International Cost of Capital

An Overview

In this note, we will explore the risk premium investors demand in the domestic and international context in an effort to determine the cost of capital for the firm.

The financial theory conjectures that "volatility" or standard deviation of returns is an effective measure of risk of a single asset under certain assumptions[1].

The insights from portfolio theory suggest that investors can reduce risk by constructing diversified portfolios. As per portfolio theory, investors can attain superior risk-return trade-offs by constracting diversified portfolios and therefore should not hold individual assets in isolation. This realization shifted the conversation about the risk from "total risk" measured by "volatility" to a version that is consistent with portfolio diversification. Portfolio theory demonstrates that firm specific risks can be eliminated by including a sufficiently large number of assests into a portfolio. The theoretical foundations established by Harry Markowitz in the context of portfolio diversification culminated to well known "Capital Asset Pricing Model."

Acknowledging the value of portfolios for the investors, the CAPM model postulates that investors should be holding a portion of a fully diversified portfolio composed of all the risky assets in an economy. While it is impossible to construct a portfolio of all risky assets in practice, a market index such as S&P500 or Russel 2000 comes close to it in the context of the US economy. In other words, according to CAPM, average risk-averse investors should be holding an S&P 500 Index mutual fund or an index ETF. In an index mutual fund or index ETF, all the firm-specific risks are eliminated, and the only risk that the portfolio is exposed to is composed of market risk. An extension of this logic is the switch in the measure of risk from volatility (a measure of total risk of an asset) to beta (a measure of market risk or systematic risk of an asset). This switch is justified because for an investor who is holding a diversified portfolio, firm-specific or diversifiable risk is no longer a relevant risk. It is not relevant because the diversifiable risk disappears in the context of a diversified portfolio. Therefore, proponents of the CAPM argue that we do not need to be worried about diversifiable firms specific (or idiosyncratic) risk and should not expect to be compensated for firm-specific risk. However, even when a portfolio is fully diversified, the investor still has exposure to market risk (or systematic risk) and should be compensated for that exposure.

This line of thought suggests that measurement of market risk or systematic risk is a critical first step to determine the appropriate risk premium. This is a pillar of modern finance that we largely depend in figuring out the compensation we demand when we contemplate risky investments.

The baseline return for an investor is given by the well known Fisher Effect which suggests that investors require compensation for a possible loss of purchasing power and a real

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[1] Although this perspective is well established, I should admit that it is also rigorously challenged by practitioners.

interest that would increase their real purchasing power. We refer to this base line return as the risk free rate of return.

Earlier we defined this as i=r*+π

We will use the symbols i_f, R_f or r_f intercangably to indicated risk free rate of return. With this reminder, it is easy to see that an investor contemplating a risky investment would require a return that can be defined as:

$$k = R_f + RP$$

In other words, investors contemplating risky investments require a return equal to risk free rate of return (the base line we indicated above) plus a risk premium that is consistent with the riskiness of the asset. To determine the RP we need to key inputs:

1. A measure of risk
2. Compensation for unit risk

As we demonstrated during the class, analytically we can calculate the systematic risk or beta by using the following formula:

$$\beta_i = \frac{Cov(R_i, R_m)}{\sigma_m^2} = \frac{\rho_{i,m} \times \sigma_i \times \sigma_m}{\sigma_m^2} = \frac{\sigma_i}{\sigma_m} \times \rho_{i,m}$$

To calculate the beta of an asset, we need respective volatilities of the asset and the market as well as the correlation between the asset and the market. While this formula is useful to make conceptual sense out of beta, in practice we use a simple regression model to estimate the beta; we refer to this model also as the "market model":

$$R_{i,t} = \alpha_i + \beta_i R_{M,t} + e_{i,t}$$

In excel =LINEST (…) function can be used to estimate beta in the above model. You will need asset returns and market returns to calculate the beta. Please see the following Excel sheet for an illustration of beta estimation:

