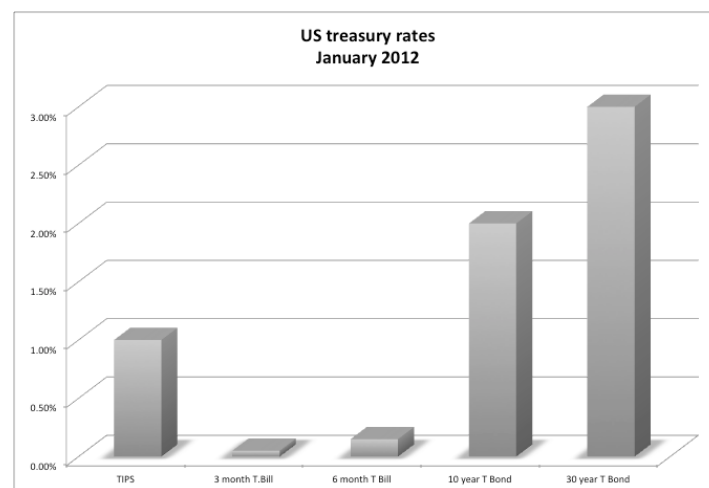


A Riskfree Rate

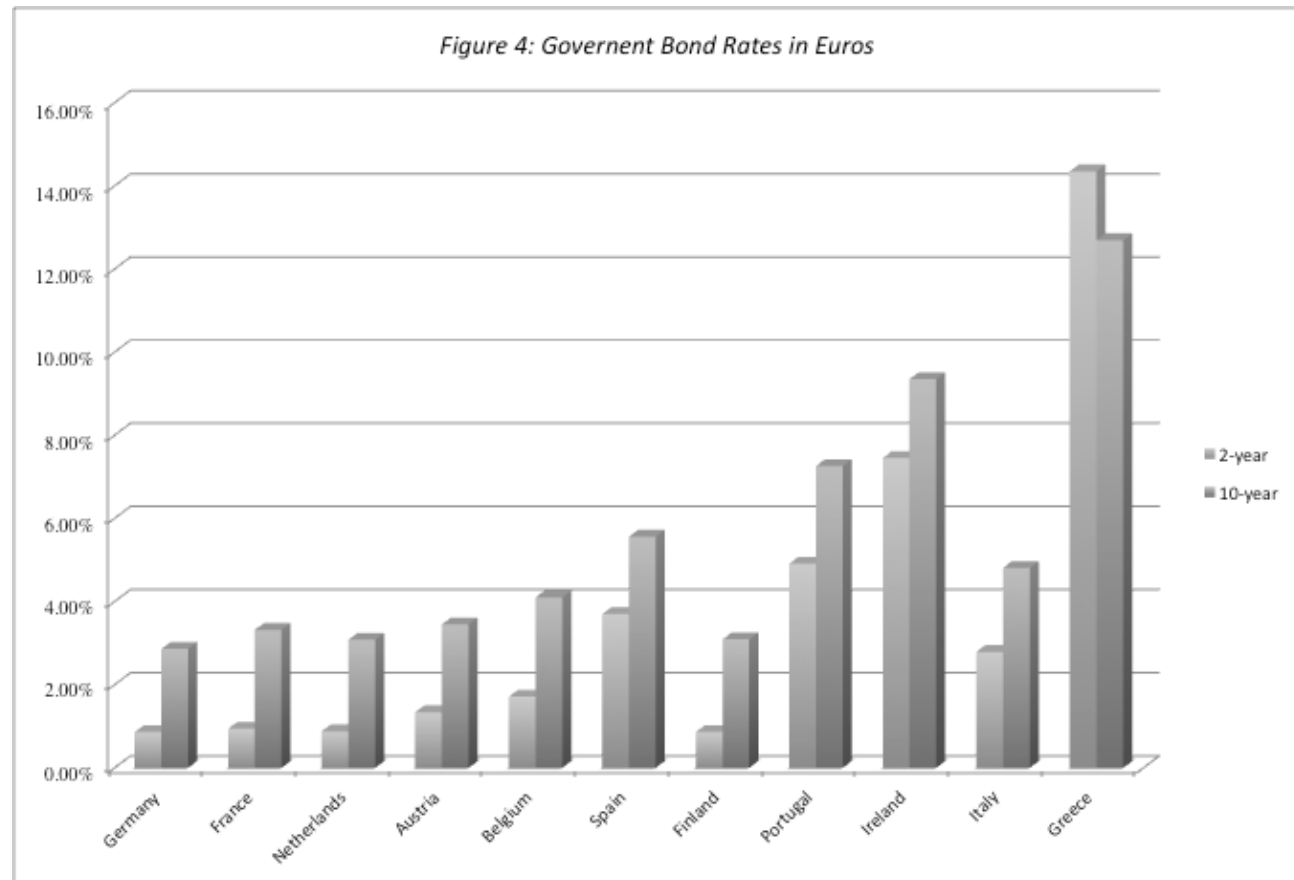
- On a riskfree asset, the actual return is equal to the expected return. Therefore, there is no variance around the expected return.
- For an investment to be riskfree, then, it has to have
 - No default risk
 - No reinvestment risk
- 1. Time horizon matters: Thus, the riskfree rates in valuation will depend upon when the cash flow is expected to occur and will vary across time.
- 2. 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
 - b) A ten-year Treasury bond rate
 - c) A thirty-year Treasury bond rate
 - d) A TIPs (inflation-indexed treasury) rate
 - e) None of the above



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 8.5% on January 1, 2012.
- In January 2012, 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 2012 was 2%.
- The riskfree rate in Indian Rupees is
 - a) The yield to maturity on the 10-year bond (8.5%)
 - b) The yield to maturity on the 10-year bond + Default spread (10.5%)
 - c) The yield to maturity on the 10-year bond – Default spread (6.5%)
 - d) None of the above

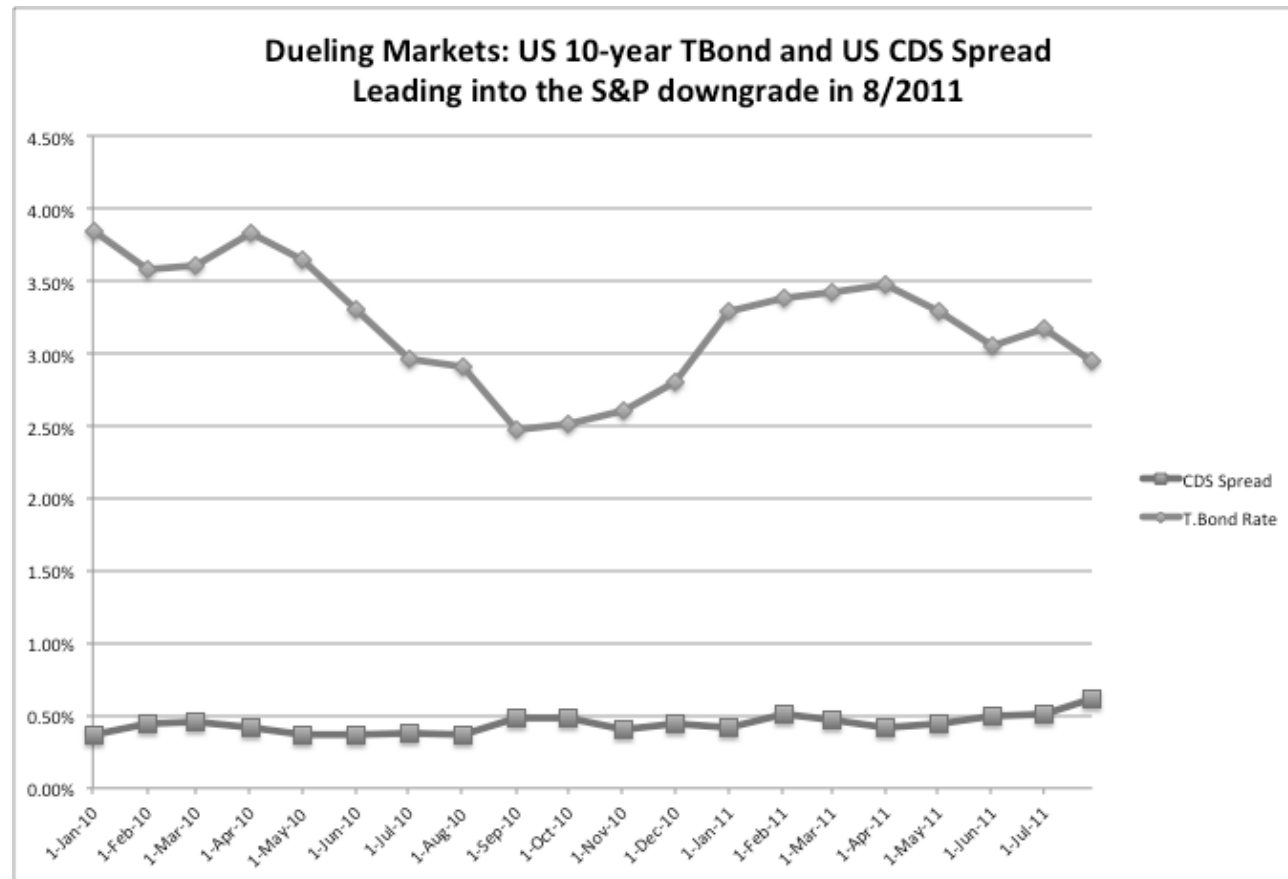
Sovereign Default Spread: Two paths to the same destination...

