Country Risk – Cost of Equity Measurement: Methodologies and Implications*

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August 1, 2017

Abstract

Evaluating investments in international (and particularly in emerging) markets often leads to confusion and controversy among academics and practitioners. Various theories propose competing models, whereas practitioners build their own alternatives. Our study provides an assessment of the most widely used methods of assessing country risk and shows that practitioners should carefully choose their country risk model. Current models produce a wide range of cost of equity estimates that can considerably affect management decisions. Our case study of reference firms in emerging markets reveals considerable spreads in the models' estimates of up to 25.6 percentage points for individual firms and 15.4 percentage points on average.

JEL classification: G31, G32

Keywords: Cost of capital, cost of equity, foreign investment, country risk

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*This paper is the extended working paper version of Horn et al. (2017), which was published in *Corporate Finance: Finanzierung, Kapitalmarkt, Bewertung, Mergers & Acquisitions* (September 2017, No. 09-10, p. 292-30), a German financial management practice journal. We thank the publisher, who granted permission to publish this working paper version including all internet appendices.

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1 Introduction

Firms lose billions of Euros in emerging markets. Many of these losses stem from regulatory violations, bribery, fraud, or damage to reputation, all of which are aspects of so-called "country risk"[1]. This paper examines how to incorporate country risk into the cost of capital when determining the value of investments in international markets – particularly in emerging markets.

Although the Capital Asset Pricing Model (the *standard* CAPM) is still widely regarded as the default model for estimating cost of equity, many executives do not believe that it adequately reflects cost of equity in the international context. In their seminal work, Graham and Harvey (2001) document that approximately one-third of firms add "some extra risk factors" to the CAPM when estimating their cost of equity capital. The most recent KPMG (2006) cost of capital study supports these results, revealing that approximately 40% of the surveyed firms add a country risk premium (CRP) to the standard CAPM formula. In practice, there is a wide range of "self-developed" models that firms apply to calculate discount rates for their international investment portfolios.

In recent years, numerous methodologies that consider country risk in the calculation of the cost of equity have emerged in the financial management literature (Bekaert, Harvey, Lundblad, and Siegel, 2016). Because the application of these methods is wide-ranging (e.g., in mergers and acquisitions, for impairment testing, or for performance measurement), the inappropriate choice of a particular country risk model may lead to unintended (and possibly severe) investment distortions. This paper aims to mitigate these possible distortions: we assess the most widely used methods, discuss their impact on cost of equity estimates and provide recommendations for the reader.[2] These recommendations are based on valuation objectives that are commonly important for various groups of investors, regulators, academics and valuation analysts: (1) theoretical foundations, (2) the degree of discretionary elements, (3) transparency, (4) data availability, and (5) ease of use.

[1] A recent survey published in the Harvard Business Review revealed that 83% of the surveyed firms (150 companies from North America and Europe with more than $1.0 bn in revenues) "suffered significant losses since 2010" from their investments in emerging markets (Hochberg, Klick, and Reilly, 2015).

[2] The inappropriate choice of discount rates is not the only source of over- and underinvestment distortions, see, e.g., Stein (2003), Hoang and Ruckes (2015), and Hoang, Gatzer, and Ruckes (2017) for extensive discussions about the distortionary effects of information and agency issues on corporate investment.

We also provide a case study that compares the cost of equity estimates of 20 well-known country risk models for reference companies in typical emerging markets (i.e., the BRIC countries – Brazil, Russia, India and China). Our analysis reveals considerable spreads in the models' estimates of up to 25.6 percentage points per company and 15.4 percentage points on average.

2 Why do Many Financial Executives Adjust the Standard CAPM for International Cost of Equity Estimates?

When calculating the cost of equity for foreign investments, many financial executives and investors believe that a company's cost of equity as calculated by (variants of) the standard CAPM is too low, particularly for countries with a high perceived country risk: take the International CAPM, a variant of the standard CAPM, as an example. In its simplest form, the International CAPM uses the CAPM framework with global parameters, i.e., with a global risk-free rate, a global market risk premium and a beta measured against the global market.[3] By applying this model, the investor assumes that any non-diversifiable risk is appropriately captured in the stock's beta factor as measured against a global index (e.g., MSCI World).

One key reason that practitioners are frequently reluctant to apply the International CAPM when valuing firms from emerging markets is that the International CAPM often results in a lower cost of equity estimate than that expected by the analyst. The (perceived) inappropriately low cost of equity estimates result from many investors' limited ability to sufficiently diversify away the idiosyncratic risk associated with investments in emerging markets. This potential imperfect diversification of systematic risk may lead investors to demand higher returns than those estimated by the International CAPM. The reasons for such limits to diversification include, inter alia, market barriers and segmented markets. Market barriers, such as discriminatory taxation and/or national legal/institutional frameworks, can result in partial segmentation and limit global diversification (Carrieri, Chaieb, and Errunza, 2013). Additionally, calculating the International CAPM-beta in segmented markets[4] can be

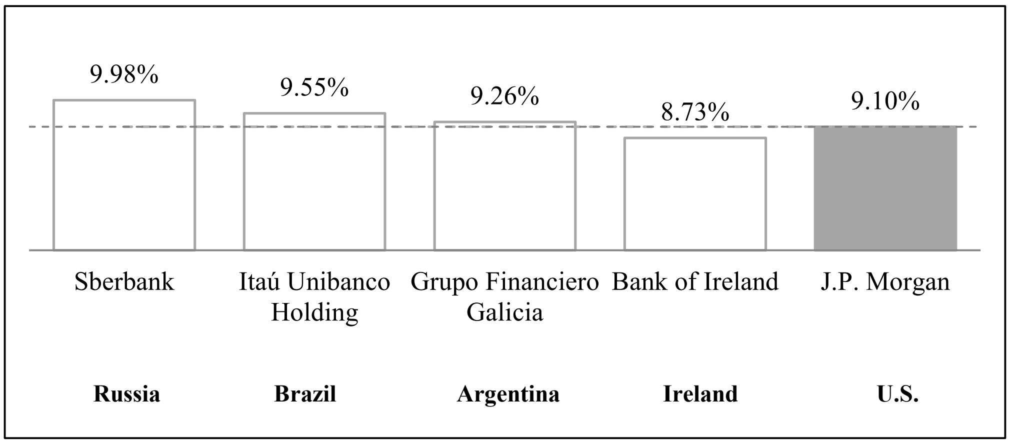
[3] A discussion of the International CAPM and its formal definition follow in Section 3.A.

[4] By segmented markets, we mean markets that are sufficiently isolated such that investors domiciled in one market cannot access the other market, and vice versa.

further complicated by the low correlation between local and international markets, which can significantly reduce the beta (Erb, Harvey, and Viskanta, 1997). However, even if global markets are integrated – and risk could thus be diversified globally – the average investor may be “home biased”, which can result in overexposure to familiar markets and severely limit global diversification (Damodaran, 2013).

To underscore our argument, we compute the cost of equity with the International CAPM for companies located in countries with various risk profiles[5]. The results are depicted in Figure 1.

Figure 1: Cost of Equity as of June 30, 2016 (risk-free rate: 3.5 %, MRP: 5%)



The costs of equity based on the International CAPM as of June 30, 2016, range from 8.73% (for the Bank of Ireland) to 9.98% (for Sberbank).[6] The U.S. bank J.P. Morgan, which might be considered less affected by country risk than its peers in this example, has an estimated cost of equity of 9.1%. The cost of equity estimates for the reference banks from Brazil and Russia, however, are relatively on par with those of J.P. Morgan’s.

Some analysts may find these results counterintuitive and may feel that the relatively small difference of 45-88 basis points in the cost of equity estimate of the reference banks from Brazil and Russia relative to J.P. Morgan does not compensate for the country risk to which an investor is exposed.

[5] The investor in this example is U.S.-based, and the valuation is performed in USD. For illustration, we select Russia, Brazil, Ireland, and Argentina — all countries with substantial country-risk exposures. The companies are from the finance industry and mainly operate in their domestic markets.

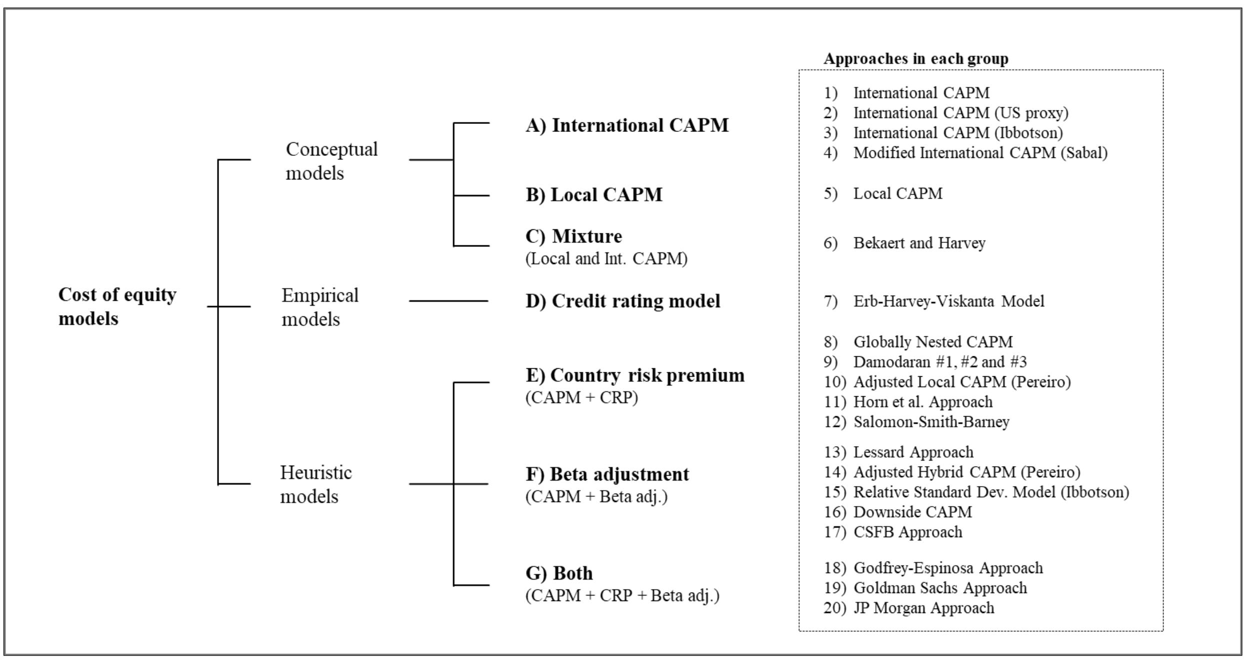
[6] Detailed calculations for the illustrative example in Figure 1 are available on request.