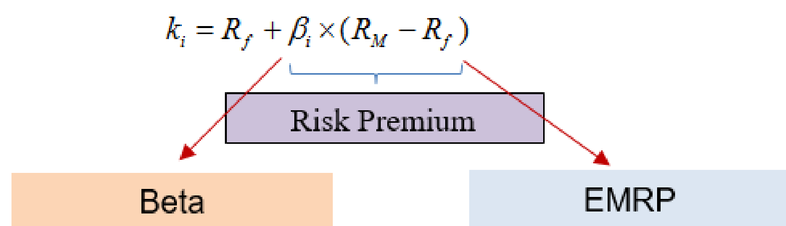
https://drive.google.com/open?id=1sIx58XZSfDfsrgSHRlUnVngW5sLPTkJb

The preceding discussion explains why we use beta as a measure of risk to determine the risk premium. The measure of risk we defined in "beta" solves half of the problem. We also need a price per unit risk, or compensation for taking the unit risk, in addition to a measure that reveals the extent of risk. This brings us to the equity market risk premium (EMRP) or the price of unit risk. Theoretically, EMRP is the compensation demanded by the average risk-averse investor in an economy for taking the unit risk.

How should we estimate it for practical use? One possible solution is to extract this from the historical returns on risky investments. If we agree that S&P 500 or a comparable broad-based index represents risky assets in the economy, return on S&P500 in excess of the risk-free rate of return over an extended period provides a reasonable estimate of the EMRP or unit price of risk. Historial averages produce a unit price in the range of 4.5-8.5% depending on the time frame used. A survey conducted in 2011 indicates that 49% of the CFOs used an EMRP within the range of 5% to 6%[2]. A more recent survey suggests a median of 5.2%[3].

Having laid this foundation, we can introducee CAPM. The CAPM model tells us what should be the required rate of return on a risky asset provided that we can measure its risk. It is based on the principle that return on a risky asset should be equal to the risk-free rate of return plus a risk premium consistent with the riskiness of the asset. In other words, the CAPM offers an answer to our risk premium question.

Formally we express CAPM in the following form:



$$R_f = \text{ Risk Free Rate } \rightarrow \text{ Common for all assets}$$

$$\beta_i = \text{Systematic Risk of Asset i } \rightarrow \text{ Specific for each asset}$$

$$(R_M - R_f) = \text{Economy wide price of risk } \rightarrow \text{Common for all assets}$$

After this introduction of the "Local or Domestic" version of the CAPM, let's explore the international version of CAPM.

How does international CAPM differ from local CAPM?

There are a few important differences. First, International or Global CAPM assumes that investors hold the global market portfolio instead of a domestic market portfolio. This assumption has a significant impact on both unit price of risk and the measure of risk that we use in CAPM.

The unit price of risk is affected because; the market portfolio is now a far larger and possibly more diversified world portfolio or global portfolio. It reflects the compensation

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[2] Do yo know your cost of capital by Michael T. Jacobs and Anil Shivdasani, HBR July August 2012

[3] Market Risk Premium and Risk-Free Rate used for 59 countries in 2018: a survey ; can be retrieved at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3155709

per unit risk (Global EMRP or GEMRP) provided that investors hold a portion of the global portfolio. It may be larger or smaller than the domestic EMRP.

Beta in the global context implies a sensitivity of the company returns to the economic shocks that affect the global market portfolio. This sensitivity may be weaker or stronger as compared to sensitivity to the local market portfolio. However, for the average company, sensitivity to the global market portfolio is lower. The combined impact of both components is likely to create a lower expected risk premium for holding risky assets.

Global or International CAPM can be expressed as follows:

$$k_{iG} = R_f + \beta_{Gi} \times (R_{GM} - R_f)$$

Where:

k_{iG} = Required return on the asset "i" from a globally diversified investors' perspective

R_f = Risk free rate in investors' country in investors currency

B_{gi} = Beta of the asset with respect to the global market portfolio representing risky global assets

$(R_{GM}-R_f)$=Global Equity Market Risk Premium or global price of unit risk in investors' preferred currency (has to be consistent with all of the currencies used above)

In this model, the required return is calculated from the perspective of an investor holding a globally diversified portfolio. Note that the returns expressed here are in US dollar terms, and therefore the risk free rate is the US risk free rate, and the returns for the firm and the global market portfolio are calculated in US dollars. For each investor in an integrated capital market, the required return can be calculated from their own perspective using their own currency. Assuming that currency risk is diversifiable or can be hedged, local currency required return can be converted into any currency by using IFE that we explored earlier.