- Sovereign dollar or euro denominated bonds: Find sovereign bonds denominated in US dollars, issued by emerging markets. The difference between the interest rate on the bond and the US treasury bond rate should be the default spread. For instance, in January 2012, the US dollar denominated 10-year bond issued by the Brazilian government (with a Baa2 rating) had an interest rate of 3.5%, resulting in a default spread of 1.6% over the US treasury rate of 1.9% at the same point in time. (On the same day, the ten-year Brazilian BR denominated bond had an interest rate of 12%)
- CDS spreads: Obtain the default spreads for sovereigns in the CDS market. In January 2012, the CDS spread for Brazil in that market was 1.43%.
- Average 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 in the same rating class.

Sovereign Default Spreads: End of 2011

<i>Rating</i>	<i>Default spread in basis points</i>
Aaa	0
Aa1	25
A2	50
Aa3	70
A1	85
A2	100
A3	115
Baa1	150
Baa2	175
Baa3	200
Ba1	240
Ba2	275
Ba3	325
B1	400
B2	500
B3	600
Caa1	700
Caa2	850
Caa3	1000

Revisiting US treasuries: What is the right riskfree rate in US dollars?



Test 4: A Real Riskfree Rate

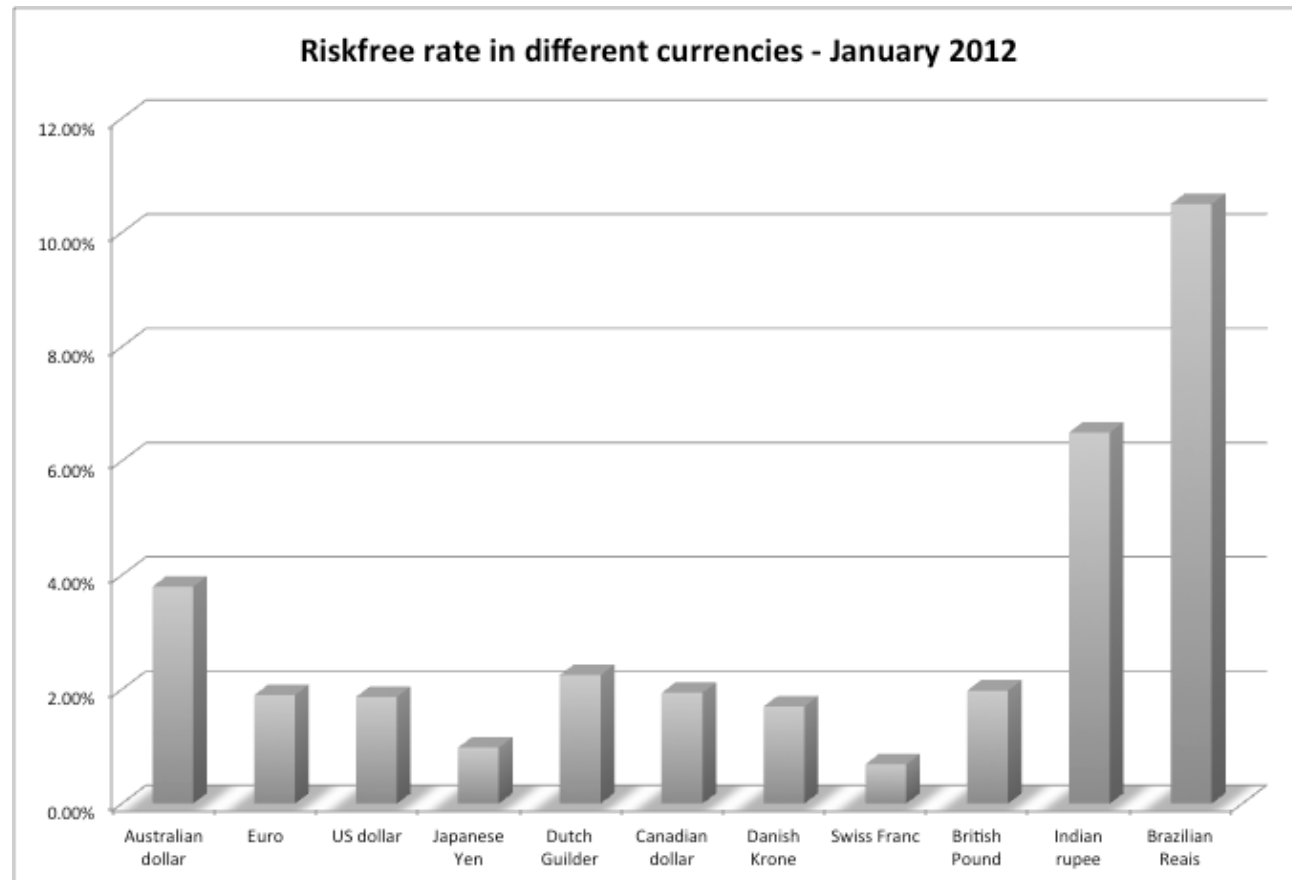
- In some cases, you may want a riskfree rate in real terms (in real terms) rather than nominal terms.
 - To get a real riskfree rate, you would like a security with no default risk and a guaranteed real return. Treasury indexed securities offer this combination.
 - In January 2012, the yield on a 10-year indexed treasury bond was 1.00%. Which of the following statements would you subscribe to?
 - a) This (1.00%) is the real riskfree rate to use, if you are valuing US companies in real terms.
 - b) This (1.00%) is the real riskfree rate to use, anywhere in the world
- Explain.

No default free entity: Choices with riskfree rates....

- 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 a currency where you can get a riskfree rate, say US dollars or Euros.

Why do riskfree rates vary across currencies?

January 2012 Risk free rates



One more test on riskfree rates...

- In January 2012, the 10-year treasury bond rate in the United States was 1.87%, a historic low. Assume that you were valuing a company in US dollars then, but were wary about the riskfree 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 4%)
 - 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...