In fact, although these (perceived) shortcomings of the International CAPM are well known, no approach to including country risk in business valuations has been successfully established as the standard pricing model across the investor spectrum. To the best of our knowledge, no method is widely accepted by all market participants, resulting in many different approaches suggested by both academics and practitioners. We present these methods in the following section.

3 Cost of Equity Models and Country Risk

Academics and practitioners frequently apply a variety of CAPM approaches that "correct" for country risk. Figure 2 provides an overview of the main approaches that include country risk in the cost of equity estimation.[7]

Figure 2: Country Risk - Cost of equity estimation: Main methodologies



We classify the various approaches into three main groups: *conceptual* models, *empirical* models and *heuristic* models. The models in the first two groups have been widely approved by academics and generally have a strong foundation in economic theory. However, these models have been perceived

[7] We refer to Table A1 in the Appendix for a complete list of these 20 approaches, including calculation formulas.

as either limited or unfeasible for application in a daily business setting, at least by some practitioners. Therefore, valuation analysts have also developed alternative models. These models are more or less "loosely" based on the CAPM framework and include adjustments for specific country-related risks, for example, by including a CRP or by adjusting the exposure (beta) to systematic risk.

Most of these models involve deviations from and adjustments to the *standard* CAPM.

Standard CAPM:

$$E[r_i] = r_f + \beta_i \times MRP \tag{1}$$

where $E[.]$ represents the expectation operator, r_i is the return of risky asset i, r_f is the risk-free rate, β_i is the beta factor of asset i measured as $Cov(r_i, r_m)/Var(r_m)$, with r_m as the return of the market portfolio, and MRP is the market risk premium.

In subsequent sections, we present the *most representative* methods of assessing country risk for each of the different groups of models. We emphasize that our summary is not a detailed step-by-step guide to apply these models; our aim is instead to outline the general workings of these models. Table A1 in the Appendix contains a comprehensive and detailed description of the remaining approaches not discussed in the main text.

A) International CAPM

Conceptual Formula:

$$E[r_i] = r_{f\_global} + \beta_{i,global} \times MRP_{global}, \tag{2}$$

where r_{f_global} is the global risk-free rate, $\beta_{i,global}$ is the beta factor of the company with respect to the global market, and MRP_{global} is the global market risk premium.

In its simplest form, the International CAPM uses the standard CAPM framework with global parameters.[8] This approach is in line with the standard CAPM theory and is theoretically sound if markets are globally integrated. In general, this approach is easy to implement, the data availability is good, and it can be applied to companies in most countries. However, in many cases, this approach does not result in the expected increased cost of equity for emerging markets (see example in Figure 1), which is counterintuitive. The key reason is the observed low correlation between local emerging

[8] There is no consistent name convention in the literature. The group of models presented here is frequently called Global CAPM, World CAPM, or Single-Factor International CAPM.

and global markets that occurs when these markets are fully or partially segmented. This low correlation leads to low betas and lower than expected costs of equity.[9]

There are also other versions of the International CAPM. For instance, Pratt and Grabowski (2008) argue that given the size and the maturity of U.S. financial markets, analysts can use the U.S. risk-free rate as a proxy for the global risk-free rate, the U.S. MRP as a proxy for the global MRP, and the company beta with respect to the U.S. market as a proxy for the global beta. The result is the so-called International CAPM (US proxy).

International CAPM: $$E[r_i] = r_{f\_global} + \beta_{i,global} \times MRP_{global} \quad (3)$$

International CAPM (US proxy): $$E[r_i] = r_{f\_US} + \beta_{i,US} \times MRP_{US} \quad (4)$$

Before continuing, we should note that there are also variants of the International CAPM that explicitly incorporate risks arising out of deviations from the purchasing power parity, which is done by adding an additional risk factor that measures the exchange-rate risk between local and base currency. To provide clear-cut results, we assume throughout this paper that the purchasing power parity holds in the long run for real investments, which implies that exchange risk is not priced. We refer the interested reader to Sabal (2004) for discussions on currency effects in the context of the International CAPM.

B) Local CAPM

The local CAPM assumes the segmentation of capital markets and implies that only the local market is relevant for the asset return:

$$E[r_i] = r_{f\_local} + \beta_{i,local} \times MRP_{local}, \quad (5)$$

where r_{f_local} is the local risk-free rate, $\beta_{i,local}$ is the beta factor of the company with respect to the local market, and MRP_{local} is the local market risk premium.

As for the international version of the CAPM, the local CAPM is theoretically sound, i.e., consistent with the CAPM theory, but only if markets are segmented and the local market can be regarded as the

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[9] The Beta for the MSCI Emerging Frontier Markets Africa ex South Africa Index (EM Index) against MSCI World is only 0.46, although the EM index is more volatile and considered riskier than the MSCI World. This result can be attributed primarily to the low correlation between those two markets. The beta is calculated as of June 30, 2016, based on two years of historical weekly returns.

relevant market portfolio. In practice, estimating the local beta and market risk premium might be challenging in illiquid and inefficient markets because of poor data quality stemming from issues such as low liquidity and short time series. Additionally, in some cases, the emerging country's government bonds (used to determine the local risk-free rate) may not be free of default risk.

C) Mixture Model of Bekaert and Harvey

Instead of choosing between local and global betas and local and global market risk premiums, Bekaert and Harvey (1995) suggest including both because both parameters may be relevant to a company's return. An additional factor, λ, models the proportional impact of the global beta and the global market risk premium on the return of the risky asset.

$$E[r_i] = r_{f\_US} + (1-\lambda) \times \beta_{i,local} \times MRP_{local} + \lambda \times \beta_{i,global} \times MRP_{global} \quad (6)$$

Thus, λ represents the level of the local country's integration into the world market. With a λ of one, the Bekaert and Harvey mixture approach assumes perfectly integrated markets; conversely, when λ equals zero, markets are perfectly segmented.

D) Credit Rating Model

Credit rating models are based on the idea that historical returns and ratings can predict future returns. Erb, Campbell, and Viskanta (1996) present several versions of the credit rating model. They fit a regression model using equity market data and survey-based credit ratings from countries with liquid equity markets. Using these estimates, they forecast "out-of-sample" the expected returns for markets with ratings but without equity market.

E) Additive CRP

Models in this category include an additive CRP.

Conceptual Formula: $$E[r_i] = r_{f\_US} + \beta_{i,US} \times MRP_{US} + CRP, \quad (7)$$

where r_{f_US} is the U.S. risk-free rate, $\beta_{i,US}$ is the beta factor of the company with respect to the U.S. market, MRP_{US} is the U.S. market risk premium, and CRP is the country risk premium added.

This type of adjustment is widely accepted among practitioners. Normally, this approach uses both the beta and the market risk premium of a mature market with good data availability, e.g. from the U.S., as a baseline and then adds a CRP to incorporate those parts of the idiosyncratic risk that investors believe to be important and not diversifiable.

There are different approaches to estimating the CRP (Damodaran, 2013). The most widely applied method (García-Sánchez, Preve, and Sarria-Allende, 2010) is to define the CRP as the country's default spread[10]. The main intuition behind applying the default spread comes from assuming that a company's country risk is driven by many of the same factors as government default risk, such as political instability. Because this risk is already priced into the government bond market, it also serves as a convenient and always up-to-date proxy for a company's country risk. Aswath Damodaran regularly publishes CRPs based on country ratings, default spreads and CDS spreads[11].

In addition to the different approaches to estimating the CRP, various authors have proposed adjusting the CRP in various ways that are based on company or market specific factors.

Damodaran No. 1:

$$E[r_i] = r_{f\_US} + \beta_{i,US} \times MRP_{US} + CRP \tag{8}$$

Damodaran No. 2:

$$E[r_i] = r_{f\_US} + \beta_{i,US} \times MRP_{US} + CRP \, \frac{\sigma_{local,E}}{\sigma_{local,B}} \tag{9}$$

Damodaran No. 3:

$$E[r_i] = r_{f\_US} + \beta_{i,US} \times MRP_{US} \, \frac{\sigma_{local}}{\sigma_{US}} \tag{10}$$

Horn et al.:

$$E[r_i] = r_{f\_US} + \beta_{i,US} \times MRP_{US} + CRP + Ceiling\ Risk\ Premium \tag{11}$$

Salomon-Smith-Barney:

$$E[r_i] = r_{f_{US}} + \beta_{i,global} \times MRP_{global} + CRP \, \frac{\gamma_1 + \gamma_2 + \gamma_3}{30} \tag{12}$$

[10] The default spread is defined as the spread between two countries' government bonds with similar denominations, yields, terms and currencies, where one of the bonds is defined as risk-free. Typically, a U.S. government bond is chosen as the risk-free benchmark, and both bonds are denominated in USD.

[11] Current figures found at http://pages.stern.nyu.edu/~adamodar/.