Example:

Assume that GCAPM estimate of investment in Nestle is 9% when it is calculated in Swiss Francs. If the expected change in the Swiss Franc with respect to USD is 3% appreciation over the course of one year, the required rate of return in USD terms from Nestle investment should be:

$$k_{\$}^{Nestle} = (1 + k_{CHF}^{Nestle}) \times (1 + \Delta\% \text{ in CHF}) \text{-} 1 \rightarrow k_{\$}^{Nestle} = \left(1 + 0.09\right) x \left(1 + 0.03\right) - 1 = 12.27\%$$

Note that this model is a simplified version of the reality because it ignores the covariance between the Nestlé's equity returns and the changes in the value of Swiss Franc. Normally, we would need a covariance term added to the calculation to capture the conversion accurately. More accurate ex-ante USD expected return[4] for Nestle would be:

$$k_{\$}^{Nestle} = k_{CHF}^{Nestle} - x^{\text{USD/CHF}} - Cov(k_{CHF}^{Nestle}, x^{\text{USD/CHF}}) + \sigma_{USD/CHF}^{2}$$

Cost of Equity in Global Capital Markets

Suppose country A has a **segmented** capital market. The term implies that the residents of the country cannot invest abroad and foreign investors cannot invest in country A. The investors in country A are bounded with domestic investment opportunities. When an economic shock hits the country's economy, the market portfolio is negatively affected (i.e., prices decline collectively, index declines and negative returns are generated). Each individual firm is also affected at varying levels. Individual company share prices decline, and negative returns are generated for individual firms. The investors in country A cannot protect themselves against such a negative shock effectively or reduce their exposure to these shocks since they are not allowed to invest in securities originating from foreign capital markets. Since they take a serious risk because of the lack of diversification, they also expect relatively large compensation for taking this risk.

If we assume that investors in country A are allowed to invest abroad, domestic investors would not be as vulnerable to domestic economic shocks and therefore expected compensation for taking the domestic markets risks would change. If they diversify their portfolio by investing in foreign equities, they will not be affected by domestic economic shocks as before, and they will be less vulnerable. A theoretical and practical implication of this is that they would demand lower compensation for taking the home market risk as compared to the case where they did not have the opportunity to diversify (segmented market case).

Similarly, foreign investors holding an internationally diversified portfolio, are less vulnerable to domestic market shocks, and therefore demand a lower compensation than the domestic investor would in a segmented market. The impact of globalization of capital markets, therefore, is lower required rates of return demanded by investors. This implies higher equity prices and lower cost of equity for the companies.

Analytical Exposition:

The impact of globalization on the cost of capital can also be analytically shown. The risk measure in the global context does change! How? In order to see this let's look at the following beta or systematic risk expression:

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[4] This equation is derived by using Ito's linear conversion; for more information see "The Global CAPM And A Firm's Cost Of Capital In Different Currencies" by Thomas j. O'Brian; Journal Of Applied Corporate Finance Volume 12 Number 3 Fall 1999

$$\beta_i = \frac{Cov(R_i, R_M)}{\sigma_M^2} = \rho_{i,M} \times \frac{\sigma_i}{\sigma_M}$$

As you can see in the equation, a high correlation between the company returns and the local market portfolio implies high systematic risk or high beta. However, on average company returns have a lower correlation with the global market portfolio. Therefore correlation coefficient, therefore beta should be smaller under the assumption that investors' reference portfolio is the global equity portfolio. This is the reason why globalization (or integration) reduces the systematic risk for the average company.

