Uluslararası Alanya İşletme Fakültesi Dergisi
Yıl:2013, C:5, S:3, s. 63-72

International Journal of Alanya Faculty of Business
Year:2013, Vol:5, No:3, s. 63-72

Cost of Equity Estimation for Energy Network Utilities in Emerging Economies: A Comprehensive Review

Gelişmekte Olan Ekonomilerde Enerji Şebeke Şirketleri için Öz Sermaye Maliyetinin Tahmin Edilmesi: Kapsamlı Bir İnceleme

Mustafa GÖZEN
Dr., Enerji Uzmanı, Enerji Piyasası Düzenleme Kurumu, (mgozen@epdk.org.tr)

Keywords:

Cost of capital, cost of equity, WACC, CAPM, energy tariff

ABSTRACT

This article introduces the models for estimating the cost of equity for energy network utilities in emerging economies and discusses them from the perspective of finance theory. For this purpose, a comprehensive review of literature is conducted. The available models in the literature are classified and evaluated in detail. Several versions of CAPM have been developed to estimate the cost of equity in emerging markets since the 1990s. However, the majority of the models are thought to violate the main assumptions of CAPM. On the other hand, all estimation methods look at the issue from the perspective of a global investor with a diversified portfolio. Emerging markets are either segmented from or partially integrated with the global market and frequently there are limits on local investors in these markets to invest in the international market. As a result, the cost of equity to a local investor could be relatively different from that to a global investor. In conclusion, both in practice and theory, there are very diverse and controversial proposals, which do not provide good guidelines for energy regulators in emerging countries in order to fulfill their duties regarding the tariff regulation of energy network utilities.

Anahtar Kelimeler:

Sermaye maliyeti, öz sermaye maliyeti, WACC, CAPM, enerji tarifesi

ÖZ

Bu makale gelişmekte olan ekonomilerde enerji şebeke şirketleri için öz sermaye maliyetinin tahminine yönelik modelleri tanıtmakta ve bu modelleri finans teorisi açısından tartışmaktadır. Bu amaçla, kapsamlı bir literatür taraması yapılmıştır. Literatürde ulaşılan modeller sınıflandırılmış ve ayrıntılı olarak değerlendirilmiştir. 1990'lı yıllardan itibaren gelişmekte olan ülkelerde öz sermaye maliyetinin tahmini için CAPM modeline dayalı çeşitli modeller geliştirilmiştir. Ancak bu modellerin çoğunluğunun CAPM'in ana varsayımlarını ihlal ettiği düşünülmektedir. Diğer taraftan, tüm tahmin yöntemleri konuya çeşitlendirilmiş portföye sahip global bir yatırımcı açısından bakmaktadır. Gelişmekte olan ülkeler ya global piyasalar ile kısmen entegre ya da ayrışmış olmakta ve bazı durumlarda yerli yatırımcıların uluslararası piyasalarda yatırım yapmasına yönelik sınırlamalar bulunmaktadır. Bu nedenle, yerli ve global yatırımcılar için öz sermaye maliyeti birbirinden göreceli olarak farklı olabilmektedir. Sonuç itibarıyla, teori ve uygulamada gelişmekte olan ülkelerdeki enerji düzenleme kurumlarının enerji şebeke şirketlerinin tarifelerinin düzenlenmesine ilişkin görevlerini yerine getirmeleri için iyi kılavuz niteliğinde olmayan, farklı ve karşıt öneriler bulunmaktadır.

1. INTRODUCTION

Energy regulators in emerging markets are authorized by national laws to estimate a fair and reasonable cost of capital for energy network utilities. The cost of capital plays an important role in tariff regulation of network-based energy utilities. Because electricity and natural gas sectors are based on networks where no competition is possible, regulating network tariffs and third party access to these networks are important to provide competition and ensure efficiency. This provides a key economic reason for specific regulation in these sectors, namely tariff regulation (Waterson, 1988: 1-15).