For example, Damodaran (2013) suggests multiplying the CRP with the relative equity market volatility over the bond market volatility ($\sigma_{local,E}/\sigma_{local,B}$) to reflect the additional volatility in the equity market that is not incorporated in the default spread (*Damodaran No. 2*). In contrast, Zenner and Akaydin (2002) argue that the default spread (and hence the government default risk) is the maximum country-specific risk faced by every company operating in that country. Consequently, they recommend downward adjusting the CRP based on a particular company's exposure to political risk, defined by three factors that summarily represent an entity's total exposure to political risk (the *Salomon-Smith-Barney approach*)[12].

Horn et al. (2015) present a further enhancement to the CRP concept by adding a ceiling risk premium to the CRP (*Horn* et al. *approach*). The notion of a ceiling risk premium captures the transfer risk, which occurs when companies transfer money through several countries on the way to the parent entity. Transfer risk can be particularly relevant to corporations with complex holding structures, in which cash flows are transferred between subsidiaries in different countries.

Finally, Damodaran (2013) suggests adjusting the CAPM by considering the relative volatility between the local market and a chosen mature equity market, such as the U.S. equity market (*Damodaran No. 3 approach*). This volatility ratio is multiplied by the market risk premium to add an implicit CRP to the *standard* CAPM.

F) Beta-Adjustments

Models in this category adjust the asset beta to incorporate country risk.

Conceptual Formula:

$$E[r_i] = r_{f\_US} + \beta_{adj} \times MRP, \tag{13}$$

where r_{f_US} is the U.S. risk-free rate, β_{adj} is the adjusted beta factor of the company that seeks to incorporate country risk in the adjusted beta calculation, and MRP is the market risk premium (either U.S. or global).

[12] The three criteria are as follows: i) access to capital markets, ii) exposure of investment to political risk, and iii) the importance of the investment to the investor, represented by γ_1, γ_2, and γ_3 in the formula.

For example, Lessard (1996) suggests multiplying the company beta by the local country's beta, both with respect to the U.S. market (*Lessard Approach*). As discussed earlier, a low correlation between the local and the global stock markets may lead to low betas. Ibbotson (2013) addresses this problem and considers the volatility in different markets when estimating exposure to the market risk premium: $\beta_{adj} = \sigma_{local}/\sigma_{US}$ (*Ibbotson approach*), thereby omitting the correlation between company stock and reference index as input in the beta calculation.

The *Downside CAPM* is defined as the International CAPM with a downside beta (Estrada, 2002). The downside beta is calculated using semi-variance, which is a measure of the dispersion of all observations below the mean. Estrada argues that the semi-variance of returns is a better measure for risk than variance for three reasons: (1) investors dislike only downside volatility; (2) semi-variance is more useful if the underlying distribution is asymmetric; and (3) semi-variance combines the information provided by both the variance and the skewness, which makes it useful for a one-factor return model.

A final model in this group is the CSFB Approach by Hauptman and Natella (1997), which is a model quoted by a few academic studies, e.g., Harvey (2001), but rarely used by practitioners. This approach multiplies the local beta with the ratio of the coefficient of variation in the local market and the coefficient of variation of the U.S. market (ratio defined as A_{local}), which in turn is multiplied with 0.6. Harvey (2001) concludes his description of the approach by stating that "this model is a perfect example of the confusion that exists in measuring the cost of capital".

Lessard Approach:

$$E[r_i] = r_f + \beta_{i,US} \times \beta_{local,US} \times MRP_{US} \tag{14}$$

Ibbotson Approach:

$$E[r_i] = r_{f\_US} + MRP_{US} \times \frac{\sigma_{local}}{\sigma_{US}} \tag{15}$$

Downside CAPM:

$$E[r_i] = r_{f\_US} + \beta^D_{i,global} \times MRP_{global} \tag{16}$$

CSFB Approach:

$$E[r_i] = r_{f\_B} + \beta_{i,local} \times MRP_{US} \times 0.6\, A_{local} \tag{17}$$

G) Both: Additive CRP and Beta-Adjustments

Finally, some authors have proposed further adjustments to beta in addition to adding a country risk premium. Two examples thereof are the Godfrey-Espinosa (1996) approach and the Goldman Sachs approach (Mariscal and Hargis, 1999). Models in this group are based on the following conceptual formula:

Conceptual Formula: $$E[r_i] = r_{f\_US} + \beta_{adj} \times MRP_{US} + CRP, \quad (18)$$

where r_{f_US} is the U.S. risk-free rate, β_{adj} is the adjusted beta factor of the company that seeks to incorporate country risk in the adjusted beta calculation, MRP_{US} is the U.S. market risk premium, and CRP is the country risk premium.

In general, these adjustments to the CAPM consider the relative equity volatility between the local and the U.S. market, or global market. The derivation of these models is relatively ad hoc, and their notation is relatively complex. For instance, the Godfrey-Espinosa approach distinguishes two types of risks: "commercial risks" and "sovereign risks". "Sovereign risks" (as measured by the country credit spread) are captured in the additive CRP. "Commercial risks" (from operating in the local market relative to the home market) are captured by an "adjusted beta", which is defined as the ratio of the volatility of the local stock market relative to the volatility of the U.S. (or world) market. Because both types of risks are likely interdependent, the authors propose to reduce the adjusted beta by 40% to avoid double counting risk. This adjustment, however, is admittedly ad hoc.

The Goldman Sachs approach refines the Godfrey-Espinosa approach and proposes an alternative beta adjustment to address the abovementioned double-counting. The authors propose to multiply the company beta (measured against the local market) with the previously introduced ratio of the volatilities and with one minus the observed correlation between the stock and bond market (ρ_{SB}). This adjustment shall isolate from changes in the economy that similarly affect movements in sovereign spreads and equity market volatility. The approach also allows for adding further components (φ) to account for further company-specific characteristics. We refer to the original articles for further details on these models.

Godfrey-Espinosa Approach:

$$E[r_i] = r_{f\_US} + MRP_{US} \times 0.6\ \frac{\sigma_{\text{local}}}{\sigma_{\text{US}}} + \text{CRP} \tag{19}$$

Goldman Sachs Approach:

$$E[r_i] = r_{f\_US} + MRP_{US}\ \times (1\ -\ \rho_{SB})\ \frac{\sigma_{local}}{\sigma_{US}} \times\ \beta_{i,local} + \varphi\ +\ CRP \tag{20}$$

In summary, this presentation of the various methods to incorporate country risk demonstrates that there is a broad range of different approaches available to the analyst. We again note that the focus of our summary was on the most representative models within each model category of Figure 2 and on the general workings of these models. The formal definitions of the comprehensive list of country risk approaches from Figure 2, including references to the original works, are in Table A1 in the Appendix.

4 Case Study: Cost of Equity Estimation for Firms in BRIC Countries

We estimate the cost of equity for three large companies in each of the four sample countries: Brazil, Russia, India and China (which are well known as the so-called BRIC countries). We show that the models presented previously result in a remarkably wide range of cost of equity estimates in a real-world setting. For the twelve reference companies (see Table 1), the maximum and minimum cost of equity estimates largely depend on the approach chosen, and the differences among these estimates can be considerable.

We calculate the different estimates from the perspective of an U.S. investor who has projected the companies' cash flows in USD. The three companies from each country were selected based on three criteria: (1) country of incorporation, (2) among the largest 20 public companies by market capitalization listed on the main local index, and (3) Operating in either of three domestic market-focused businesses within each country with substantial exposure to local country risk: oil and gas, basic materials, and financials.

We select the *MSCI World Index* as a proxy for the world market. The *S&P 500* serves as a proxy for the U.S. market, *Bovespa* for the Brazilian, *Micex* for the Russian, *S&P CNX Nifty* for the Indian, and *Shanghai Shenzhen CSI 300 Index* for the Chinese market. All local market risk premiums are based on the Fernandez 2016 survey (Fernandez, Ortiz and Acín, 2016), the U.S. market risk premium is

6.25% as per Damodaran[13], and the global market risk premium is approximated by the U.S. MRP. To calculate betas, we use two years of weekly returns. All stock market data are from Bloomberg. Finally, for all cost of equity calculations, the cutoff date is June 30, 2016[14].

Table 1: Companies included in the case study

Country	Company	Industry (ICB[15])
Brazil	Petróleo Brasileiro	Oil & Gas
	Vale	Basic Materials
	Itau Unibanco	Financials
Russia	Gazprom	Oil & Gas
	Norilsk Nickel	Basic Materials
	Sberbank	Financials
India	Reliance Industries	Oil & Gas
	Coal India	Basic Materials
	HDFC Bank	Financials
China	PetroChina	Oil & Gas
	China Shenhua Energy	Basic Materials
	Industrial & Commercial Bank of China	Financials

4.1 Results

Figure 3 summarizes the results from the cost of equity (CoE) estimates calculated for each company as of the end of June 2016. We apply all models depicted in Figure 2.