The global version of CAPM in its generic form assumes that country risk and foreign exchange risk are diversifiable risks and therefore GCAPM does not account for additional compensation for such risks. However, these assumptions are often challenged. If these risks are considered to be systematic risks, some modifications in the model are necessary to account for these risks.

Such modifications were suggested by Solnik (1979) and Schramm-Wang (2011). The Shramm-Wang Model integrates currency risk into the International CAPM model as follows:

Risk Free Return in USD

Sensitivity of USD Returns to exchange Rate

Currency Risk Premium

$$k_i = R_f + \beta_{i,GM} \times (R_{GM} - R_f) + \varphi_i \times \left(\frac{F_T - S_T}{S_0} \right)$$

Global Beta calculated by using USD returns

Global Risk Premium

The additional parameters in the model are estimated in the same spirit as in the original CAPM or ICAPM models. Incorporation of currency risk requires a measure of asset's currency risk and compensation for unity currency risk (or unit price of currency risk). The measure of currency risk is simply the asset's exposure to the currency risk that is derived through the following model:

$$R_i = \alpha_i + \varphi_i s_{LC/FC} + \varepsilon_i$$

R represents asset returns, $s_{LC/FC}$ is the percentage change in the foreign currency the asset has exposure to, and alpha and epsilon are constant and residual errors respectively.

The price of unit currency risk is estimated as the historical average of deviations of the forward rate from the future spot rate at the expiration of the forward contract as a percentage of spot price:

$$FXRP = \frac{1}{N}\sum_{t=0}^{N}\left(\frac{F_{t,T} - S_T}{S_t}\right)$$

Solnik (1979) offers a similar model with a slightly different "price per unit currency risk". Solnik's unit compensation measure is the deviation from the "IFE implied exchange rate change" and stated as follows:

$$SRP = R_{DC,F}^{FOR} - R_F^{DC} = R_F^{FOR} + s - R_F^{DC} = s - (R_F^{DC} - R_F^{FOR})$$

Where s indicates the change in the foreign currency and interest rate differential indicates the interest rate differential between domestic and foreign risk free interest rates. We state Solnik's ICAPM model is as follows:

$$E(R_i) = R_F + \beta_{i,G} \times GMRP + \sum_{j=1}^{N} \gamma_{i,j} \times SRP_j$$

In the model, SRP is the unit price of risk for currency j , and the gamma is the sensitivity asset i to the currency j. The SRP corresponds to FXRP in Shramm-Wang model, and the gamma corresponds to

Integrated vs. Segmented or Partially Segmented Markets and Country Risk Factor

In international (Global) CAPM we conveniently assumed that country and exchange rate risks are diversifiable non-systematic risks. Under the integration assumption, the cost of equity for a a company I can be determined by using the ICAPM model.

$$k_i = R_f + \beta_{Gi} \times (R_{GM} - R_f) \text{ or } k_i = R_f + \beta_{Gi} \times GEMRP$$

Under the integration assumption, the cost of equity estimated in one currency can be easily converted into another currency by using IFE relationship that I demonstrated with an example above.

As we have shown above, when we assume that currency risk is not a diversifiable risk factor, investors should justifiably demand compensation for taking that risk. The Shramm-Wang and Solnik models are illustrations of how we can address additional risk factors.

Under the segmented financial markets or partially integrated markets assumption, the country risk may also be considered as a non-diversifiable risk factor.

There is no consensus regarding how to integrate the country risk factor into the cost of equity.

In this note, I will discuss several approaches. We will consider the required return from a US investor's perspective in an asset located in an Emerging Market economy, more specifically Peru.

