

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

- You can scale up the riskfree rate in a base currency (\$, Euros) by the differential inflation between the base currency and the currency in question. In US \$:

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

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

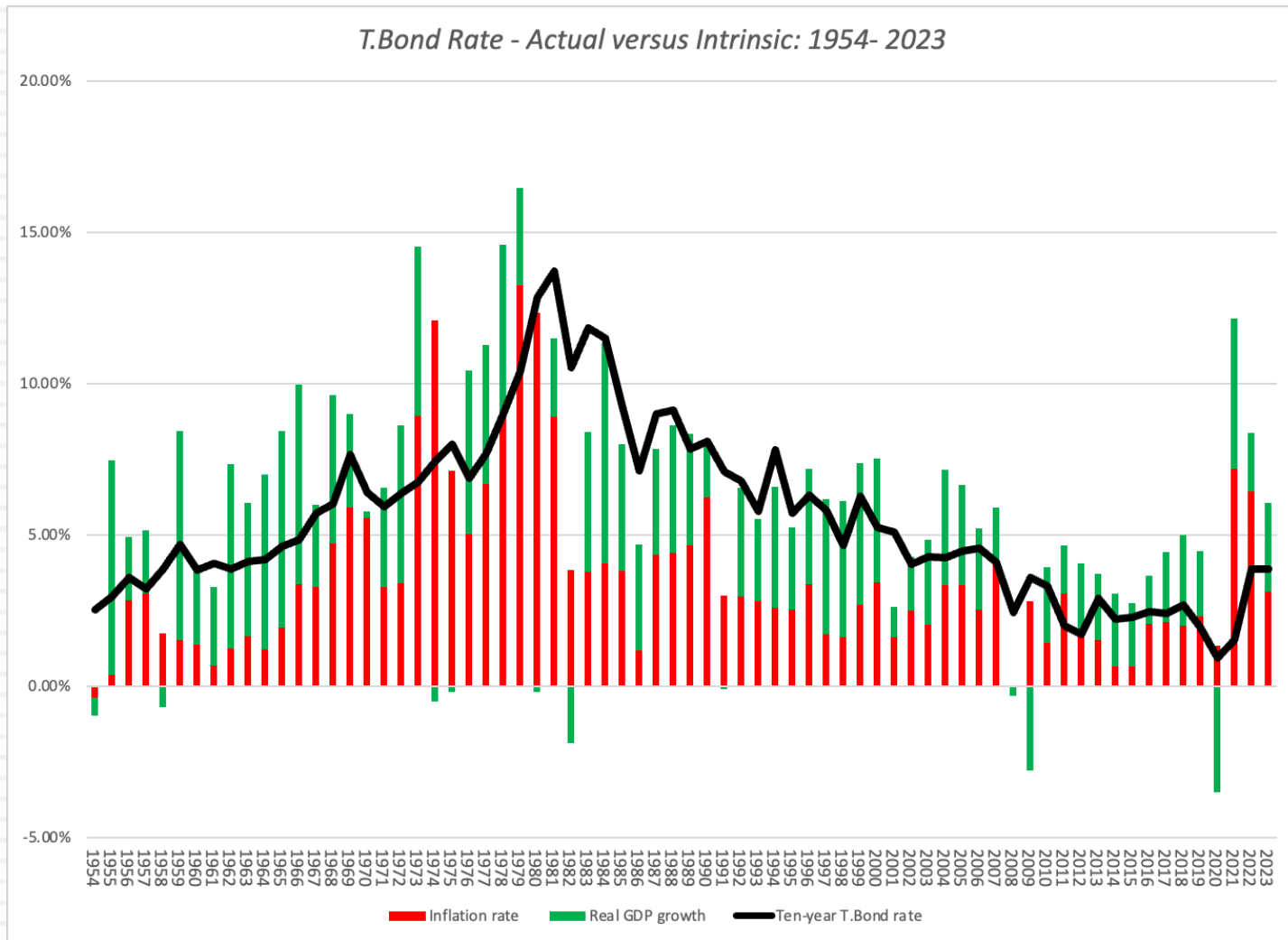
$$\text{Risk free rate} = (1.02) \frac{(1.15)}{(1.015)} - 1 = 15.57\%$$

One more test on riskfree rates...