B. Equity Risk Premiums

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
1928-2011	7.55%	5.79%	5.62%	4.10%
Std error	2.22%	2.36%		
1962-2011	5.38%	3.36%	4.02%	2.35%
Std error	2.39%	2.68%		
2002-2011	3.12%	-1.92%	1.08%	-3.61%
Std error	6.46%	8.94%		

The perils of trusting the past.....

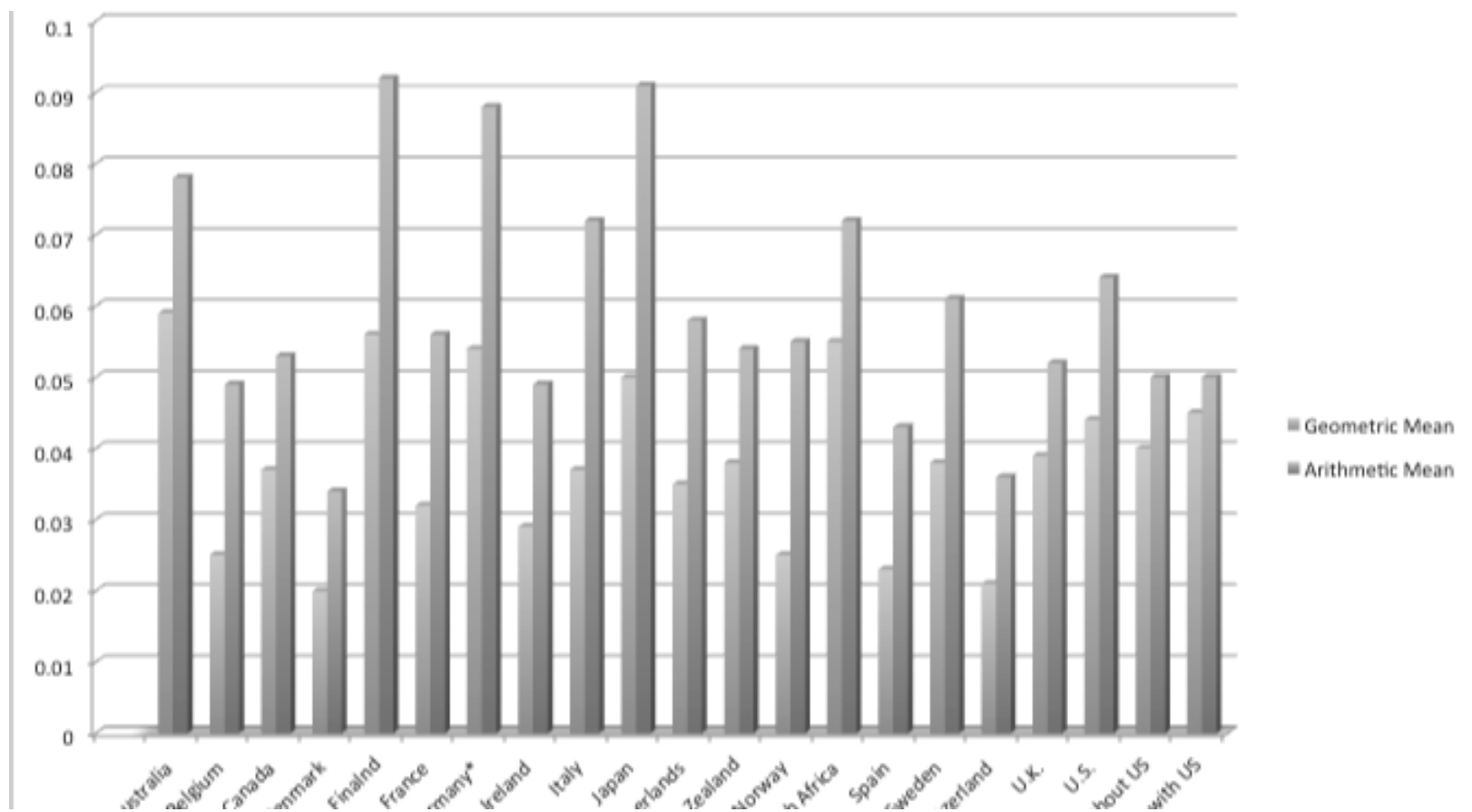
- Noisy estimates: Even with long time periods of history, the risk premium that you derive will have substantial standard error. For instance, if you go back to 1928 (about 80 years of history) and you assume a standard deviation of 20% in annual stock returns, you arrive at a standard error of greater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

$$\text{Standard Error in Premium} = 20\% / \sqrt{80} = 2.26\%$$

(An aside: The implied standard deviation in equities rose to almost 50% during the last quarter of 2008. Think about the consequences for using historical risk premiums, if this volatility persisted)

- 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



Two Ways of Estimating Country Equity Risk Premiums for other markets.. Brazil in August 2004

- *Default spread on Country Bond:* In this approach, the country equity risk premium is set equal to the default spread of the bond issued by the country (but only if it is denominated in a currency where a default free entity exists.
 - Brazil was rated B2 by Moody's and the default spread on the Brazilian dollar denominated C.Bond at the end of August 2004 was 6.01%. (10.30%-4.29%)
- *Relative Equity Market approach:* The country equity risk premium is based upon the volatility of the market in question relative to U.S market.

$$\text{Total equity risk premium} = \text{Risk Premium}_{\text{US}} * \sigma_{\text{Country Equity}} / \sigma_{\text{US Equity}}$$

Using a 4.82% premium for the US (the historical premium from 1928-2003), this approach would yield:

$$\text{Total risk premium for Brazil} = 4.82\% (34.56\%/19.01\%) = 8.76\%$$

$$\text{Country equity risk premium for Brazil} = 8.76\% - 4.82\% = 3.94\%$$

(The standard deviation in weekly returns from 2002 to 2004 for the Bovespa was 34.56% whereas the standard deviation in the S&P 500 was 19.01%)

And a third approach

- 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 August 2004, you would get:
 - Country Equity risk premium = Default spread on country bond* $\frac{\sigma_{\text{Country Equity}}}{\sigma_{\text{Country Bond}}}$
 - Standard Deviation in Bovespa (Equity) = 34.56%
 - Standard Deviation in Brazil C-Bond = 26.34%
 - Default spread on C-Bond = 6.01%
 - Country Equity Risk Premium = 6.01% (34.56%/26.34%) = 7.89%

Can country risk premiums change? Updating Brazil – January 2007 and January 2009

- In January 2007, Brazil's rating had improved to B1 and the interest rate on the Brazilian \$ denominated bond dropped to 6.2%. The US treasury bond rate that day was 4.7%, yielding a default spread of 1.5% for Brazil.

- Standard Deviation in Bovespa (Equity) = 24%
- Standard Deviation in Brazil \$-Bond = 12%
- Default spread on Brazil \$-Bond = 1.50%
- Country Risk Premium for Brazil = 1.50% (24/12) = 3.00%

On January 1, 2009, Brazil's rating was Ba1 but the interest rate on the Brazilian \$ denominated bond was 6.3%, 4.1% higher than the US treasury bond rate of 2.2% on that day.

