risk or the subsidized cost of debt?

a. The subsidized cost of debt (6%). That is what the company is paying.

b. The fair cost of debt (9.25%). That is what the company should require its projects to cover.

c. A number in the middle.

Weights for the Cost of Capital Computation

- In computing the cost of capital for a publicly traded firm, the general rule for computing weights for debt and equity is that you use market value weights (and not book value weights). Why?
  a. Because the market is usually right
  b. Because market values are easy to obtain
  c. Because book values of debt and equity are meaningless
  d. None of the above

Estimating Cost of Capital: Embraer in 2004

- Equity
  - Cost of Equity = 4.29% + 1.07 (4%) + 0.27 (7.89%) = 10.70%
  - Market Value of Equity =11,042 million BR ($ 3,781 million)
- Debt
  - Cost of debt = 4.29% + 4.00% +1.00%= 9.29%
  - Market Value of Debt = 2,083 million BR ($713 million)
- Cost of Capital

Cost of Capital = 10.70 % (.84) + 9.29% (1- .34) (0.16)) = 9.97%

  - The book value of equity at Embraer is 3,350 million BR.
  - The book value of debt at Embraer is 1,953 million BR; Interest expense is 222 mil BR; Average maturity of debt = 4 years
  - Estimated market value of debt = 222 million (PV of annuity, 4 years, 9.29%) + $1,953 million/$1.0929^4$ = 2,083 million BR

If you had to do it….Converting a Dollar Cost of Capital to a Nominal Real Cost of Capital

- Approach 1: Use a BR riskfree rate in all of the calculations above. For instance, if the BR riskfree rate was 12%, the cost of capital would be computed as follows:
  - Cost of Equity = 12% + 1.07(4%) + 0.27 (7. 89%) = 18.41%
  - Cost of Debt = 12% + 1% = 13%
  - (This assumes the riskfree rate has no country risk premium embedded in it.)
- Approach 2: Use the differential inflation rate to estimate the cost of capital. For instance, if the inflation rate in BR is 8% and the inflation rate in the U.S. is 2%

$$\text{Cost of capital} = (1+\text{Cost of Capital}_{\$})\left[\frac{1+\text{Inflation}_{BR}}{1+\text{Inflation}_{\$}}\right]$$

$$= 1.0997\ (1.08/1.02)-1 \quad = 0.1644 \text{ or } 16.44\%$$

Dealing with Hybrids and Preferred Stock

- When dealing with hybrids (convertible bonds, for instance), break the security down into debt and equity and allocate the amounts accordingly. Thus, if a firm has $ 125 million in convertible debt outstanding, break the $125 million into straight debt and conversion option components. The conversion option is equity.
- When dealing with preferred stock, it is better to keep it as a separate component. The cost of preferred stock is the preferred dividend yield. (As a rule of thumb, if the preferred stock is less than 5% of the outstanding market value of the firm, lumping it in with debt will make no significant impact on your valuation).

Decomposing a convertible bond…

- Assume that the firm that you are analyzing has $125 million in face value of convertible debt with a stated interest rate of 4%, a 10 year maturity and a market value of $140 million. If the firm has a bond rating of A and the interest rate on A-rated straight bond is 8%, you can break down the value of the convertible bond into straight debt and equity portions.
  - Straight debt = (4% of $125 million) (PV of annuity, 10 years, 8%) + 125 million/1.0810 = $91.45 million
  - Equity portion = $140 million - $91.45 million = $48.55 million
- The debt portion ($91.45 million) gets added to debt and the option portion ($48.55 million) gets added to the market capitalization to get to the debt and equity weights in the cost of capital.

Recapping the Cost of Capital