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- On January 1, 2022, the 10-year treasury bond rate in the United States was 1.51%, low by historic standards. Assume that you are valuing a company in US dollars then but are 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 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?

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- In 2022, 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?

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Discount Rates: II

The Equity Risk Premium

II. The Equity Risk Premium

The ubiquitous historical risk premium

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- 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:

	<i>Arithmetic Average</i>		<i>Geometric Average</i>	
	Stocks - T. Bills	Stocks - T. Bonds	Stocks - T. Bills	Stocks - T. Bonds
1928-2023	8.32%	6.80%	6.50%	5.23%
Std Error	<i>2.03%</i>	<i>2.14%</i>		
1974-2023	8.18%	5.95%	6.79%	4.97%
Std Error	<i>2.45%</i>	<i>2.73%</i>		
2014-2023	11.70%	11.17%	10.63%	10.44%
Std Error	<i>4.97%</i>	<i>3.86%</i>		

The perils of trusting the past.....

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- 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 90 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%:

$$\text{Standard Error in Premium} = 20\%/\sqrt{90} = 2.1\%$$

- 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.

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

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- 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 2024, that spread was % for the Brazilian \$ bond) was 1.817%.
 - The sovereign CDS spread for the country. In January 2024, the ten-year CDS spread for Brazil, adjusted for the US CDS, was 1.81%.
 - The default spread based on the local currency rating for the country. Brazil's sovereign local currency rating is Ba2 and the default spread for a Ba2 rated sovereign was about 3.28% in January 2024.
- 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 4.60%.
 - Country Risk Premium for Brazil = 3.28%
 - Total ERP for Brazil = 4.60% + 3.28% = 7.88%

An equity volatility based approach to estimating the country total ERP

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- 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 5.94%.
 - 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 = 4.60% (30%/18%) = 7.67%
 - Country equity risk premium for Brazil = 7.67% - 4.60% = 3.07%

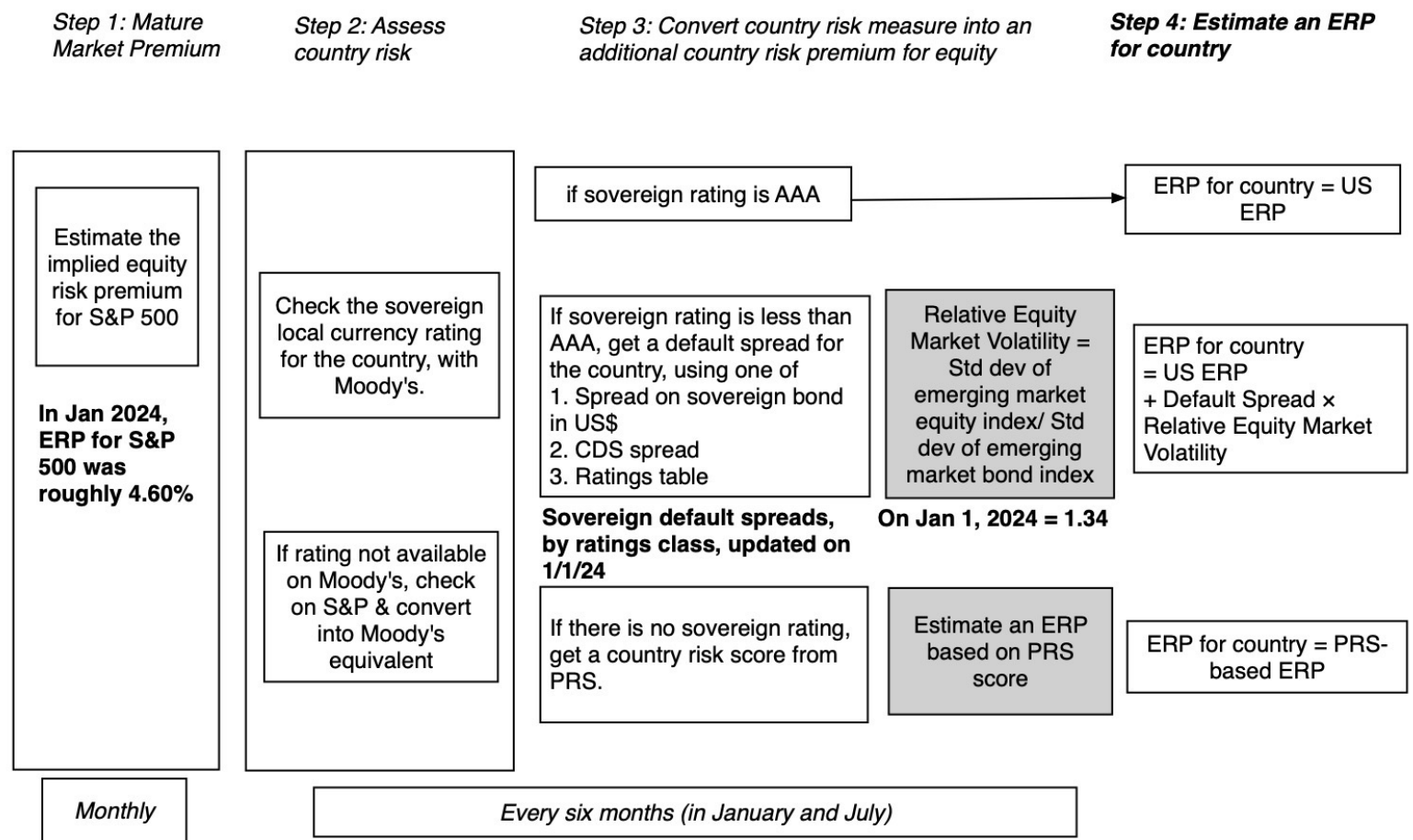
A melded approach to estimating the additional country risk premium