The average CoE calculated using the various approaches ranges from 8.6% (International CAPM) up to 16.7% (Local CAPM). The mean of all the approaches is 11.5%, the median is 10.6%, and

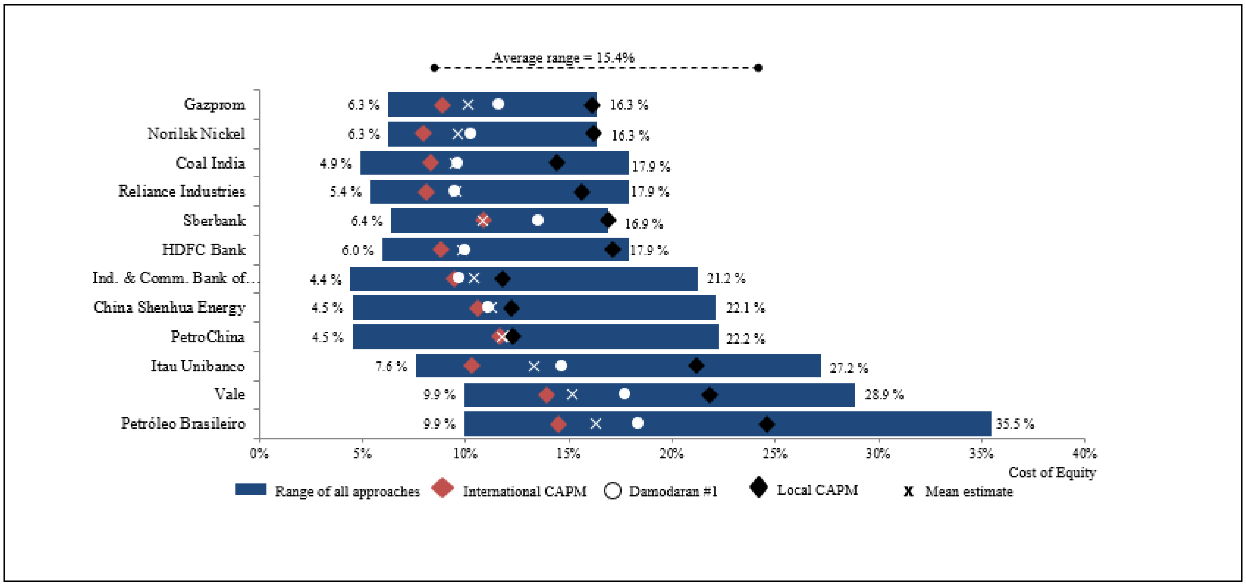
[13] Damodaran regularly publishes market risk premium estimates on his homepage: http://pages.stern.nyu.edu/~adamodar/. Accessed August 2016.

[14] Our Erb-Harvey-Viskanta (1996) estimates are based on published numbers from year-end 2014, but the results nonetheless offer an indication of the CoE estimates level.

[15] Classification follows the FTSE Industry Classification Benchmark (ICB).

approximately two thirds of the calculated CoEs are situated within the range of 8% to 14%. The full set of model parameters and case study results are in Table A1-A3 in the appendix.

Figure 3: Range of cost of equity estimates split by companies



Company	BRAZIL			RUSSIA			INDIA			CHINA		
	Itau Unibanco	Petróleo Brasileiro	Vale	Gazprom	Sberbank	Norilsk Nickel	HDFC Bank	Reliance Industries	Coal India	PetroChina	Ind. & Comm. Bank of China	China Shenhua Energy
Maximum	27.2%	35.5%	28.9%	16.3%	16.9%	16.3%	17.9%	17.9%	17.9%	22.2%	21.2%	22.1%
Top quartile	14.5%	17.1%	16.1%	10.7%	12.2%	10.6%	10.0%	9.5%	9.5%	12.3%	11.7%	12.1%
Median	12.3%	14.5%	14.3%	10.1%	10.8%	9.0%	8.9%	8.9%	8.9%	11.8%	9.7%	11.0%
Bottom quartile	10.8%	13.3%	12.6%	8.5%	9.4%	8.0%	8.0%	8.0%	8.0%	10.2%	8.5%	9.9%
Minimum	7.6%	9.9%	9.9%	6.3%	6.4%	6.3%	6.0%	5.4%	4.9%	4.5%	4.4%	4.5%
Range	19.6%	25.6%	18.9%	10.1%	10.5%	10.1%	11.9%	12.5%	13.0%	17.7%	16.8%	17.6%
Average	13.3%	16.3%	15.2%	10.1%	10.9%	9.6%	9.8%	9.5%	9.5%	11.8%	10.4%	11.2%
Country median	**Brazil:**	**14.0 %**		**Russia:**	**10.1 %**		**India:**	**8.9 %**		**China:**	**11.0 %**	

Initial Findings

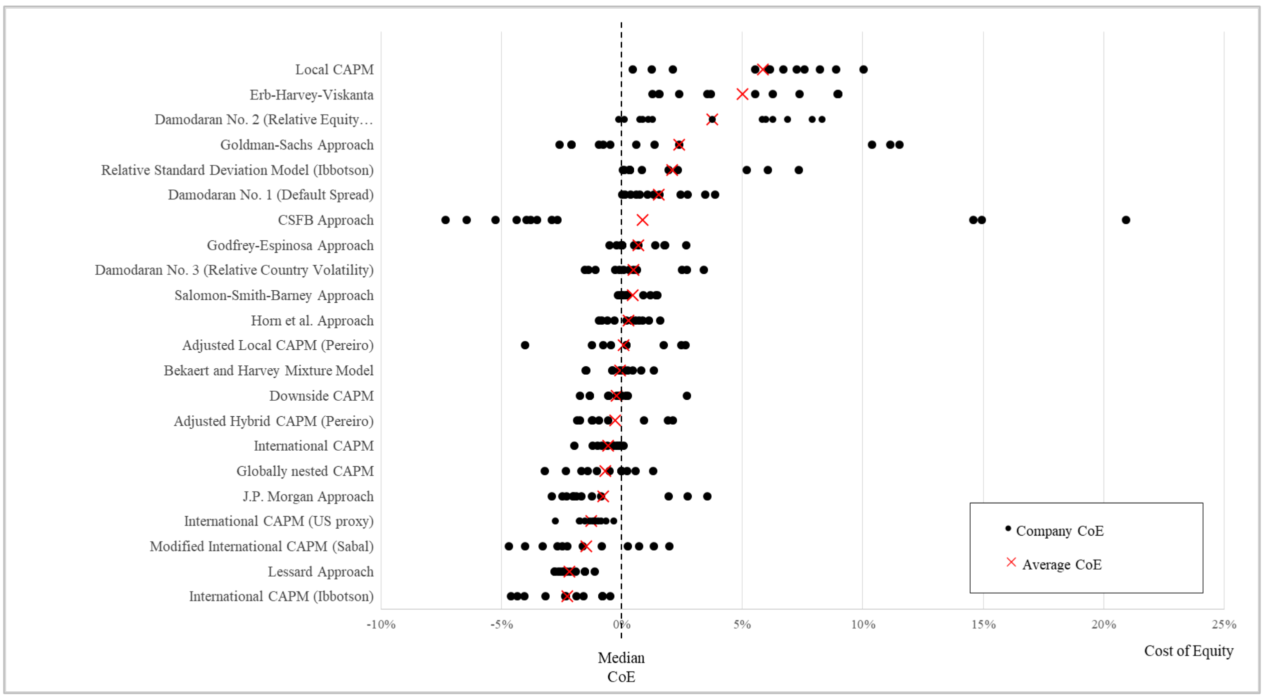
- The first obvious finding is the wide range of cost of equity estimates for each company that are calculated using the different approaches. The average range between the maximum and minimum estimate for each company is 15.4 percentage points.

- As a reference, we show where estimates from three benchmark models (Local CAPM, International CAPM, Damodaran No. 1) are situated. Consistent with theory, the use of the local CAPM results in higher CoE than the use of the International CAPM, on average and consistently across all companies, which results from the International CAPM's implicit assumption that country risk is diversifiable in an international portfolio. The Damodaran No. 1 approach, a widely used method, delivers results that hover closely around the mean across models. This quasi-consensus estimates of the Damodaran No. 1 approach across all relevant models might be one reason for its wide application and popularity among practitioners. A more detailed analysis across models follows below.

- The mean/median CoE estimate for each country shows clear differences between the countries that may reflect their specific country risk. The median CoE for Brazil is the highest, at 14.0%, followed by China at 11.0%, Russia at 10.1% and India at 8.9%.

We further investigate the results from the various models relative to each other and calculate *median-adjusted* cost of equity estimates (Figure 4).

Figure 4: Median-adjusted cost of equity estimates per model



The median-adjusted cost of equity is the difference between the actual estimate (from a specific model) and the median estimate across all models (for a specific firm), which accounts for firm heterogeneity and enables model comparisons across firms.[16] This analysis is particularly useful for assessing the

[16] For instance, for Reliance (India), the Local CAPM produces a cost of equity of 15.6% and the median estimate across all models is 8.9%; hence, the median-adjusted cost of equity is 6.7%.

dispersion of the models' cost of equity estimates. Each dot in the figure relates to a specific company. The red crosses represent the average estimate for each model.

Additional Findings

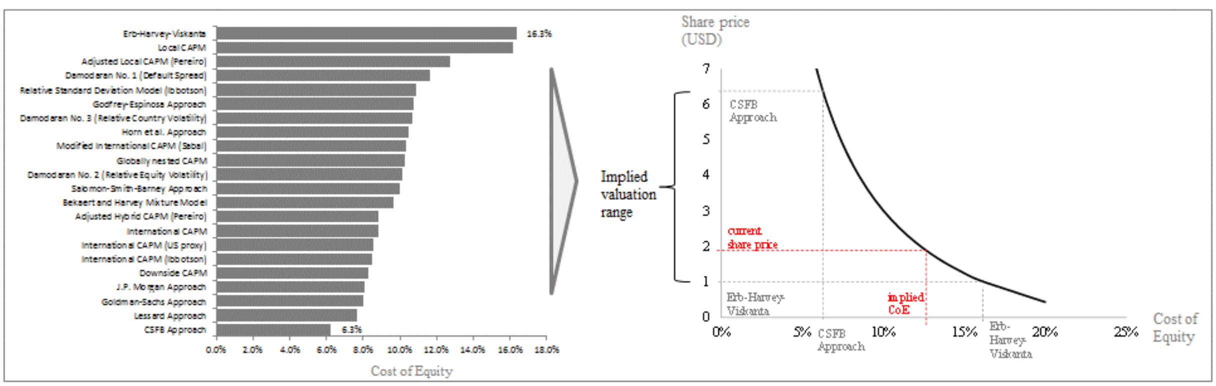
- Some models do not deliver CoE estimates that lie consistently above or below the average/median CoE estimate across companies and countries (e.g., the CSFB approach and the Goldman Sachs approach); in other words, they result in large variations in cost of equity estimates in the cross-section (Figure 4). This lack of consistency is a main drawback for analysts. For instance, the CSFB approach leads to the highest cost of equity for Brazilian companies and the lowest for Chinese companies. The main reason for this variation is the inclusion of the mean returns and volatility of local stock market indices. Additionally, the Goldman Sachs approach shows a large variation around the median across all firms. This approach results in the highest estimates for the Chinese companies and estimates around the mean for all other companies, primarily because of large variations in the correlation between local equity and the sovereign bond market. In contrast, the Bekaert and Harvey Mixture Model is the model that leads to the most focused estimates, all between -1.5% and +1.3%, compared to the median across all models.
- The Local CAPM is the model with the highest cost of equity compared to the median, followed by the Erb-Harvey-Viskanta model and the Damodaran No. 2 approach. For the reference firms, these models imply relatively "defensive" investment behavior and low asset values on average. On the other end of the scale, the most "aggressive" models in the case study—resulting in the lowest cost of equity and thus highest asset value—are the various variants of the International CAPM. In particular, the International CAPM (Ibbotson) results in very low cost of equity, as this approach uses the local country beta instead of the local company beta and, here, the average local country beta is lower than the average company beta (both measured against a global index). Finally, model estimates based on the Salomon-Smith-Barney, the Damodaran or the Bekaert-and-Harvey models do not have substantial outliers from the mean/median across all models.