The level of capital cost determines the distribution of the wealth in the energy market. It could be high enough to attract the required investments to the utilities and provide for their financial integrity as well. In line with market structure, it is crucial that energy networks act as natural monopolists in their designated regions, remain in the business and serve the customers. On the other hand, the cost of capital could be lower for customers to enjoy energy supply on a continuous and affordable basis.

Even though setting a fair cost of capital in developed markets is subject to debate, it is much more complex and difficult in emerging markets. Obviously, estimation of debt cost is relatively easier than that of equity. Then, the main difficulty is how to estimate the cost of equity.

The models, which are suggested to estimate the cost of equity, such as the discounted cash flow model (*DCF*) and capital asset pricing model (*CAPM*), can only be used in developed markets or assist investors in these markets. Harvey (1995: 773-816) reports that the standard CAPM fails to explain risk-return relations in emerging markets. They cannot be applied with confidence to emerging markets because these markets do not have capital markets with the requisite history of input data required to use these models. In addition, even though financial integration among countries is a dynamic process, the capital markets in emerging markets still remain illiquid and not efficient (Pereiro, 2002: 14-56, 104-107; Brealey et al., 2008: 187-211).

Therefore, the purpose of this article is to introduce and discuss the models proposed to estimate the cost of equity in emerging economies. This article is structured as follows. The second section discusses the role of capital cost in energy market regulation in emerging economies. The third section introduces and discusses DCF and the standard, modified and adjusted versions of CAPM from the perspective of energy regulators, within the context of finance theory. The fourth section outlines some empirical studies. The fifth and final section summarizes the article and makes concluding remarks.

2. COST OF EQUITY IN EMERGING ECONOMIES

In general, it is agreed that investments in emerging markets are riskier than similar investments in developed markets. Nevertheless, in recent years, this view has been questioned as it has been claimed that investment in an emerging market actually reduces the risk attached to the overall cash flows of an international company (McRae, 1996: 107-137) and provides opportunities for diversification benefits for the companies, due to low correlation between developed and emerging markets. Investors are able to reduce some of the risk that they would, otherwise, have to bear in a segmented market, by diversifying across nations whose economic cycles are not perfectly in phase. A globally diversified portfolio will be less risky than a purely domestic portfolio. The reason is that risk, which is systematic in the context of the US economy, may be unsystematic in the context of the global economy (Shapiro, 2003: 513-523).

On the contrary, in practice, many companies add an additional premium into the cost of capital or a discount rate applied to investments in emerging markets. As criticized by Buckley (2004: 457-480), this application increases the cost of capital or discount rate, and then the cash flows are over-discounted and, consequently, investment opportunities are penalized. On the other hand, as shown by Harvey (1995: 773-816), the CAPM, which assumes complete integration of capital markets, does not provide an answer to explain the cross section of average returns in emerging countries, usually giving a result that is too low compared to the risks associated.

It is obvious that there are a number of difficulties that arise in the application of DCF and CAPM in international settings. As stated by Kennedy (2004: 155-178), the main problems in applying CAPM to emerging markets are the limited development of capital markets and the resultant lack of financial data. The risk free rate can be calculated based on Eurobond spreads for countries, which have issued Eurobonds. Although regulated utilities in emerging markets have not often issued bonds, there is usually enough information on lending rates to calculate the debt premium.

The difficulty comes in estimating the equity return, given that there is not enough information to estimate the market risk premium relative to the risk free rate, or the premium of the regulated utility relative to the market, given the immature nature of stock markets. As a solution, Kennedy (2004: 155-178) recommends using international data to estimate the return and comparing similar regulatory regimes in terms of the type of regulation. He also stresses that emerging markets rather than the U.S. and Western European markets should be employed for the purpose of comparison. This suggestion is questionable because emerging markets do not have reliable and good quality data when compared to other markets.

Since the 1990s, there have been increases in the number of contributions by which the modified and adjusted versions of the standard CAPM have been developed to estimate the cost of capital in emerging markets. Nevertheless, the majority of these contributions is thought to violate the main assumptions of CAPM (Bekaert and Harvey, 2002: 429-448) and is lacking theoretical explanation (Sabal, 2004: 155-166). Furthermore, in many proposed models, country risk is considered as a non-diversifiable risk factor (Sabal, 2004: 155-166) although there is supporting evidence that the economic and political risks faced by companies are unsystematic, which can be eliminated through diversification on the level of individual investors (Shapiro, 2003: 513-523).