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- 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 2024, 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) = 30%
 - Standard Deviation in Brazil government bond = 20%
 - Default spread for Brazil= 3.28%
 - Brazil Country Risk Premium = 3.28% (30%/20%) = 4.92%
 - Brazil Total ERP = Mature Market Premium + CRP = 4.60% + 4.92% = 9.52%

A Template for Estimating the ERP

ERP Estimation Procedure



Andorra	Baa2	2.78%	7.38%	Italy	Baa3	3.21%	7.81%
Austria	Aa1	0.58%	5.18%	Jersey (States of)	Aa3	0.88%	5.48%
Belgium	Aa3	0.88%	5.48%	Liechtenstein	Aaa	0.00%	4.60%
Cyprus	Baa2	2.78%	7.38%	Luxembourg	Aaa	0.00%	4.60%
Denmark	Aaa	0.00%	4.60%	Malta	A2	1.24%	5.84%
Finland	Aa1	0.58%	5.18%	Netherlands	Aaa	0.00%	4.60%
France	Aa2	0.72%	5.32%	Norway	Aaa	0.00%	4.60%
Germany	Aaa	0.00%	4.60%	Portugal	A3	1.75%	6.35%
Greece	Ba1	3.66%	8.26%	Spain	Baa1	2.34%	6.94%
Guernsey (States of)	A1	1.03%	5.63%	Sweden	Aaa	0.00%	4.60%
Iceland	A2	1.24%	5.84%	Switzerland	Aaa	0.00%	4.60%
Ireland	Aa3	0.88%	5.48%	Turkey	B3	9.51%	14.11%
Isle of Man	Aa3	0.88%	5.48%	United Kingdom	Aa3	0.88%	5.48%
				EU & Environs		1.29%	5.89%