Under the segmented market assumption, a US investor's expected return a risky investment can be stated as follows:

$$k_i = R_f + \beta_i \times (R_M - R_f) = R_f + \beta_i \times EMRP_{US}$$

How should the same investor approach to a risky investment in Peru? Since under segmentation assumption country risk is a non-diversifiable risk, we need to price this risk. The following are alternative methods to incorporate country risk into the required return by the US investor:

Baseline Data: Parent vs Host Market Volatility	
	9.00%
Peruvian Annualized Standard Deviation	31.18%
US Monthly Standard Deviation	4.66%
US Annualized Standard Deviation	16.13%
US EMRP	5.00%
Relative Volatility Model	
Assumed US EMRP	5.00%
Peruvian Equity Market Risk Premium (EMRP x Relative Volatility)	**9.67%**
Country Risk Premium	**4.67%**
Relative Equity to Debt Approach:	
5-Year Average Default Spread	2.78%
5-Year Peruvian Equity Volatility	37.10%
5-Year Peruvian Debt Volatility	14.81%
Country Risk Premium (CDS x Equity Market Volatility/Bond Market Volatility)	**6.96%**
Peruvian Equity Market Risk Premium (EMRP + CRP)	**11.96%**

Method-1: Relative Equity Country Risk Approach

In this approach, we estimate the Peruvian equity market risk premium by utilizing relative volatility of the Peruvian market with respect to the US market. The so called Adjusted Market Risk Premium for the Peruvian market can be calculated as follows:

$$\text{Adjusted Market Risk Premium} = \text{EMRP}_{US} \times \text{RMRF}_X = \text{EMRP}_{US} \times \frac{\sigma_X}{\sigma_{US}}$$

If the Peruvian market is more volatile than the US market, investors should adjust the unit price of risk to reflect the higher volatility. We use Relative Market Risk Factor (RMRF) for the respective market to make that adjustment.

$$\text{RMRF}_X = \frac{\sigma_X}{\sigma_{US}} = \frac{31.18\%}{16.13\%} = 1.933$$

Accordingly, the adjusted market risk premium for Peru is given as:

$$CRP = AMRP - EMRP = 0.0967 - 0.050 = 4.67\%$$

Suppose we estimate the required return on Peruvian company with a beta of 0.81. After estimating Peruvian country risk premium, we can determine the required return on this risky Peruvian assets by using the CAPM model:

$$\text{k}_\text{i} = \text{r}_f + \beta \times \text{EMPR+CRP=0.0308+0.81} \times \text{0.05+0.0465=11.78\%}$$

The equation above does not scale the country risk with respect to the systematic risk of the asset. In other words, it assumes that the asset has unit exposure to Peruvian country risk. We can alternatively scale the Country Risk Exposure with the beta of the firm. In that case, our estimation produces the following result:

$$\text{k}_{Nextel} = \text{r}_f + \beta \times \text{(EMPR+CRP)=0.0308+0.81} \times \text{(0.05+0.0465)=10.89\%}$$

As you can see, the lower beta of the firm, led to an overall lower required return as we scaled the exposure by beta.

An alternative Scaling Method is to use a company specific Country Risk Exposure coefficient. One such exposure coefficient can be obtained by using the relative exposure of the company to the local economy as compared to the average Peruvian company. The average exposure of the Peruvian firms to the Peruvian economy is 0.75; if the company we are considering has 100% exposure to the economy, the exposure coefficient can be obtained by:

$$\lambda_i = \frac{\text{Exposure to Local Economy}}{\text{Exposure of Average Company}} = \frac{1}{0.75} = 1.33$$

With this scaling measure we get the following estimate of the required return:

$$\text{k}_{Nextel} = \text{r}_f + \beta \times \text{EMPR} + \lambda \times \text{CRP}$$
$$\text{k}_{Nextel} = \text{0.0308+(0.81} \times \text{0.05)+(1.33} \times \text{0.0465)=13.31\%}$$

As this result suggests, the required return is highly sensitive to the choice of scaling factor.

Method-2: CRP Based on Credit Default Risk Premiums

Alternatively, we can derive the Country Risk Premium form Credit Default Spreads. This approach requires an adjustment in CDS Spreads as CDS spreads reflect risk premium for bonds. We can convert a bond based premium into an equity based premium by using the relative volatility of equity and bond markets[5].