3. REVIEW AND DISCUSSION OF THE MODELS

For the calculation of the cost of equity in emerging markets, the modified or adjusted versions of CAPM are recommended. However, in practice, country risk premium is added to the cost of equity calculated by CAPM for a U.S. company. In addition, among the suggested versions, there are some non-CAPM models. There is no literature advocating the use of other methods such as the risk premium approach, the Arbitrage Pricing Theory, or the Fama and French`s three-factor model, or even the use of DCF for regulatory purposes, probably due to the immature nature of capital markets in emerging markets.

The majority of the studies are based on the standard, adjusted and modified versions of CAPM. For example, Sabal (2004: 155-166) first classifies the models as practical and academic models, and then the academic models are discussed under two subheadings: conceptual and empirical models. Harvey (2005) does not classify the models, preferring to discuss their methodologies. However, Pereiro (2006: 160-183) classifies the models as CAPM based and non-CAPM based models.

On the contrary, it is possible, however, to adopt a different approach by classifying the models according to the variables such as whether country risk premium is included, beta is adjusted or modified, and risk factors other than beta are used. The summary of the models is presented in Table 1. The nomenclature for Table 1 is given in the Appendix. Furthermore, Table 2 provides short descriptions of the models, including their appearances in the literature. Since there are several models with complex formulas, a separate sheet is prepared to define the symbols and parameters used in the formulas.

Table 1. Cost of equity estimation models for emerging economies

Models	Description
A - Models standard for the international setting	
The Global[a] CAPM	$R_e=R_{fw}+\beta_w(R_{mw}-R_{fw})$
B - Models including additional risk premium, in general for country risk	
	Depending on the country where the investment is made, an additional risk premium (R_a) is added to the cost of equity estimated by CAPM (Sabal, 2004: 155-166).
	Country risk premium (R_c) is added to the CAPM formula instead of usually the U.S. market risk premium of $(R_{mu}-R_{fu})$ (Sabal, 2004: 155-166). Then the formula could be written as $R_e=R_{fu}+\beta_u R_c$
	Country risk premium is added usually to U.S. market risk premium (*The Beta Approach*) $(R_{mu}-R_{fu}+R_c)$ (Damodaran, 2003a: 63-76, 2009b, 2010).
	Country risk premium is added to the cost of equity estimated by CAPM usually for a U.S. asset, $R_e=R_{fu}+\beta_u(R_{mu}-R_{fu})+R_c$ (*The Bludgeon Approach*). The same calculation is done by multiplying R_c with a parameter (*namely Lambda*) to convert the calculation to the company level (*The Lambda Approach*). For different ways of calculating country risk premium and other details, see Damodaran (2003a: 63-76, 2003b, 2009b, 2010).
	Sovereign spread is added instead of the risk free rate and formulated as $R_e=R_s+\beta_w(R_{mw}-R_{fw})$ (*The Goldman Sovereign Spread Model*) (Harvey, 2005).
	For the calculation of beta and market risk premium, local data are used. Instead of the local risk free rate, global risk free rate is used and country risk premium is added to it. $R_e=R_{fw}+R_c+\beta_l(R_{ml}-R_{fl})$ (*The Local CAPM*) (Pereiro, 2006: 160-183).
	The cost of equity is calculated by adding the country long-term debt rate and the global market risk premium (*The U.S. market is assumed to represent the global market*), or by adding the cost of equity for a U.S. utility and the country risk premium (Voll et al., 1998). The latter is identical to the Bludgeon Approach.
C - Models including country/sovereign risk premiums with adjusted/modified risk factors	
The Goldman Sachs Model	$R_e=R_{fu}+R_c+\beta_l(R_{mu}-R_{fu})(1-\rho_{sb})(\sigma_c/\sigma_u)$ where $0<\rho_{sb}<1$
The Goldman Sovereign Spread Volatility Ratio Model	$R_e=R_s+(\sigma_c/\sigma_u)(R_{mw}-R_{fw})$
The Godfrey and Espinosa Model	$R_e=R_{fu}+R_c+0.60(\sigma_c/\sigma_u)(R_{mu}-R_{fu})$
The Adjusted Hybrid CAPM	$R_e=R_{fw}+R_c+\{\beta_c[\beta_{gu}(R_{mw}-R_{fw})]\}(1-R_2)$
The Lessard Model	$R_e=R_{fu}+R_c+(\beta_p\beta_c)(R_{mu}-R_{fu})$
The SalomonSmithBarney Model	$R_e=R_{fw}+\{(\gamma_1+\gamma_2+\gamma_3)/30)\}R_c+\beta_p(R_{mw}-R_{fw})$ where $0\leq\gamma_n\leq 10$
D - Models with adjusted/modified beta	
The Adjusted Local CAPM	$R_e=R_{fw}+\beta_l(R_{ml}-R_{fl})(1-R_i^2)$
The Modified International CAPM	$R_e=R_{fu}+\beta_{wp}(R_{mw}-R_{fw})$, Either world or the U.S. market risk premium is used (Sabal, 2004).
E - Models with risk factors other than beta	
Estrada's Downside Risk Model	$R_e=R_{fu}+RM(R_{mw}-R_{fw})$
Arbitrage Pricing Theory	$R_e=R_f+\beta_1 f_1+\beta_2 f_2+...+\beta_n f_n$
F - Other models	
The Erb, Harvey, and Viskanta Model	$R_e=\varepsilon_0+\varepsilon_1 lnCR$, where ε_0 and ε_1 are regression parameters. Country credit rating is available twice a year and the return is semi-annual.
The Implied Cost of Capital Model	$P_t=\sum_{t=1}^{\infty}\frac{CF_t}{(1+R_e)^t}$ This model aims at finding R_e from this equation in the international market.
The Bekaert and Harvey Model	$R_e=R_{fl}+(1-\lambda)\beta_l(R_{ml}-R_{fl})+\lambda\beta_w(R_{mw}-R_{fw})$
The Ibbotson Bayesian Model	It is a hybrid of the global CAPM.