Albania	B1	6.58%	11.18%
Armenia	Ba3	5.26%	9.86%
Azerbaijan	Ba1	3.66%	8.26%
Belarus	C	23.49%	28.09%
Bosnia and Herzego	B3	9.51%	14.11%
Bulgaria	Baa1	2.34%	6.94%
Croatia	Baa2	2.78%	7.38%
Czech Republic	Aa3	0.88%	5.48%
Estonia	A1	1.03%	5.63%
Georgia	Ba2	4.40%	9.00%
Hungary	Baa2	2.78%	7.38%
Kazakhstan	Baa2	2.78%	7.38%
Kyrgyzstan	B3	9.51%	14.11%
Latvia	A3	1.75%	6.35%
Lithuania	A2	1.24%	5.84%
Macedonia	Ba3	5.26%	9.86%
Moldova	B3	9.51%	14.11%
Montenegro	B1	6.58%	11.18%
Poland	A2	1.24%	5.84%
Romania	Baa3	3.21%	7.81%
Russia	NA	6.58%	11.18%
Serbia	Ba2	4.40%	9.00%
Slovakia	A2	1.24%	5.84%
Slovenia	A3	1.75%	6.35%
Tajikistan	B3	9.51%	14.11%
Ukraine	Ca	17.55%	22.15%
Uzbekistan	Ba3	5.26%	9.86%
E. Europe & Russia		5.06%	9.66%

Country	PRS	CRP	ERP
Algeria	67.75	6.58%	11.18%
Brunei	81.5	0.88%	5.48%
Gambia	66.75	6.58%	11.18%
Guinea	60	13.17%	17.77%
Guinea-Bissau	65.25	8.04%	12.64%
Guyana	75.25	2.34%	6.94%
Haiti	56.5	14.63%	19.23%
Iran	63	9.51%	14.11%
Korea, D.P.R.	49.25	23.49%	28.09%
Liberia	55	17.55%	22.15%
Libya	73.75	2.78%	7.38%
Madagascar	62.75	9.51%	14.11%
Malawi	52.75	17.55%	22.15%
Myanmar	57	14.63%	19.23%
Russia	66.75	6.58%	11.18%
Sierra Leone	56.25	14.63%	19.23%
Somalia	51.75	17.55%	22.15%
Sudan	44.75	23.49%	28.09%
Syria	45	23.49%	28.09%
Yemen, Republic	55.75	14.63%	19.23%
Zimbabwe	57.5	13.17%	17.77%

Canada	Aaa	0.00%	4.60%
United States	Aaa	0.00%	4.60%
North America		0.00%	4.60%

Country	Rating	CRP	ERP
Angola	B3	9.51%	14.11%
Benin	B1	6.58%	11.18%
Botswana	A3	1.75%	6.35%
Burkina Faso	Caa1	10.97%	15.57%
Cameroon	Caa1	10.97%	15.57%
Cape Verde	B3	9.51%	14.11%
Congo (DR)	B3	9.51%	14.11%
Congo (Rep of)	Caa2	13.17%	17.77%
Côte d'Ivoire	Ba3	5.26%	9.86%
Egypt	Caa1	10.97%	15.57%
Ethiopia	Caa2	13.17%	17.77%
Gabon	Caa1	10.97%	15.57%
Ghana	Caa3	14.63%	19.23%
Kenya	B3	9.51%	14.11%
Mali	Caa2	13.17%	17.77%
Mauritius	Baa3	3.21%	7.81%
Morocco	Ba1	3.66%	8.26%
Mozambique	Caa2	13.17%	17.77%
Namibia	B1	6.58%	11.18%
Niger	Caa2	13.17%	17.77%
Nigeria	Caa1	10.97%	15.57%
Rwanda	B2	8.04%	12.64%
Senegal	Ba3	5.26%	9.86%
South Africa	Ba2	4.40%	9.00%
Swaziland	B3	9.51%	14.11%
Tanzania	B2	8.04%	12.64%
Togo	B3	9.51%	14.11%
Tunisia	Caa2	13.17%	17.77%
Uganda	B2	8.04%	12.64%
Zambia	Caa3	14.63%	19.23%
Africa		9.16%	13.76%

Abu Dhabi	Aa2	0.72%	5.32%
Bahrain	B2	8.04%	12.64%
Iraq	Caa1	10.97%	15.57%
Israel	A1	1.03%	5.63%
Jordan	B1	6.58%	11.18%
Kuwait	A1	1.03%	5.63%
Lebanon	C	23.49%	28.09%
Oman	Ba1	3.66%	8.26%
Qatar	Aa3	0.88%	5.48%
Ras Al Khaimah	A3	1.75%	6.35%
Saudi Arabia	A1	1.03%	5.63%
Sharjah	Ba1	3.66%	8.26%
United Arab Emirates	Aa2	0.72%	5.32%
Middle East		2.16%	6.76%