4.2 What are the Implications of a Changing CoE? Sensitivity Analysis

To understand the impact of a large variance among cost of equity estimates for the individual firm, we discuss the valuation of the Russian company Gazprom. The cost of equity estimates for Gazprom range from a minimum of 6.3% up to 16.3%.

All cost of equity estimates for Gazprom — and the target share price that is dependent on the cost of equity applied — are depicted in Figure 5. We are running a discounted cash flow (DCF) valuation model with consensus cash flows[17] over the next ten years, a 2.0% perpetual growth rate, a target debt ratio of 37.0% and static cost of debt of 6.0%. Applying the min or max cost of equity would lead to completely different valuations, with the min CoE estimate of 6.3% resulting in a share value approximately six times higher than the max CoE value of 16.3%. The implied cost of equity (given the share price as of June 30, 2016) is approximately 12%. This market-implied cost of equity is slightly higher than the median of all estimates, which is 10.1%.

Figure 5: Conceptual estimation of Gazprom's implied CoE



5 Conclusion and Recommendations for Practitioners

Based on the analysis of the previous sections, we provide some general conclusions. First, current models result in a wide range of cost of equity estimates that can considerably affect management decisions. Therefore, analysts must be clear about the assumptions and drawbacks of each model when valuing investment opportunities in emerging markets, and practitioners should choose their model of

[17] Based on anonymous equity research analyst estimates from global investment banks.

country risk with caution. Practitioners may also find our analysis of variation across models useful (see Figure 3). Although the results for individual models (e.g., the low dispersion across estimates of the Bekaert and Harvey Mixture Model) may not generalize to applications beyond the BRIC countries or the three analyzed industries, analysts may use the median-adjusted cost of equity approach to assess the within-variation for each model for its corresponding application, e.g., country or industry. Our case study of 20 well-known country risk models for reference companies in the BRIC countries (Brazil, Russia, India and China) reveals huge spreads in the models' estimates of up to 25.6 percentage points for individual firms and 15.4 percentage points on average.

Second, none of the many presented methods has gained wide acceptance and, in the short term, reaching consensus on how to appropriately incorporate country risk seems unlikely. We propose to choose a cost of equity model based on qualitative valuation objectives, such as theoretical foundations, the degree of discretionary elements, transparency, data availability, and ease of use (see Table 2). For analysts who regard the *theoretical foundation* of a method as the most important objective, for instance, because the application is in a strict regulatory framework, we recommend applying either of the CAPM versions from the group of conceptual models or the empirical model from Erb-Harvey-Viskanta. In other cases, analysts may want to adjust the cost of equity based on many *discretionary elements*, if company or sector complexity requires it. In that case, we suggest applying the Salomon-Smith-Barney model. Moreover, if both *data availability* and *ease of use* are important model characteristics for the valuation analyst — which is often the case in a normal business setting with both time and resource constraints — we suggest applying, e.g., the Damodaran approaches. Finally, the Lessard approach and the Local, International and Downside CAPM models provide the analyst with *transparent* calculations, which are relatively easy to follow and verify for third parties.

If several models meet the analyst's requirements, then the analyst can use a subset of models and average the results. Of course, other typical robustness checks in investment valuation, such as sensitivity analysis, peer comparison, historic transaction analysis and consensus estimate verification, are also critical in the context of country risk models. Nevertheless, the valuation of investment opportunities in an international context remains challenging. Developing the standard pricing model for evaluating risk in global markets certainly remains a fruitful area for future research.

Table 2: Valuation objectives and model recommendations

Valuation objective	Recommended models
Theoretical foundations	International CAPM Local CAPM Downside CAPM Erb-Harvey-Viskanta Model
Discretionary elements	Salomon-Smith-Barney Approach
Transparency	Local CAPM International CAPM Downside CAPM Lessard Approach
Data availability	Damodaran Approaches International CAPM Horn et al. Approach
Ease of use	Damodaran Approaches

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7 Appendix

In the following tables you will find the summarized models described in the article and the case study results in detail.

Table A1: Overview of cost of equity approaches

	Approach	Formula ($E[r_i]$ =)	Theoretical foundation	Discretionary elements	Transparency	Data availability	Ease of use	References
(1)	International CAPM	$r_{f\_global} + \beta_{i,global} \times MRP_{global}$	X		X	X		Pereiro (2002)
(2)	International CAPM (US proxy)	$r_{f\_US} + \beta_{i,US} \times MRP_{US}$			X	X		
(3)	International CAPM (Ibbotson)	$r_{f\_US} + \beta_{localMarket,\ global} \times (MRP_{US} / \beta_{US,global})$						Ibbotson (2013)
(4)	Modified International CAPM (Sabal)	$r_{f\_US} + \beta_{p} \times MRP_{US}$						Sabal (2004)
(5)	Local CAPM	$r_{f\_local} + \beta_{i,local} \times MRP_{local}$	X		X			Pratt and Grabowski (2008)
(6)	Bekaert and Harvey Mixture Model	$r_{f\_US} + (1 – \lambda) \times \beta_{i,local} \times MRP_{local} + \lambda \times \beta_{i,global} \times MRP_{global}$						Harvey (1995) / Harvey (2005)
(7)	Erb-Harvey-Viskanta Model	$R_{i,t+1} = \alpha + \beta \ln(CCR_{i,t}) + \varepsilon_{i,t+1}$	X					Erb et al. (1996)
(8)	Globally Nested CAPM	$r_{f\_US} + \beta_{localMarket,global} \times MRP_{global} + \beta_{localMarket,r} \times \delta_{r}$						Ibbotson (2013)
(9a)	Damodaran No. 1 (Default Spread)	$r_{f\_US} + \beta_{i,US} \times MRP_{US} + CRP$				X	X	Damodaran (2013)
(9b)	Damodaran No. 2 (Relative Equity Volatility)	$r_{f\_US} + \beta_{i,US} \times MRP_{US} + CRP \times (\sigma_{local,E} / \sigma_{local,B})$				X	X	Damodaran (2013)
(9c)	Damodaran No. 3 (Relative Country Volatility)	$r_{f\_US} + \beta_{i,US} \times MRP_{US} \times (\sigma_{local} / \sigma_{US})$				X	X	Damodaran (2013)
(10)	Adjusted Local CAPM (Pereiro)	$r_{f\_global} + (Y_{local} – Y_{US}) + \beta_{i,local} \times MRP_{local} \times (1 – R_{i}^{2})$						Pereiro (2002)
(11)	Horn et al. Approach	$r_{f\_US} + \beta_{i,US} \times MRP_{US} + CRP + CRP_{ceiling}$			X	X		Horn et al. (2015)
(12)	Salomon-Smith-Barney Approach	$r_{f\_US} + \beta_{i,global} \times MRP_{global} + CRP \times (\gamma_{1}+\gamma_{2}+\gamma_{3}) / 30$		X				Zenner and Akaydin (2002)
(13)	Lessard Approach	$r_{f} + \beta_{i,US} \times \beta_{localMarket,US} \cdot MRP_{US}$			X			Lessard (1996)
(14)	Adjusted Hybrid CAPM (Pereiro)	$r_{f\_global} + (Y_{local} – Y_{US}) + \beta_{localMarket,global} \times \beta_{globalPeers} \times MRP_{global} \times (1 – R^{2}_{local})$						Pereiro (2002)
(15)	Relative Standard Deviation Model (Ibbotson)	$r_{f\_US} + MRP_{US} \times (\sigma_{local} / \sigma_{US})$						Ibbotson (2013)
(16)	Downside CAPM	$r_{f\_US} + \beta^{D}_{i,global} \times MRP_{global}$	X		X			Estrada (2002)
(17)	CSFB Approach	$r_{f\_B} + \beta_{i,local} \times MRP_{US} \times 0.6\ A_{local}$						Harvey (2001)
(18)	Godfrey-Espinosa Approach	$r_{f\_US} + MRP_{US} \times 0.6\ (\sigma_{local} / \sigma_{US}) + CRP$						Godfrey and Espinosa (1996)
(19)	Goldman Sachs Approach (Original)	$r_{f\_US} + \beta_{i,local} \times MRP_{US} \times (1 - \rho_{SB}) \times (\sigma_{local} / \sigma_{US}) + CRP + \varphi$						Mariscal and Hargis (1999)
(20)	JP Morgan Approach	$r_{f\_US} + MRP_{global} \times 0.64 \cdot (\sigma_{local} / \sigma_{global}) - \beta_{i,local}\ (Y_{local} – Y_{US}) + CRP$						DeSwaan and Liubych (1999)