The five years average Peruvian Credit Default spread is 2.78, and the relative volatility of Peruvian equity market to the bond market is 2.55 times.

$$\text{Country Risk Premium}_X = (\text{Country Default Spread}) \times \frac{\sigma_{Equity,X}}{\sigma_{Debt,X}}$$

$$\text{Country Risk Premium}_X = 2.78 \times \frac{37.10\%}{14.81\%} = 6.96\%$$

If we use this estimate of the CRM, we get the following required return without scaling the CRP:

$$\text{k}_{Nextel} = \text{r}_f + \beta \times \text{EMPR} + \text{CRP} = 0.0308 + 0.81 \times 0.05 + 0.0696 = 14.09\%$$

Estimation of Country Risk Premium/CDS Spreads	
5 Year Average Default Spread	2.78%
5-Year Peruvian Equity Market Volatility	37.10%
5-Year Peruvian Equity Market Volatility	14.81%
Country Risk Premium	6.96%

If we scale the CRP with the beta, we get the following estimate:

$$\text{k}_{Nextel} = \text{r}_f + \beta \times (\text{EMPR} + \text{CRP}) = 0.0308 + 0.81 \times (0.05 + 0.0696) = 12.76\%$$

Finally, if we use lamda we estimated above to scale CRP we get the following:

$$\text{k}_{Nextel} = \text{r}_f + \beta \times \text{EMPR} + \lambda \times \text{CRP}$$
$$\text{k}_{Nextel} = 0.0308 + (0.81 \times 0.05) + (1.33 \times 0.0696) = 16.38\%$$

In summary in the forgoing discussion, we used two alternative methods to derive an estimate of the country risk premium and deployed these estimates by using three alternative approaches:

1) Unscaled

2) Scaled with beta

3) Scaled with Lamda

In each case, we made certain assumptions about the asset's exposure to country risk.

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[5] This approach originally suggested by Damodaran to convert Sovereign Spreads into equity based country risk premiums.

Estimating the Firm Beta:

Estimating asset betas can be challenging because of two principal reasons:

1) The asset in question is not listed; a time series of returns series is not available

2) Listing market is illiquid or inefficient; estimated betas are not meaningful

Under these circumstances, we can estimate asset (unlevered) betas and then estimate equity (levered) betas to use in the CAPM model.

$$\beta_i = \frac{Cov(R_i, R_M)}{\sigma_M^2} = \rho_{i,M} \times \frac{\sigma_i}{\sigma_M}$$

The beta we introduced in the preceeding discussion is referred to as “levered beta” or “equity beta” and it is a measure of combined risk encompassing both business and financial risk.

If the company in question has no leverage in its capital structure, the “equity beta” or “levered beta” is equal to “unlevered beta” or “asset beta”. “Unlevered” or “Asset Beta” reflects “pure business risk” of a company. Alternatively we can interpret as the measure of systematic risk of operating assets of the firm.

Under certain assumptions, in the context of CAPM there is a simple relationship between levered and unlevered beta:

$$\beta^U = \frac{\beta^L}{\left(1 + (1 - T) \times \frac{D}{E}\right)}$$ → Assumes constant debt, and zero debt beta

$$\beta^U = \frac{E}{V} \times \beta^L = \frac{\beta^L}{(V / E)}$$ → Assumes constant debt ratio and zero debt beta

We can use these relationships to determine the average business line risk by estimating unlevered betas or asset betas in a particular industry or business line. This approach can be effectively deployed to estimate betas of firms that are not listed or stock market prices are not reliable to estimate equity betas. This approach requires deriving a business line risk indicator from comparable company asset betas and using the same equation to estimate the equity beta by re-levering the asset betas. For instance, under the constant ratio and zero debt beta assumption, we can derive the equity betas from asset betas as follows.

$$\beta^L = \beta^U \times \frac{V}{E}$$

In the case of Nextel Peru, we use a group of comparable companies to estimate Nextel's asset beta. In the case, we are given a group of comparable companies that allows us to determine business line risk in wireless communication services.