Bangladesh	B1	6.58%	11.18%
Cambodia	B2	8.04%	12.64%
China	A1	1.03%	5.63%
Fiji	B1	6.58%	11.18%
Hong Kong	Aa3	0.88%	5.48%
India	Baa3	3.21%	7.81%
Indonesia	Baa2	2.78%	7.38%
Japan	A1	1.03%	5.63%
Korea	Aa2	0.72%	5.32%
Laos	Caa3	14.63%	19.23%
Macao	Aa3	0.88%	5.48%
Malaysia	A3	1.75%	6.35%
Maldives	Caa1	10.97%	15.57%
Mongolia	B3	9.51%	14.11%
Pakistan	Caa3	14.63%	19.23%
Papua New Guinea	B2	8.04%	12.64%
Philippines	Baa2	2.78%	7.38%
Singapore	Aaa	0.00%	4.60%
Solomon Islands	Caa1	10.97%	15.57%
Sri Lanka	Ca	17.55%	22.15%
Taiwan	Aa3	0.88%	5.48%
Thailand	Baa1	2.34%	6.94%
Vietnam	Ba2	4.40%	9.00%
Asia		1.68%	6.28%

Australia	Aaa	0.00%	4.60%
Cook Islands	B1	6.58%	11.18%
New Zealand	Aaa	0.00%	4.60%
Australia & NZ		0.00%	4.60%

Aswath Damodaran

Blue: Moody's Rating
Red: Added Country Risk
Green #: Total ERP

From Country Equity Risk Premiums to Corporate Equity Risk premiums

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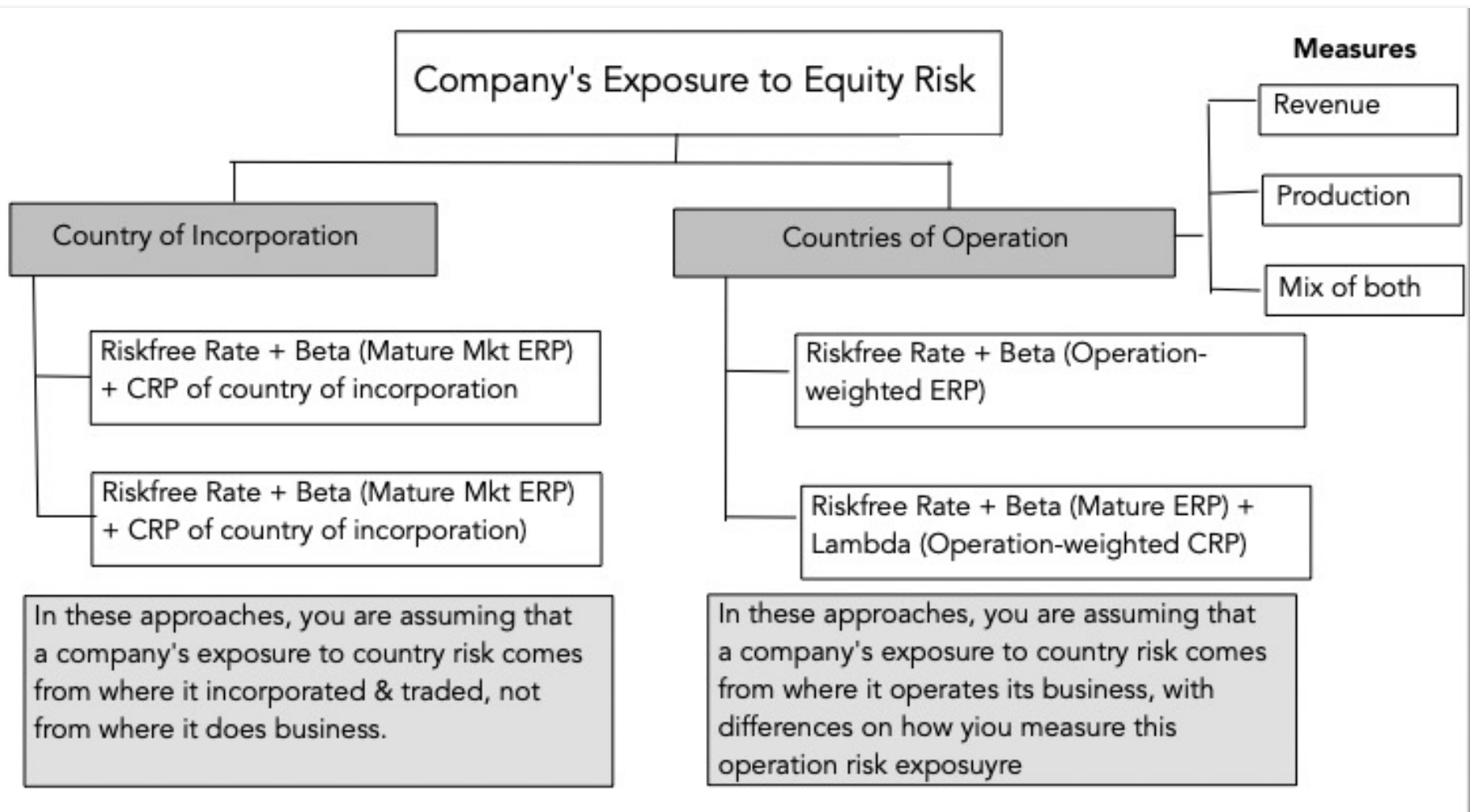
- Approach 1: Assume that every company in the country is equally exposed to country risk. In this case,
 - $E(\text{Return}) = \text{Riskfree Rate} + \text{CRP} + \text{Beta} (\text{Mature ERP})$
- Approach 2: Assume that a company's exposure to country risk is similar to its exposure to other market risk.
 - $E(\text{Return}) = \text{Riskfree Rate} + \text{Beta} (\text{Mature ERP} + \text{CRP})$
- 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)
 - $E(\text{Return}) = \text{Riskfree Rate} + \beta (\text{Mature ERP}) + \lambda (\text{CRP})$