where		
r_{f_local} = *Local risk-free rate*	λ = *Level of integration of the local country to the world market*	ρ_{SB} = *Correlation between the benchmark government bond and local stock*
r_{f_US} = *U.S. risk-free rate*	MRP_{global} = *Global market risk premium*	*market (both in USD)*
r_{f_global} = *Global risk-free rate*	MRP_{US} = *U.S. market risk premium*	φ = *Company specific risk premium (*e.g.*, company bond spread)*
r_{f_B} = *Stripped yield of a Brady bond*	MRP_{local} = *Local market risk premium*	γ_1 = *Access to capital markets*
$\beta_{i,global}$ = *Beta with respect to the global market*	δ_r = *Risk premium associated with region r that is not part of the world*	γ_2 = *Susceptibility of investment to political risk*
$\beta_{localMarket,global}$ = *Beta of local country market with respect to global market*	*equity risk premium*	γ_3 =*Importance of the investment for the investor*
$\beta_{i,local}$ = *Beta with respect to the local market*	*CRP* = Country risk premium; the r*ating induced spread published by*	σ_{US} = *Volatility of U.S. equity market*
$B_{i,US}$ = *Beta with respect to the U.S. market*	*Damodaran applied as proxy for the default spread*	$\sigma_{local,B}$ = *Volatility of government bonds in local market*
$\beta_{US,global}$ = *Beta of the U.S. market with respect to the world market*	$(Y_{local} – Y_{US})$ = *Gov. bond default spread*	σ_{local} =*Volatility of equity market in local market*
β_p = *Weighted project beta, based on both local country beta and industry*	$RIS_{ceiling}$ = *Country risk premium for the company's holding structure*	$\sigma_{local,E}$ = *Volatility of local equity market index*
beta	$R_{i,t+1}$ = *Semi-annual return (USD) for country i*	R^2_{local} = *Coefficient of determination of the regression between the equity*
$\beta_{localMarket,r}$ = *The country's covariance with the regional risk*	α, *B* = *Regression coefficients*	*volatility of the local market against the variation in country risk*
$\beta_{i,US}$= *Beta with respect to the U.S. market*	*CCR* = *Country credit rating*	R^2_i = *Coefficient of determination of the regression between the volatility of*
$\beta_{globalPeers}$ = *Beta of comparable companies quoting in the global market*	ε = *Regression residual*	*returns of the local company and the variation of country risk*
$\beta^D_{i,global}$ = *Downside beta with respect to the global market*	*t* = *Measured in half years*	A_{local} = *Coefficient of variation in the local market divided by the coefficient*
$\beta_{localMarket,US}$ = *Beta of local country market with respect to the U.S. market*		*of variation of the U.S. market*

Table A2: Case study results

The table contains the complete table with all case study results. All estimates are calculated from the perspective of a U.S. investor who has projected the companies' cash flows in USD. For all cost of equity calculations, the cutoff date is June 30, 2016.

	BRAZIL			RUSSIA			INDIA			CHINA				
CoE Approaches	Itau Unibanco	Petróleo Brasileiro	Vale	Gazprom	Sberbank	Norilsk Nickel	HDFC Bank	Reliance Industries	Coal India	PetroChina	Ind. & Comm. Bank of China	China Shenhua Energy	Average	Median
(1) International CAPM	10.3 %	14.5 %	13.9 %	8.8 %	10.9 %	7.9 %	8.8 %	8.1 %	8.3 %	11.7 %	9.4 %	10.6 %	10.3 %	9.9 %
(2) International CAPM (US proxy)	9.5 %	13.2 %	12.5 %	8.5 %	10.4 %	7.2 %	8.2 %	7.8 %	7.9 %	11.0 %	8.5 %	9.9 %	9.6 %	9.0 %
(3) International CAPM (Ibbotson)	9.9 %	9.9 %	9.9 %	8.5 %	8.5 %	8.5 %	8.1 %	8.1 %	8.1 %	7.8 %	7.8 %	7.8 %	8.6 %	8.3 %
(4) Modified International CAPM (Sabal)	7.6 %	11.9 %	12.6 %	10.3 %	6.8 %	10.9 %	6.4 %	9.6 %	10.2 %	9.6 %	6.4 %	10.1 %	9.4 %	9.9 %
(5) Local CAPM	21.2 %	24.6 %	21.9 %	16.2 %	16.9 %	16.2 %	17.1 %	15.6 %	14.4 %	12.3 %	11.8 %	12.2 %	16.7 %	16.2 %
(6) Bekaert and Harvey Mixture Model	10.8 %	14.5 %	12.8 %	9.7 %	10.9 %	9.4 %	10.2 %	9.2 %	8.8 %	11.4 %	10.5 %	11.1 %	10.8 %	10.6 %
(7) Erb-Harvey-Viskanta	15.8 %	15.8 %	15.8 %	16.3 %	16.3 %	16.3 %	17.9 %	17.9 %	17.9 %	13.4 %	13.4 %	13.4 %	15.8 %	16.1 %
(8) Globally nested CAPM	12.9 %	12.9 %	12.9 %	10.3 %	10.3 %	10.3 %	8.9 %	8.9 %	8.9 %	8.6 %	8.6 %	8.6 %	10.2 %	9.6 %
(9a) Damodaran No. 1 (Default Spread)	14.7 %	18.4 %	17.7 %	11.6 %	13.5 %	10.3 %	9.9 %	9.5 %	9.6 %	12.2 %	9.7 %	11.1 %	12.4 %	11.4 %
(9b) Damodaran No. 2 (Relative Equity Volatility)	19.2 %	22.9 %	22.2 %	10.2 %	12.1 %	8.8 %	15.2 %	14.7 %	14.9 %	12.9 %	10.4 %	11.8 %	14.6 %	13.8 %
(9c) Damodaran No. 3 (Relative Country Volatility)	12.6 %	17.9 %	16.9 %	10.7 %	13.3 %	8.9 %	7.8 %	7.4 %	7.5 %	12.3 %	9.4 %	11.0 %	11.3 %	10.9 %
(10) Adjusted Local CAPM (Pereiro)	12.4 %	13.3 %	10.2 %	12.7 %	10.0 %	11.4 %	n/a	n/a	n/a	12.0 %	11.4 %	10.5 %	11.6 %	11.4 %
(11) Horn et al. Approach	12.0 %	15.7 %	15.0 %	10.5 %	12.4 %	9.2 %	9.8 %	9.3 %	9.5 %	11.2 %	8.7 %	10.1 %	11.1 %	10.3 %
(12) Salomon-Smith-Barney Approach	12.1 %	16.0 %	15.5 %	10.0 %	12.2 %	9.1 %	9.8 %	8.9 %	9.1 %	12.1 %	9.9 %	11.0 %	11.3 %	10.5 %
(13) Lessard Approach	9.6 %	13.4 %	12.7 %	7.6 %	9.3 %	6.5 %	7.0 %	6.6 %	6.7 %	9.0 %	7.1 %	8.2 %	8.7 %	7.9 %
(14) Adjusted Hybrid CAPM (Pereiro)	13.2 %	16.6 %	16.2 %	8.8 %	9.8 %	8.4 %	n/a	n/a	n/a	10.0 %	8.4 %	9.2 %	11.2 %	9.8 %
(15) Relative Standard Deviation Model (Ibbotson)	14.6 %	14.6 %	14.6 %	10.9 %	10.9 %	10.9 %	9.2 %	9.2 %	9.2 %	17.0 %	17.0 %	17.0 %	12.9 %	12.7 %
(16) Downside CAPM	10.9 %	17.3 %	14.5 %	8.3 %	10.9 %	7.6 %	8.8 %	8.7 %	8.3 %	11.3 %	9.7 %	11.0 %	10.6 %	10.3 %
(17) CSFB Approach	27.2 %	35.5 %	28.9 %	6.3 %	6.4 %	6.3 %	6.0 %	5.4 %	4.9 %	4.5 %	4.4 %	4.5 %	11.7 %	6.1 %
(18) Godfrey-Espinosa Approach	14.0 %	14.0 %	14.0 %	10.7 %	10.7 %	10.7 %	8.9 %	8.9 %	8.9 %	12.4 %	12.4 %	12.4 %	11.5 %	11.6 %
(19) Goldman-Sachs Approach	11.8 %	13.8 %	12.2 %	8.0 %	8.2 %	8.0 %	11.3 %	10.3 %	9.5 %	22.2 %	21.2 %	22.1 %	13.2 %	11.5 %
(20) J.P. Morgan Approach	11.0 %	12.7 %	11.3 %	8.1 %	8.3 %	8.1 %	7.2 %	6.9 %	6.6 %	13.8 %	13.2 %	13.7 %	10.1 %	9.7 %
Average	13.3 %	16.3 %	15.2 %	10.1 %	10.9 %	9.6 %	9.8 %	9.5 %	9.5 %	11.8 %	10.4 %	11.2 %	11.5 %	
Median	12.3 %	14.5 %	14.3 %	10.1 %	10.8 %	9.0 %	8.9 %	8.9 %	8.9 %	11.8 %	9.7 %	11.0 %	-	
Min	7.6 %	9.9 %	9.9 %	6.3 %	6.4 %	6.3 %	6.0 %	5.4 %	4.9 %	4.5 %	4.4 %	4.5 %	-	
Max	27.2 %	35.5 %	28.9 %	16.3 %	16.9 %	16.3 %	17.9 %	17.9 %	17.9 %	22.2 %	21.2 %	22.1 %	-	
Range	19.6 %	25.6 %	18.9 %	10.1 %	10.5 %	10.1 %	11.9 %	12.5 %	13.0 %	17.7 %	16.8 %	17.6 %	15.4 %	

Table A3: Case study parameters and results

The table contains all case study parameters and results. All estimates are calculated from the perspective of a U.S. investor who has projected the companies' cash flows in USD. For all cost of equity calculations, the cutoff date is June 30, 2016. We select the MSCI World Index as a proxy for the world market. The S&P 500 serves as a proxy for the U.S. market, Bovespa serves as a proxy for the Brazilian market, Micex serves as a proxy for the Russian market, S&P CNX Nifty serves as a proxy for the Indian market, and Shanghai Shenzhen CSI 300 Index serves as a proxy for the Chinese market. All local market risk premiums are based on the Fernandez 2016 survey, the U.S. market risk premium is 6.25% per Damodaran, and the global market risk premium is approximated by the U.S. MRP. To calculate betas, we use two years of weekly returns. All stock market data are from Bloomberg.