Companies:	Current D/V	Historic D/V	Equity Beta (1)	Debt Beta (2)	Asset Beta
America Movil	27.2%	17.7%	1.01	0.12	0.85
Embratel Participacoes S.A.	11.0%	25.2%	0.63	0.05	0.48
ENTEL	14.1%	13.7%	0.80	0.07	0.70
NII Holdings	80.0%	41.7%	0.77	0.18	0.52
Oi SA	74.0%	32.5%	1.14	0.15	0.82
Telecom Argentina	-19.5%	-13.9%	1.17	0.00	1.33
Telefonica Brasil	1.6%	3.3%	1.58	0.00	1.52
Telefonica Del Peru	22.0%	26.6%	0.35	0.17	0.30
TIM Participacoes S.A.	7.1%	6.8%	0.81	0.07	0.76
Average					**0.81**

The asset betas above derived under the assumption of constant debt ratio and non zero debt beta.

$$\beta_{Asset} = \frac{E}{V} \times \beta_E + \frac{D}{V} \times \beta_D = \left(1 - D/V\right) \times \beta_E + \left(D/V\right) \times \beta_D$$

The average Wireless telecom beta is 0.81. Assuming that the Nextel is a pure equity firm, we can use this beta to reflect Nextel's systematic risk to the US investors holding diversified US Portfolios.

Additional Methods to Incorporate Country Risk in Determining Required Returns:

Offshore Beta Approach:

Offshore beta approach was developed by Don Lassard. Lassard suggested that project risk should be adjusted for the country risk. He argued that this could be done by using a "country beta" which measures the sensitivity of foreign market equity index returns to global market index returns. If the project is located in a market with high beta, then the project risk would be adjusted to reflect this risk. He also cautiously suggested a downside risk adjustment by adding a country risk premium such as sovereign yield spread. While he cautioned the practitioners about the importance of accounting for the risks in the cash flows, he indicated that an adjusted discounted factor might be a good first cut in evaluating offshore projects. Lassard's risk adjusted discount factors are given as follows. Note that the first discount factor does not include a downside adjustment for the country risk.

$$k = R_f + \beta_{Country} \times \beta_{Project} \times GEMRP$$

$$k = R_f + CRP + \beta_{Country} \times \beta_{Project} \times GEMRP$$

The analysts noted that project beta reflected the project's risk in the home market because of the unreliability of the data in the foreign markets.

Bank of America Model

A model suggested by Bank of America's Godfrey and Espinoza argues that using a project beta calculated with respect to investor's home market underestimates the risks in the foreign market. Accordingly, they suggest an adjusted beta that reflects the relative volatility of the foreign market with respect to the global market or home market (depending on segmented or integrated market assumptions). Godfrey and Espinoza define "adjusted beta" as the ratio of foreign market volatility to the global market volatility adjusted for an overlap between equity market risk and sovereign yield spread. The relative volatility is downward adusted by 40% under the assumption that the overlap between the equity market volatility and the sovereign yield spread is approximately 40%.

$$\beta_{adj} = 0.6 \times \frac{\sigma_F}{\sigma_W}$$

Accordingly, the discount factor for a project in a foreign market is given as:

$$k = R_f + CRP + \beta_{adj} \times GEMRP$$

$$k = R_f + CRP + \{0.6 \times \frac{\sigma_F}{\sigma_W}\} \times GEMRP$$

Goldman Sachs Model

A third model proposed by Goldman Sachs analysts simply proposes a different adjustment for double counting than that included in the Godfrey-Espinosa model. More precisely, these analysts propose to substitute a fixed adjustment factor of "0.60" by one minus the observed correlation between the stock market and the bond market of the country in which the project is based. In other words, the adjusted beta proposed by Goldman Sachs analysts is:

$$\beta_{adj} = (1 - \rho_{S/B}) \times \frac{\sigma_F}{\sigma_W}$$

where $\rho_{S/B}$ denotes the correlation between the stock and bond markets of the foreign country. In addition, as in the Godfrey-Espinosa model, the Goldman Sachs model includes the adjustment for country risk.