- Standard Deviation in Bovespa (Equity) = 33%
- Standard Deviation in Brazil \$-Bond = 20%
- Default spread on Brazil \$-Bond = 4.1%
- Country Risk Premium for Brazil = 4.10% (33/20) = 6.77%

Country Risk Premiums January 2012

Canada	6.00%
United States of America	6.00%

Argentina	15.00%
Belize	15.00%
Bolivia	12.00%
Brazil	8.63%
Chile	7.05%
Colombia	9.00%
Costa Rica	9.00%
Ecuador	18.75%
El Salvador	10.13%
Guatemala	9.60%
Honduras	13.50%
Mexico	8.25%
Nicaragua	15.00%
Panama	9.00%
Paraguay	12.00%
Peru	9.00%
Uruguay	9.60%
Venezuela	12.00%

Austria [1]	6.00%
Belgium [1]	7.05%
Cyprus [1]	9.00%
Denmark	6.00%
Finland [1]	6.00%
France [1]	6.00%
Germany [1]	6.00%
Greece [1]	16.50%
Iceland	9.00%
Ireland [1]	9.60%
Italy [1]	7.50%
Malta [1]	7.50%
Netherlands [1]	6.00%
Norway	6.00%
Portugal [1]	10.13%
Spain [1]	7.28%
Sweden	6.00%
Switzerland	6.00%
United Kingdom	6.00%

Angola	10.88%
Botswana	7.50%
Egypt	13.50%
Mauritius	8.63%
Morocco	9.60%
Namibia	9.00%
South Africa	7.73%
Tunisia	9.00%

Albania	12.00%
Armenia	10.13%
Azerbaijan	9.60%
Belarus	15.00%
Bosnia and Herzegovina	13.50%
Bulgaria	8.63%
Croatia	9.00%
Czech Republic	7.28%
Estonia	7.28%
Georgia	10.88%
Hungary	9.60%
Kazakhstan	8.63%
Latvia	9.00%
Lithuania	8.25%
Moldova	15.00%
Montenegro	10.88%
Poland	7.50%
Romania	9.00%
Russia	8.25%
Slovakia	7.28%
Slovenia [1]	7.28%
Ukraine	13.50%

Bahrain	8.25%
Israel	7.28%
Jordan	10.13%
Kuwait	6.75%
Lebanon	12.00%
Oman	7.28%
Qatar	6.75%
Saudi Arabia	7.05%
Senegal	12.00%
United Arab Emirates	6.75%

Bangladesh	10.88%
Cambodia	13.50%
China	7.05%
Fiji Islands	12.00%
Hong Kong	6.38%
India	9.00%
Indonesia	9.60%
Japan	7.05%
Korea	7.28%
Macao	7.05%
Malaysia	7.73%
Mongolia	12.00%
Pakistan	15.00%
Papua New Guinea	12.00%
Philippines	10.13%
Singapore	6.00%
Sri Lanka	12.00%
Taiwan	7.05%
Thailand	8.25%
Turkey	10.13%
Vietnam	12.00%

Australia	6.00%
New Zealand	6.00%

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,

$$E(\text{Return}) = \text{Riskfree Rate} + \text{Country ERP} + \text{Beta (US premium)}$$

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.

$$E(\text{Return}) = \text{Riskfree Rate} + \text{Beta (US premium} + \text{Country ERP)}$$

- 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)

$$E(\text{Return}) = \text{Riskfree Rate} + \beta (\text{US premium}) + \lambda (\text{Country ERP})$$

ERP: Equity Risk Premium

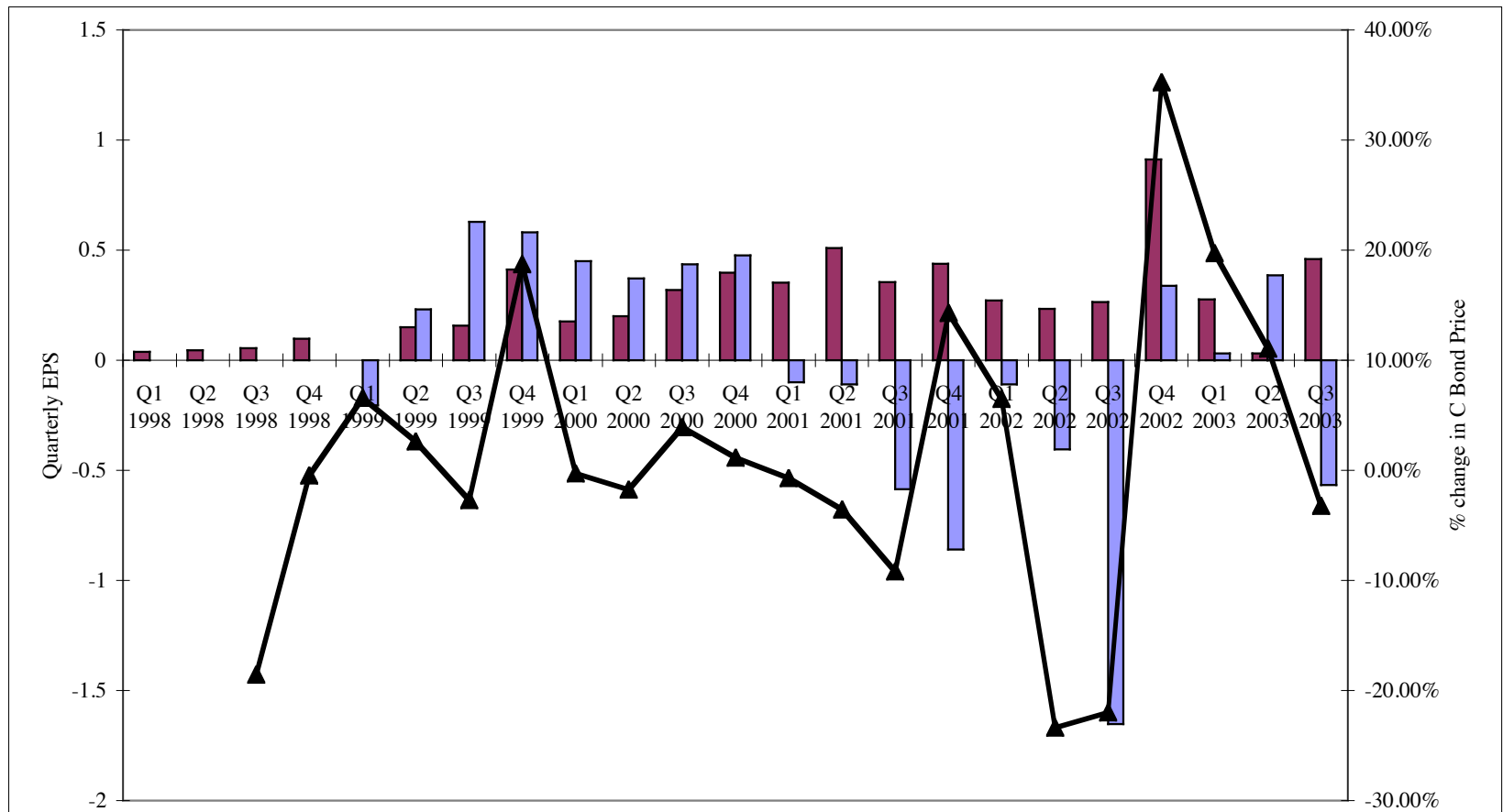
Estimating Company Exposure to Country Risk: Determinants

- Source of revenues: Other things remaining equal, a company should be more exposed to risk in a country if it generates more of its revenues from that country. A Brazilian firm that generates the bulk of its revenues in Brazil should be more exposed to country risk than one that generates a smaller percent of its business within Brazil.
- Manufacturing facilities: Other things remaining equal, a firm that has all of its production facilities in Brazil should be more exposed to country risk than one which has production facilities spread over multiple countries. The problem will be accentuated for companies that cannot move their production facilities (mining and petroleum companies, for instance).
- Use of risk management products: Companies can use both options/futures markets and insurance to hedge some or a significant portion of country risk.