	BRAZIL			RUSSIA			INDIA			CHINA		
	Itau Unibanco	Petróleo Brasileiro	Vale	Gazprom	Sberbank	Norilsk Nickel	HDFC Bank	Reliance Industries	Coal India	PetroChina	Ind. & Comm. Bank of China	China Shenhua Energy
(1) International CAPM												
Global risk free rate	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%
Beta vs. global index	1.21	1.88	1.79	0.98	1.30	0.83	0.97	0.85	0.89	1.43	1.07	1.26
Global market risk premium	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%
Cost of equity	**10.31%**	**14.49%**	**13.92%**	**8.84%**	**10.85%**	**7.94%**	**8.81%**	**8.09%**	**8.30%**	**11.68%**	**9.44%**	**10.61%**
(2) International CAPM (US proxy)												
U.S. risk free rate	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%
Beta vs. U.S. index	1.08	1.67	1.56	0.93	1.23	0.71	0.88	0.81	0.83	1.32	0.92	1.14
U.S. market risk premium	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%
Cost of equity	**9.51%**	**13.21%**	**12.53%**	**8.54%**	**10.44%**	**7.21%**	**8.23%**	**7.78%**	**7.93%**	**10.98%**	**8.48%**	**9.88%**
(3) International CAPM (Ibbotson)												
U.S. risk free rate	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%
Country beta vs. global index	1.13	1.13	1.13	0.90	0.90	0.90	0.84	0.84	0.84	0.79	0.79	0.79
U.S. market risk premium	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%
U.S. country beta vs. global index	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Cost of equity	**9.93%**	**9.93%**	**9.93%**	**8.47%**	**8.47%**	**8.47%**	**8.09%**	**8.09%**	**8.09%**	**7.80%**	**7.80%**	**7.80%**
(4) Modified International CAPM (Sabal)												
U.S. risk free rate	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%
Weighted project beta	0.77	1.46	1.58	1.21	0.64	1.31	0.59	1.10	1.19	1.09	0.58	1.18
U.S. market risk premium	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%
Cost of equity	**7.59%**	**11.86%**	**12.62%**	**10.31%**	**6.77%**	**10.95%**	**6.41%**	**9.63%**	**10.21%**	**9.57%**	**6.37%**	**10.14%**
(5) Local CAPM												
Local risk free rate	12.80%	12.80%	12.80%	8.83%	8.83%	8.83%	7.75%	7.75%	7.75%	3.67%	3.67%	3.67%
Beta vs. local index	1.20	1.68	1.29	1.05	1.16	1.06	1.17	0.98	0.84	1.23	1.16	1.22
Local market risk premium	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%	8.00%	8.00%	8.00%	7.00%	7.00%	7.00%
Cost of equity	**21.19%**	**24.57%**	**21.85%**	**16.16%**	**16.94%**	**16.22%**	**17.12%**	**15.61%**	**14.44%**	**12.28%**	**11.81%**	**12.22%**

	BRAZIL			RUSSIA			INDIA			CHINA		
	Itau Unibanco	Petróleo Brasileiro	Vale	Gazprom	Sberbank	Norilsk Nickel	HDFC Bank	Reliance Industries	Coal India	PetroChina	Ind. & Comm. Bank of China	China Shenhua Energy
(6) Bekaert and Harvey Mixture Model												
U.S. risk free rate	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%
Level of integration (λ)	0.46	0.46	0.46	0.33	0.33	0.33	0.57	0.57	0.57	0.28	0.28	0.28
Beta vs. local index	1.20	1.68	1.29	1.05	1.16	1.06	1.17	0.98	0.84	1.23	1.16	1.22
Local market risk premium	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%	8.00%	8.00%	8.00%	7.00%	7.00%	7.00%
Beta vs. global index	1.21	1.88	1.79	0.98	1.30	0.83	0.97	0.85	0.89	1.43	1.07	1.26
Global market risk premium	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%
Cost of equity	**10.75%**	**14.50%**	**12.78%**	**9.67%**	**10.85%**	**9.42%**	**10.23%**	**9.17%**	**8.79%**	**11.45%**	**10.48%**	**11.10%**
(7) Erb-Harvey-Viskanta												
Cost of equity	**15.81%**	**15.81%**	**15.81%**	**16.34%**	**16.34%**	**16.34%**	**17.88%**	**17.88%**	**17.88%**	**13.36%**	**13.36%**	**13.36%**
(8) Globally nested CAPM												
U.S. risk free rate	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%
Country beta vs. global index	1.13	1.13	1.13	0.90	0.90	0.90	0.84	0.84	0.84	0.79	0.79	0.79
Global market risk premium	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%
Country beta vs. regional risk	0.93	0.93	0.93	0.70	0.70	0.70	0.80	0.80	0.80	0.84	0.84	0.84
Regional risk	3.29%	3.29%	3.29%	2.71%	2.71%	2.71%	1.11%	1.11%	1.11%	1.11%	1.11%	1.11%
Cost of equity	**12.85%**	**12.85%**	**12.85%**	**10.27%**	**10.27%**	**10.27%**	**8.89%**	**8.89%**	**8.89%**	**8.64%**	**8.64%**	**8.64%**
(9a) Damodaran No. 1 (Default Spread)												
U.S. risk free rate	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%
Beta vs. U.S. index	1.08	1.67	1.56	0.93	1.23	0.71	0.88	0.81	0.83	1.32	0.92	1.14
U.S. market risk premium	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%
Yield spread	5.19%	5.19%	5.19%	3.09%	3.09%	3.09%	1.72%	1.72%	1.72%	1.23%	1.23%	1.23%
Cost of equity	**14.70%**	**18.40%**	**17.72%**	**11.63%**	**13.53%**	**10.30%**	**9.95%**	**9.50%**	**9.65%**	**12.21%**	**9.71%**	**11.11%**
(9b) Damodaran No. 2 (Relative Equity Volatility)												
U.S. risk free rate	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%
Beta vs. U.S. index	1.08	1.67	1.56	0.93	1.23	0.71	0.88	0.81	0.83	1.32	0.92	1.14
U.S. market risk premium	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%
Yield spread	5.19%	5.19%	5.19%	3.09%	3.09%	3.09%	1.72%	1.72%	1.72%	1.23%	1.23%	1.23%
Rel. volatility factor (EQ vs. Bond)	1.86	1.86	1.86	0.52	0.52	0.52	4.04	4.04	4.04	1.59	1.59	1.59
Cost of equity	**19.16%**	**22.86%**	**22.17%**	**10.16%**	**12.06%**	**8.83%**	**15.17%**	**14.73%**	**14.87%**	**12.94%**	**10.43%**	**11.83%**
(9c) Damodaran No. 3 (Relative Country Volatility)												
U.S. risk free rate	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%
Beta vs. U.S. index	1.08	1.67	1.56	0.93	1.23	0.71	0.88	0.81	0.83	1.32	0.92	1.14
U.S. market risk premium	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%
Rel. volatility factor (local vs. U.S.)	1.45	1.45	1.45	1.37	1.37	1.37	0.92	0.92	0.92	1.16	1.16	1.16
Cost of equity	**12.57%**	**17.95%**	**16.95%**	**10.69%**	**13.30%**	**8.86%**	**7.79%**	**7.38%**	**7.51%**	**12.32%**	**9.41%**	**11.04%**
(10) Adjusted Local CAPM (Pereiro)												
Global risk free rate	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%
Sov. bond yield local (USD)	6.75%	6.75%	6.75%	4.85%	4.85%	4.85%	2.28%	2.28%	2.28%	2.78%	2.78%	2.78%
Sov. bond yield U.S. (USD)	2.57%	2.57%	2.57%	1.74%	1.74%	1.74%	0.00%	0.00%	0.00%	1.74%	1.74%	1.74%
Beta vs. local index	1.20	1.68	1.29	1.05	1.16	1.06	1.17	0.98	0.84	1.23	1.16	1.22
Local market risk premium	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%	8.00%	8.00%	8.00%	7.00%	7.00%	7.00%
R^2_i	0.3417	0.4599	0.6355	0.0650	0.4861	0.2464	0.0000	0.0000	0.0000	0.0442	0.0635	0.2136
Cost of equity	**12.45%**	**13.28%**	**10.23%**	**12.71%**	**10.02%**	**11.43%**	**n/a**	**n/a**	**n/a**	**12.02%**	**11.40%**	**10.51%**