$$k = R_f + CRP + (1 - \rho_{S/B}) \times \frac{\sigma_F}{\sigma_W} \times GEMRP$$

Solomon Smith Barney Model

Solomon-Smith Barney suggests the following model:

$$k = R_f + \beta_{\text{Project}} \times GEMPR + \frac{\gamma_1 + \gamma_2 + \gamma_3}{30} \times CRP$$

The proposed model incorporates the firms specific country risk depending on the nature of the project, where

R_f = the risk free rate of the home country

□$_{project}$= the global CAPM *beta* for company i am corresponding to the optimal capital structure and the industry of the investment

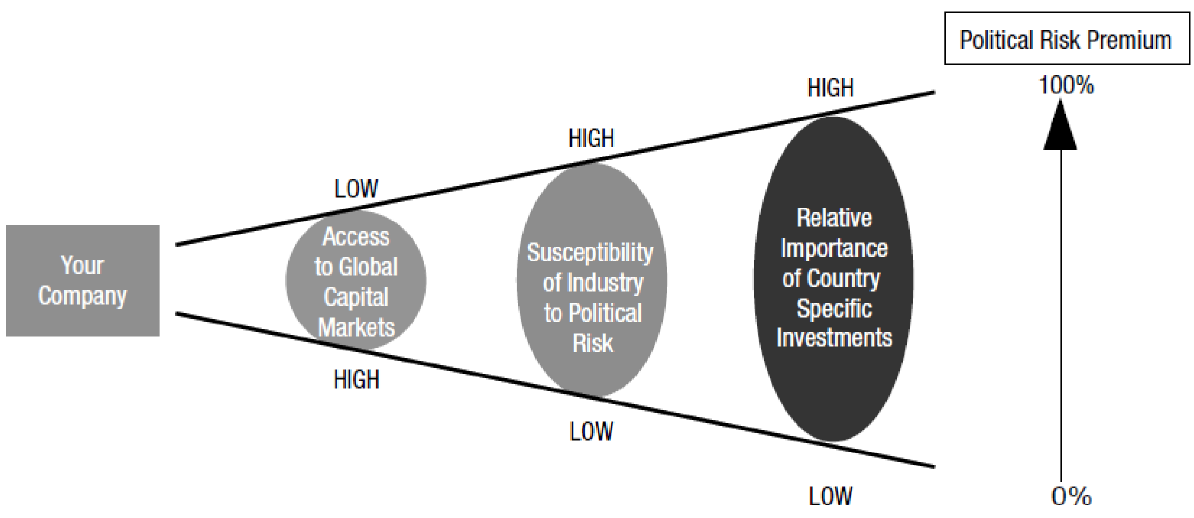
GEMRP = the global equity market risk premium
γ_1= access to capital markets score (score from 0 to 10 with a 0 indicating the best access to capital markets)
γ_2 = susceptibility of investment to political risk (score from 0 to 10 with "0" indicating the least susceptibility to political intervention)
γ_3 = importance of the investment for the investing company (score from 0 to 10 with a 0 indicating that the investment only constitutes a small portion of the firm's assets)
CRP = unadjusted counry risk premium

γ_1 measures the fact that large firms with wide access to capital markets are likely to have fully diversified investors and, therefore, will most likely be concerned only about the systematic risk captured by the CAPM beta and less concerned about any diversifiable or country-specific risk.

The Salamon Smith Barney model incorporates γ_2 because if the political risk premium represents a cash flow loss from expropriation, it should be most relevant for industries that are highly susceptible to political intervention.

Finally, γ_3 captures the fact that if the investment constitutes a minor part of the firm's assets, then the asset is not likely to significantly increase the total risk of the firm, but in fact, may decrease it because of diversification.

In contrast, if the new investment constitutes a major part of the firm's assets, then political uncertainty in the host country could significantly affect the investing firm's risk profile.



The figure above outlines how the political risk premium weights γ 1, γ 2, and γ 3 are applied.