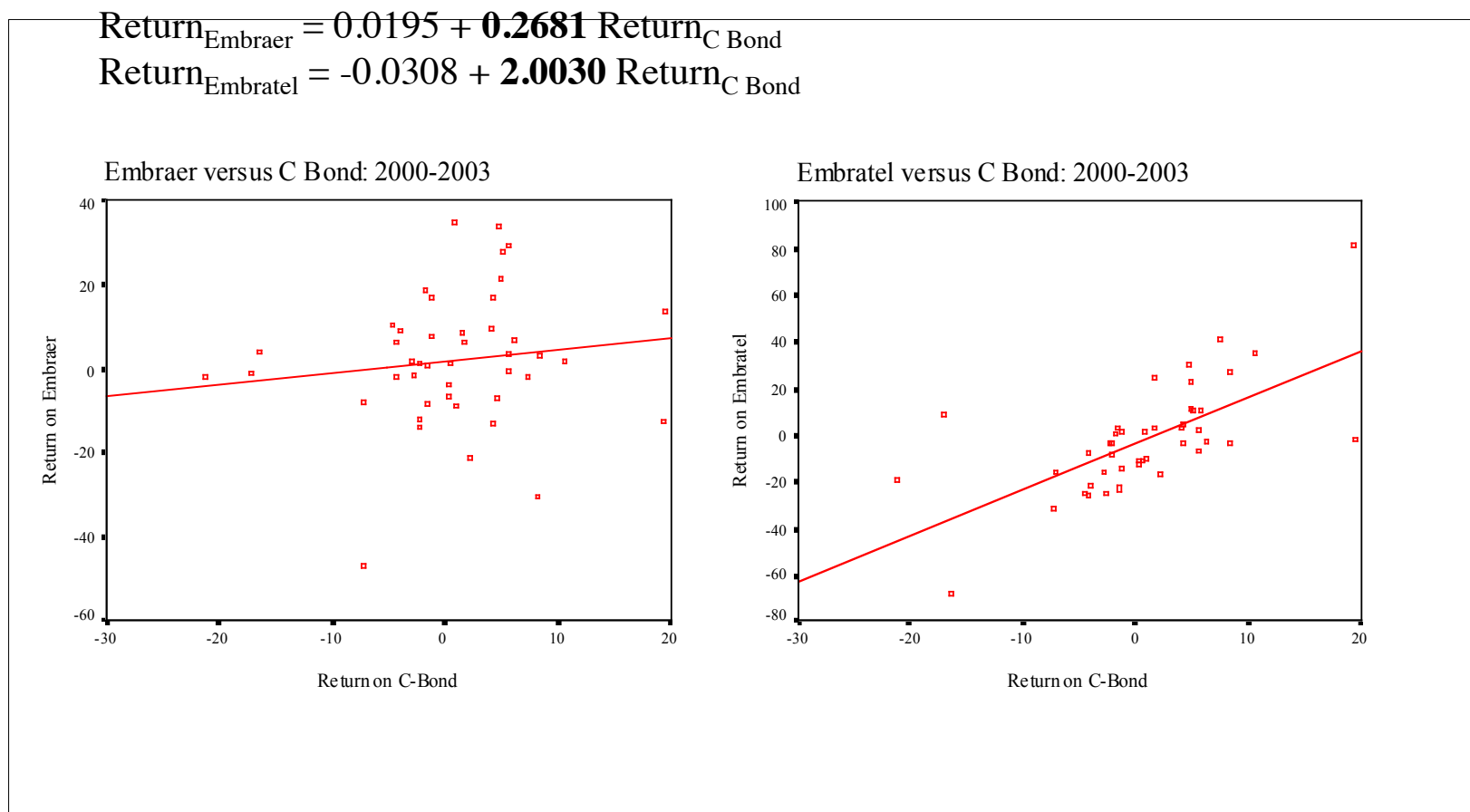
Estimating Lambdas: The Revenue Approach

- The easiest and most accessible data is on revenues. Most companies break their revenues down by region.
 $\lambda = \% \text{ of revenues domestically}_{\text{firm}} / \% \text{ of revenues domestically}_{\text{avg firm}}$
- Consider, for instance, Embraer and Embratel, both of which are incorporated and traded in Brazil. Embraer gets 3% of its revenues from Brazil whereas Embratel gets almost all of its revenues in Brazil. The average Brazilian company gets about 77% of its revenues in Brazil:
 - $\text{Lambda}_{\text{Embraer}} = 3\% / 77\% = .04$
 - $\text{Lambda}_{\text{Embratel}} = 100\% / 77\% = 1.30$
- 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
- Consider, for instance, the fact that SAP got about 7.5% of its sales in “Emerging Asia”, we can estimate a lambda for SAP for Asia (using the assumption that the typical Asian firm gets about 75% of its revenues in Asia)
 - $\text{Lambda}_{\text{SAP, Asia}} = 7.5\% / 75\% = 0.10$

Estimating Lambdas: Earnings Approach



Estimating Lambdas: Stock Returns versus C-Bond Returns



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

- Assume that the beta for Embraer is 1.07, and that the riskfree rate used is 4.29%. Also assume that the risk premium for the US is 4.82% and the country risk premium for Brazil is 7.89%.
- Approach 1: Assume that every company in the country is equally exposed to country risk. In this case,
$$E(\text{Return}) = 4.29\% + 1.07 (4.82\%) + 7.89\% = 17.34\%$$
- Approach 2: Assume that a company's exposure to country risk is similar to its exposure to other market risk.
$$E(\text{Return}) = 4.29\% + 1.07 (4.82\% + 7.89\%) = 17.89\%$$
- 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)
$$E(\text{Return}) = 4.29\% + 1.07(4.82\%) + 0.27 (7.89\%) = 11.58\%$$

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 17.34% 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.

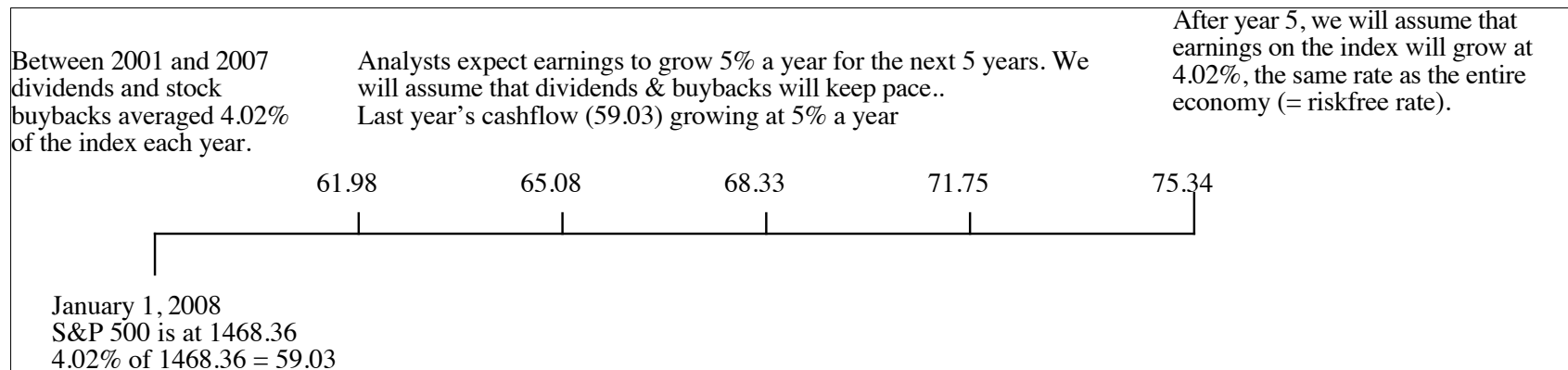
Can you construct an investment strategy to take advantage of the misvaluation?

Implied Equity Premiums

- If we assume that stocks are correctly priced in the aggregate and we can estimate the expected cashflows from buying stocks, we can estimate the expected rate of return on stocks by computing an internal rate of return. 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.