	BRAZIL			RUSSIA			INDIA			CHINA		
	Itau Unibanco	Petróleo Brasileiro	Vale	Gazprom	Sberbank	Norilsk Nickel	HDFC Bank	Reliance Industries	Coal India	PetroChina	Ind. & Comm. Bank of China	China Shenhua Energy
(11) Horn et al. Approach												
U.S. risk free rate	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%
Beta vs. U.S. index	1.08	1.67	1.56	0.93	1.23	0.71	0.88	0.81	0.83	1.32	0.92	1.14
U.S. market risk premium	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%
Ceiling Risk Premium	0	0	0	0	0	0	0	0	0	0	0	0
Yield spread	2.46%	2.46%	2.46%	1.95%	1.95%	1.95%	1.54%	1.54%	1.54%	0.25%	0.25%	0.25%
Cost of equity	**11.97%**	**15.67%**	**14.99%**	**10.49%**	**12.39%**	**9.16%**	**9.77%**	**9.32%**	**9.47%**	**11.23%**	**8.73%**	**10.13%**
(12) Salomon-Smith-Barney Approach												
U.S. risk free rate	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%
Beta vs. global index	1.21	1.88	1.79	0.98	1.30	0.83	0.97	0.85	0.89	1.43	1.07	1.26
Global market risk premium	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%
Sov. bond yield local (USD)	6.75%	6.75%	6.75%	4.85%	4.85%	4.85%	2.28%	2.28%	2.28%	2.78%	2.78%	2.78%
Sov. bond yield U.S. (USD)	2.57%	2.57%	2.57%	1.74%	1.74%	1.74%	0.00%	0.00%	0.00%	1.74%	1.74%	1.74%
γ_1	0	0	0	0	0	0	0	0	0	0	0	0
γ_2	8	6	6	6	8	6	8	6	6	6	8	6
γ_3	5	5	5	5	5	5	5	5	5	5	5	5
Cost of equity	**12.12%**	**16.02%**	**15.45%**	**9.98%**	**12.20%**	**9.08%**	**9.79%**	**8.92%**	**9.14%**	**12.05%**	**9.89%**	**10.99%**
Cost of equity (low): Gammas = 0	10.31%	14.49%	13.92%	8.84%	10.85%	7.94%	8.81%	8.09%	8.30%	11.68%	9.44%	10.61%
Cost of equity (high): Gammas = 10	14.49%	18.67%	18.10%	11.95%	13.96%	11.05%	11.09%	10.37%	10.58%	12.71%	10.48%	11.64%
(13) Lessard Approach												
U.S. risk free rate	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%
Beta vs. U.S. index	1.08	1.67	1.56	0.93	1.23	0.71	0.88	0.81	0.83	1.32	0.92	1.14
Country beta vs. U.S. index	1.02	1.02	1.02	0.85	0.85	0.85	0.77	0.77	0.77	0.76	0.76	0.76
U.S. market risk premium	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%
Cost of equity	**9.64%**	**13.41%**	**12.71%**	**7.65%**	**9.25%**	**6.52%**	**6.97%**	**6.62%**	**6.73%**	**9.03%**	**7.12%**	**8.19%**
(14) Adjusted Hybrid CAPM (Pereiro)												
Global risk free rate	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%
Sov. bond yield local (USD)	6.75%	6.75%	6.75%	4.85%	4.85%	4.85%	2.28%	2.28%	2.28%	2.78%	2.78%	2.78%
Sov. bond yield U.S. (USD)	2.57%	2.57%	2.57%	1.74%	1.74%	1.74%	0.00%	0.00%	0.00%	1.74%	1.74%	1.74%
Country beta vs. global index	1.13	1.13	1.13	0.90	0.90	0.90	0.84	0.84	0.84	0.79	0.79	0.79
Beta vs. global index	1.21	1.88	1.79	0.98	1.30	0.83	0.97	0.85	0.89	1.43	1.07	1.26
Global market risk premium	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%
R^2_x (hybrid)	0.2669	0.2669	0.2669	0.4545	0.4545	0.4545	0.0000	0.0000	0.0000	0.1258	0.1258	0.1258
Cost of equity	**13.18%**	**16.64%**	**16.17%**	**8.85%**	**9.83%**	**8.40%**	**n/a**	**n/a**	**n/a**	**9.98%**	**8.43%**	**9.24%**
(15) Relative Standard Deviation Model (Ibbotson)												
U.S. risk free rate	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%
U.S. market risk premium	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%
Rel. volatility factor (local vs. U.S.)	1.89	1.89	1.89	1.30	1.30	1.30	1.04	1.04	1.04	2.29	2.29	2.29
Cost of equity	**14.59%**	**14.59%**	**14.59%**	**10.90%**	**10.90%**	**10.90%**	**9.22%**	**9.22%**	**9.22%**	**17.03%**	**17.03%**	**17.03%**
(16) Downside CAPM												
U.S. risk free rate	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%
Downside beta vs. global index	1.31	2.32	1.88	0.89	1.31	0.78	0.96	0.95	0.89	1.37	1.11	1.31
Global market risk premium	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%
Cost of equity	**10.94%**	**17.25%**	**14.50%**	**8.31%**	**10.94%**	**7.63%**	**8.75%**	**8.69%**	**8.31%**	**11.29%**	**9.67%**	**10.97%**

	BRAZIL			RUSSIA			INDIA			CHINA		
	Itau Unibanco	Petróleo Brasileiro	Vale	Gazprom	Sberbank	Norilsk Nickel	HDFC Bank	Reliance Industries	Coal India	PetroChina	Ind. & Comm. Bank of China	China Shenhua Energy
(17) CSFB Approach												
Stripped yield of a Brady bond	6.75%	6.75%	6.75%	4.85%	4.85%	4.85%	2.28%	2.28%	2.28%	2.78%	2.78%	2.78%
Beta vs. local index	1.20	1.68	1.29	1.05	1.16	1.06	1.17	0.98	0.84	1.23	1.16	1.22
U.S. market risk premium	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%
Volatility of local EQ market	28.13%	28.13%	28.13%	19.34%	19.34%	19.34%	15.37%	15.37%	15.37%	33.92%	33.92%	33.92%
Volatility of U.S. EQ market	14.84%	14.84%	14.84%	14.84%	14.84%	14.84%	14.84%	14.84%	14.84%	14.84%	14.84%	14.84%
Mean of local EQ market	0.03%	0.03%	0.03%	0.28%	0.28%	0.28%	0.09%	0.09%	0.09%	0.46%	0.46%	0.46%
Mean of U.S. EQ market	0.08%	0.08%	0.08%	0.08%	0.08%	0.08%	0.08%	0.08%	0.08%	0.08%	0.08%	0.08%
Local coef. of variation*	888.69	888.69	888.69	70.02	70.02	70.02	164.23	164.23	164.23	73.61	73.61	73.61
U.S. coef. of variation	194.87	194.87	194.87	194.87	194.87	194.87	194.87	194.87	194.87	194.87	194.87	194.87
A_{local}	4.56	4.56	4.56	0.36	0.36	0.36	0.84	0.84	0.84	0.38	0.38	0.38
Cost of equity	**27.23%**	**35.49%**	**28.86%**	**6.26%**	**6.41%**	**6.28%**	**5.98%**	**5.39%**	**4.92%**	**4.52%**	**4.43%**	**4.51%**

* When the mean is close to zero the coefficient of variation is very sensitive - result should be handled with caution.

(18) Godfrey-Espinosa Approach												
U.S. risk free rate	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%
Sov. bond yield local (USD)	6.75%	6.75%	6.75%	4.85%	4.85%	4.85%	2.28%	2.28%	2.28%	2.78%	2.78%	2.78%
Sov. bond yield U.S. (USD)	2.57%	2.57%	2.57%	1.74%	1.74%	1.74%	0.00%	0.00%	0.00%	1.74%	1.74%	1.74%
U.S. market risk premium	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%
Rel. volatility factor (local vs. U.S.)	1.89	1.89	1.89	1.30	1.30	1.30	1.04	1.04	1.04	2.29	2.29	2.29
Cost of equity	**14.03%**	**14.03%**	**14.03%**	**10.75%**	**10.75%**	**10.75%**	**8.91%**	**8.91%**	**8.91%**	**12.36%**	**12.36%**	**12.36%**
(19) Goldman-Sachs Approach												
U.S. risk free rate	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%
Sov. bond yield local (USD)	6.75%	6.75%	6.75%	4.85%	4.85%	4.85%	2.28%	2.28%	2.28%	2.78%	2.78%	2.78%
Sov. bond yield U.S. (USD)	2.57%	2.57%	2.57%	1.74%	1.74%	1.74%	0.00%	0.00%	0.00%	1.74%	1.74%	1.74%
U.S. market risk premium	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%
Correlation EQ vs. sov. bond	0.66	0.66	0.66	0.75	0.75	0.75	0.18	0.18	0.18	-0.05	-0.05	-0.05
Rel. volatility factor (local vs. U.S.)	1.89	1.89	1.89	1.30	1.30	1.30	1.04	1.04	1.04	2.29	2.29	2.29
Beta vs. local index	1.20	1.68	1.29	1.05	1.16	1.06	1.17	0.98	0.84	1.23	1.16	1.22
Company specific factor	0	0	0	0	0	0	0	0	0	0	0	0
Cost of equity	**11.79%**	**13.75%**	**12.18%**	**7.98%**	**8.20%**	**8.00%**	**11.28%**	**10.27%**	**9.49%**	**22.24%**	**21.22%**	**22.10%**
(20) J.P. Morgan Approach												
U.S. risk free rate	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%	2.75%
Sov. bond yield local (USD)	6.75%	6.75%	6.75%	4.85%	4.85%	4.85%	2.28%	2.28%	2.28%	2.78%	2.78%	2.78%
Sov. bond yield U.S. (USD)	2.57%	2.57%	2.57%	1.74%	1.74%	1.74%	0.00%	0.00%	0.00%	1.74%	1.74%	1.74%
Global market risk premium	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%	6.25%
Rel. volatility factor (local vs. global)	1.90	1.90	1.90	1.31	1.31	1.31	1.04	1.04	1.04	2.29	2.29	2.29
Beta vs. local index	1.20	1.68	1.29	1.05	1.16	1.06	1.17	0.98	0.84	1.23	1.16	1.22
Cost of equity	**11.02%**	**12.67%**	**11.34%**	**8.07%**	**8.30%**	**8.09%**	**7.22%**	**6.87%**	**6.59%**	**13.77%**	**13.22%**	**13.70%**