Mature ERP = Mature market Equity Risk Premium
CRP = Additional country risk premium

Estimating country risk premium exposure_

Variants

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Operation based CRP: Single versus Multiple Emerging Markets

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- 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

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<i>Region</i>	<i>Revenues</i>	<i>Total ERP</i>	<i>CRP</i>
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..

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- 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

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<i>Country</i>	<i>Oil & Gas Production</i>	<i>% of Total</i>	<i>ERP</i>
Denmark	17396	3.83%	6.20%
Italy	11179	2.46%	9.14%
Norway	14337	3.16%	6.20%
UK	20762	4.57%	6.81%
<i>Rest of Europe</i>	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%
<i>Rest of Asia & ME</i>	24480	5.39%	7.74%
<i>Oceania</i>	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%
<i>Rest of Latin America</i>	576	0.13%	10.78%
Royal Dutch Shell	454326	100.00%	8.26%

Estimate a lambda for country risk

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- 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:

$$\lambda = \% \text{ of revenues domestically}_{\text{firm}} / \% \text{ of revenues domestically}_{\text{average firm}}$$

- 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:

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

$$\lambda_{\text{TCS}} = 7.62\% / 80\% = 0.09$$

- 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

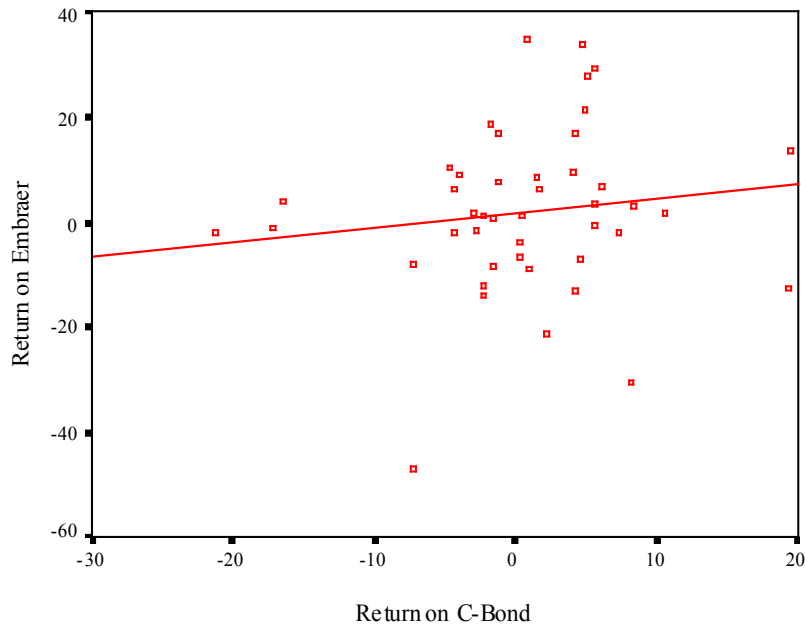