- 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%

Implied Risk Premium Dynamics

- Assume that the index jumps 10% on January 2 and that nothing else changes. What will happen to the implied equity risk premium?
 - Implied equity risk premium will increase
 - Implied equity risk premium will decrease
- Assume that the earnings jump 10% on January 2 and that nothing else changes. What will happen to the implied equity risk premium?
 - Implied equity risk premium will increase
 - Implied equity risk premium will decrease
- Assume that the riskfree rate increases to 5% on January 2 and that nothing else changes. What will happen to the implied equity risk premium?
 - Implied equity risk premium will increase
 - Implied equity risk premium will decrease

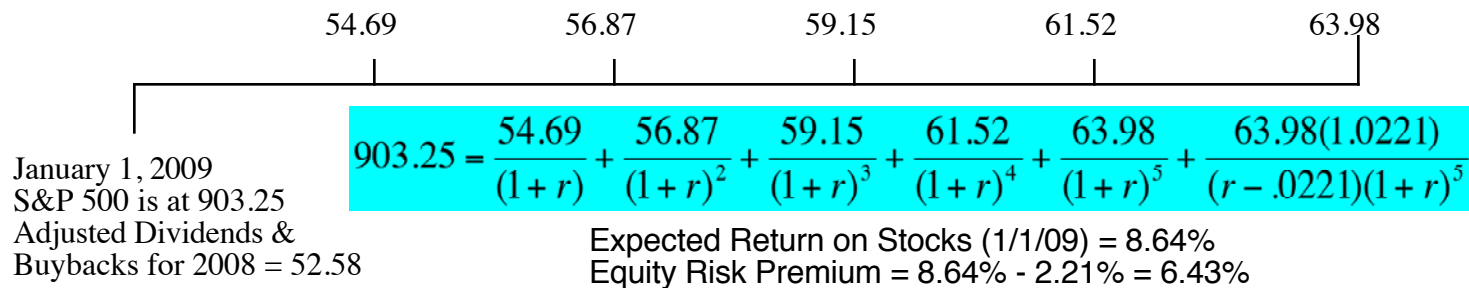
A year that made a difference.. The implied premium in January 2009

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%

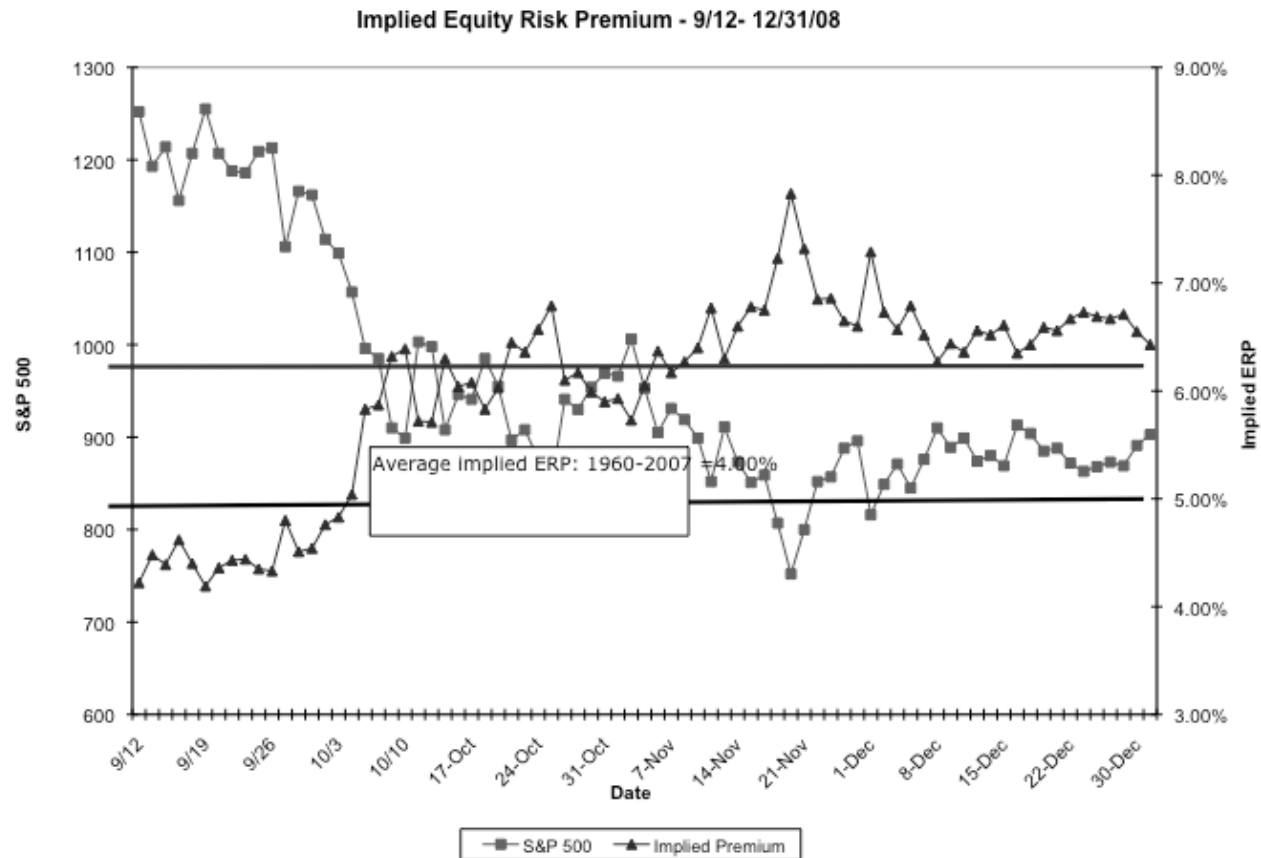
In 2008, the actual cash returned to stockholders was 68.72. However, there was a 41% dropoff in buybacks in Q4. We reduced the total buybacks for the year by that amount.

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).



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



An Updated Equity Risk Premium: January 2012

- On January 1, 2012, the S&P 500 was at 1257.60, essentially unchanged for the year. And it was a year of macro shocks – political upheaval in the Middle East and sovereign debt problems in Europe. The treasury bond rate dropped below 2% and buybacks/dividends surged.

In the trailing 12 months, the cash returned to stockholders was 74.17. Using the average cash yield of 4.71% for 2002-2011 the cash returned would have been 59.29.

Analysts expect earnings to grow 9.6% in 2012, 11.9% in 2013, 8.2% in 2014, 4.5% in 2015 and 2% thereafter, resulting in a compounded annual growth rate of 7.18% over the next 5 years. We will assume that dividends & buybacks will grow 7.18% a year for the next 5 years.

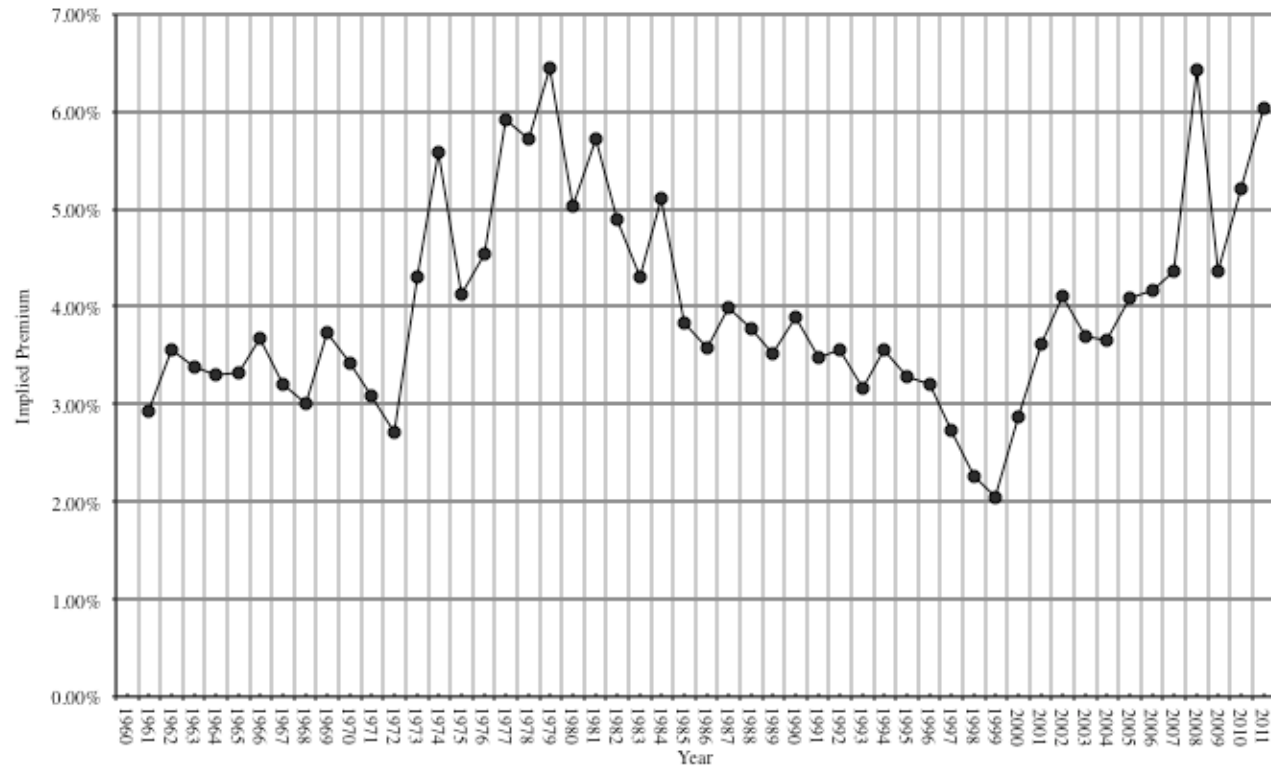
After year 5, we will assume that earnings on the index will grow at 1.87%, the same rate as the entire economy (= riskfree rate).

	63.54	68.11	73.00	78.24	83.86	
	----- ----- ----- ----- -----					
January 1, 2012 S&P 500 is at 1257.60 Adjusted Dividends & Buybacks for 2011 = 59.29	$1257.60 = \frac{63.54}{(1+r)} + \frac{68.11}{(1+r)^2} + \frac{73.00}{(1+r)^3} + \frac{78.24}{(1+r)^4} + \frac{83.86}{(1+r)^5} + \frac{83.86(1.0187)}{(r-.0187)(1+r)^5}$					
	Expected Return on Stocks (1/1/12)			= 7.91%		
	T.Bond rate on 1/1/12			= 1.87%		
	Equity Risk Premium = 7.91% - 1.87%			= 6.04%		

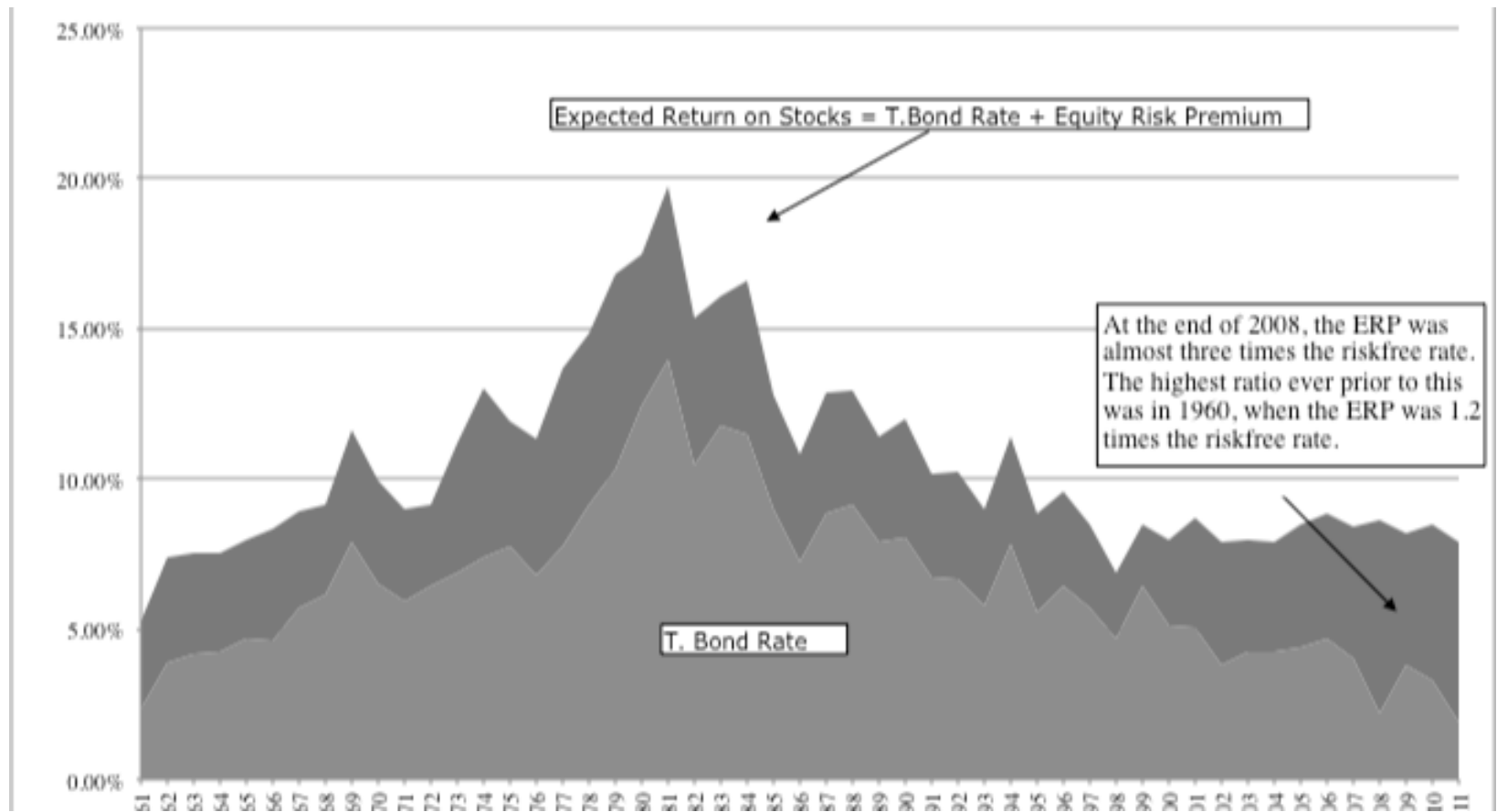
Data Sources:
Dividends and Buybacks last year: S&P
Expected growth rate: News stories, Yahoo! Finance, Bloomberg