A Price/Return based Lambda

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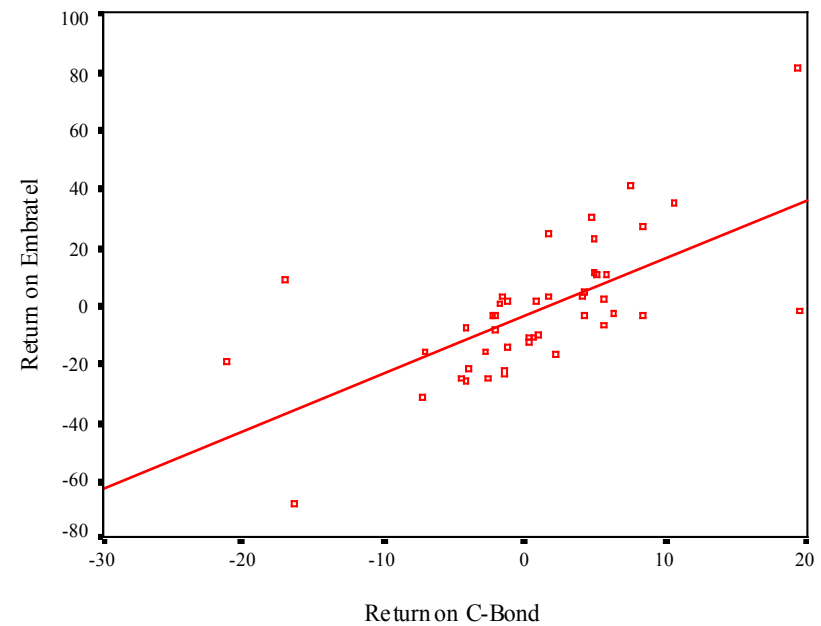
$$\text{Return}_{\text{Embraer}} = 0.0195 + \mathbf{0.2681} \text{Return}_{\text{C Bond}}$$

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

Embraer versus C Bond: 2000-2003



Embratel versus C Bond: 2000-2003



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

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- 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
 - $E(\text{Return}) = 4\% + 1.07 (5\%) + 7.89\% = 17.24\%$
 - ▣ Approach 2: Constant exposure to CRP, Operation CRP
 - $E(\text{Return}) = 4\% + 1.07 (5\%) + (0.03*7.89\% + 0.97*0\%) = 9.59\%$
 - ▣ Approach 3: Beta exposure to CRP, Location CRP
 - $E(\text{Return}) = 4\% + 1.07 (5\% + 7.89\%) = 17.79\%$
 - ▣ Approach 4: Beta exposure to CRP, Operation CRP
 - $E(\text{Return}) = 4\% + 1.07 (5\% + (0.03*7.89\% + 0.97*0\%)) = 9.60\%$
 - ▣ Approach 5: Lambda exposure to CRP
 - $E(\text{Return}) = 4\% + 1.07 (5\%) + 0.27(7.89\%) = 11.48\%$

Valuing Emerging Market Companies with significant exposure in developed markets

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

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

Implied Equity Premiums

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- For a start: 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 your expected return.
- Stock Price & Risk: 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.
- Implied ERP: 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).

Equity Risk Premium: January 2020

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