Implied Premiums in the US: 1960-2011

Implied Premium for US Equity Market

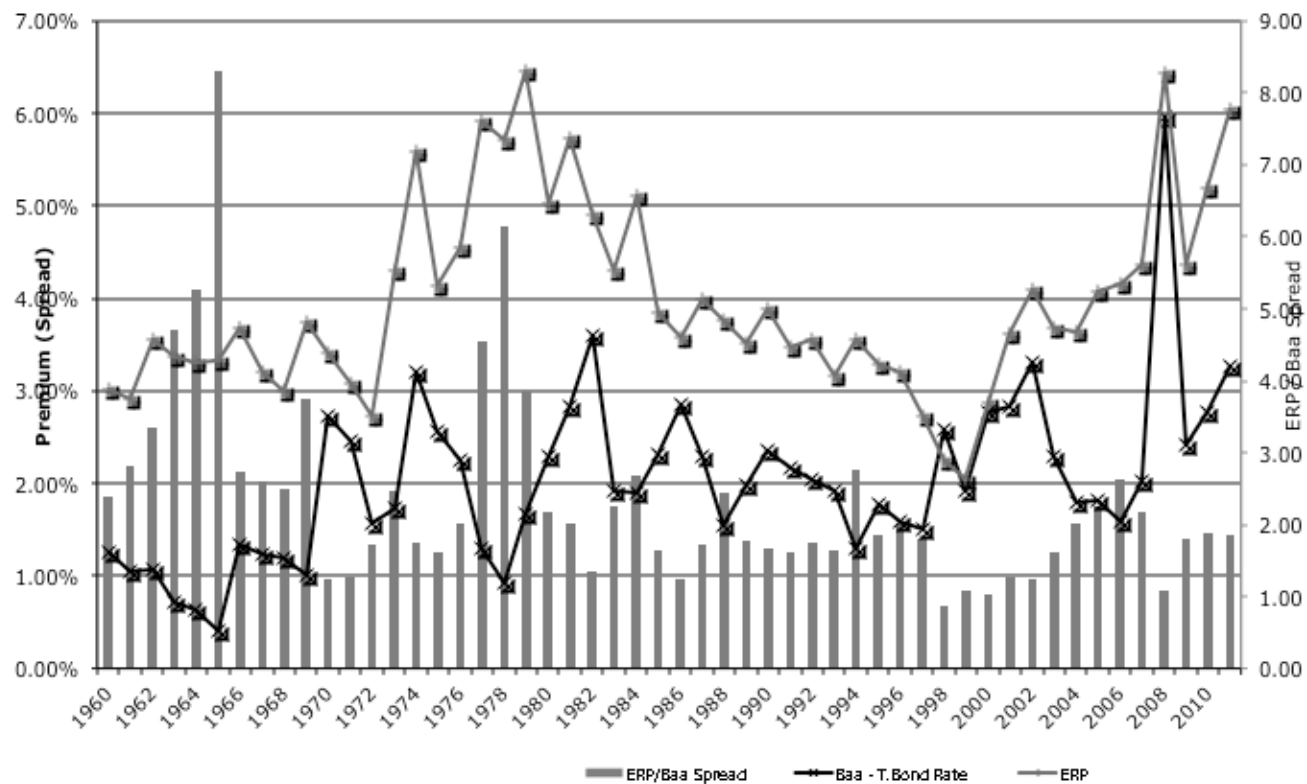


Implied Premium versus Risk Free Rate

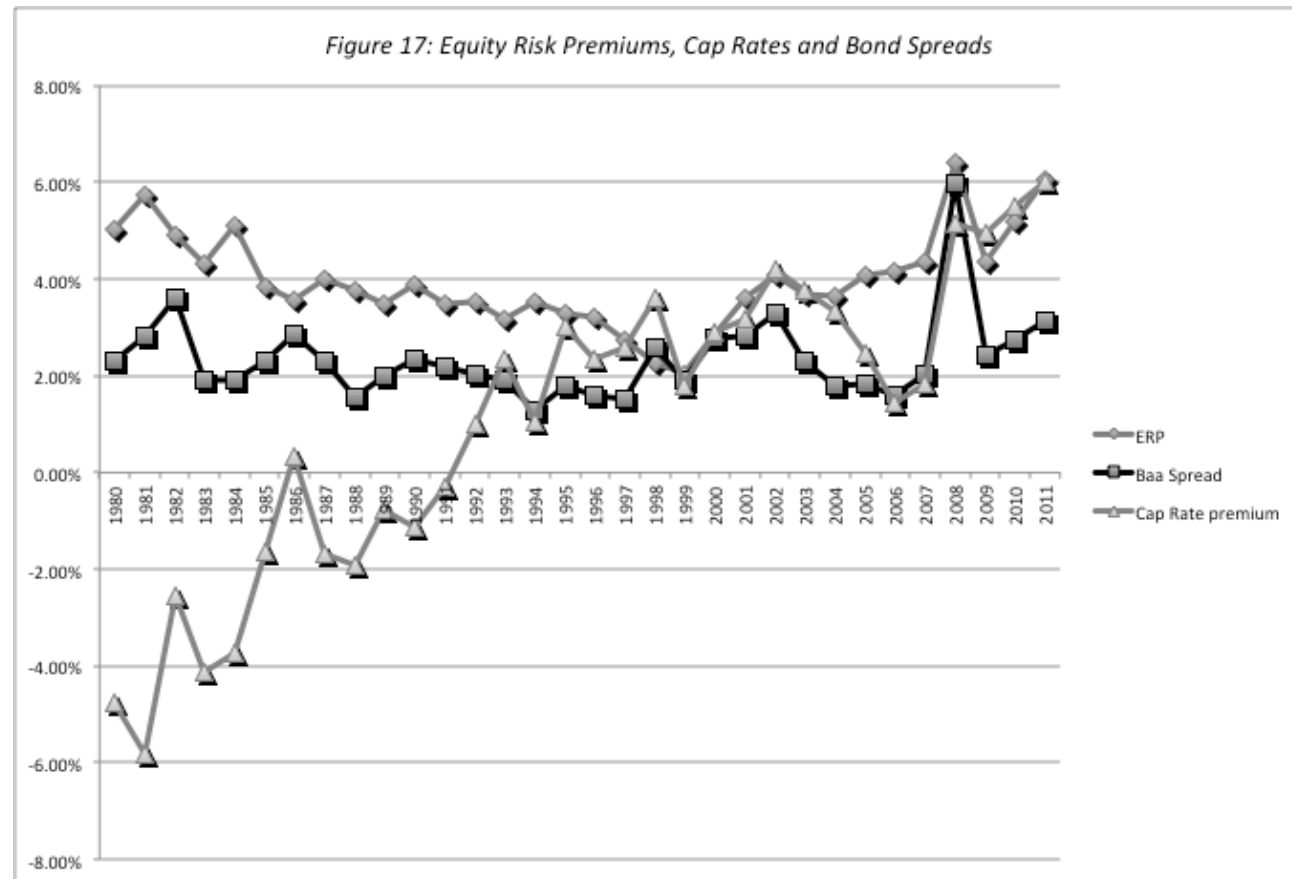


Equity Risk Premiums and Bond Default Spreads

Figure 15: 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 geometric average premium for 1928-2011 of 4.1% to value stocks in January 2012, given the implied premium of 6.04%, what were they likely to find?
- The values they obtain will be too low (most stocks will look overvalued)
- The values they obtain will be too high (most stocks will look undervalued)
- 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 for the US?

- *Historical Risk Premium*: When you use the historical risk premium, you are assuming that premiums will revert back to a historical norm and that the time period that you are using is the right norm.
- *Current Implied Equity Risk premium*: You are assuming that the market is correct in the aggregate but makes mistakes on individual stocks. If you are required to be market neutral, this is the premium you should use. (What types of valuations require market neutrality?)
- *Average Implied Equity Risk premium*: The average implied equity risk premium between 1960-2011 in the United States is about 4%. You are assuming that the market is correct on average but not necessarily at a point in time.

Implied premium for the Sensex (September 2007)

■ 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%

Implied Equity Risk Premium comparison: January 2008 versus January 2009

<i>Country</i>	<i>ERP (1/1/08)</i>	<i>ERP (1/1/09)</i>
United States	4.37%	6.43%
UK	4.20%	6.51%
Germany	4.22%	6.49%
Japan	3.91%	6.25%
India	4.88%	9.21%
China	3.98%	7.86%
Brazil	5.45%	9.06%