Source: Damodaran (2003a: 63-76, 2003b, 2009a, 2009b), Bruner et al. (2002: 310-324), Sabal (2004: 155-166), Harvey (2005), Pereiro (2006: 160-183), Estrada (2007: 72-77), Pratt and Grabowski (2008: 307-325), Gozen (2012: 62-79).

[a] The word "*international*" is used interchangeably instead of the word "*global*".

Table 2. The models: their appearances in the literature and short descriptions

Models	Date	Short description of the models
The Standard CAPM[a] (Sharpe, 1964: 425-442; Lintner, 1965: 13-37; Black, 1972: 444-455)	1964	The local parameters are used in the CAPM formula. Due to its methodology, there is no need to add a country risk premium.
The Arbitrage Pricing Model (Ross, 1976: 341-360)	1976	The model foresees more than one risk factor compared with the single beta of CAPM, but there is no answer for the type and number of possible risk factors.
The Goldman Sovereign Spread Model (Mariscal and Lee, 1993; Harvey, 2005)	1993	It recommends the addition of a sovereign spread instead of the risk free rate.
The Goldman Sovereign Spread Volatility Ratio Model (Harvey, 2005)	1994	Sovereign spread is added instead of the risk free rate and the relative volatility of markets are multiplied by the market risk premium. Alternatively, Harvey (2005) proposes to calculate the volatility by the same methodology of the Implied Sovereign Spread Model.
The Erb-Harvey-Viskanta Model (Erb et al., 1995, 1996: 46-58)	1995	The cost of equity is associated with country credit rating.
The Bekaert and Harvey Model (Bekaert and Harvey, 1995: 773-816)	1995	CAPM is reformulated with time-varying market integration. It is a dynamic model and combines both local and global CAPMs in a single formula.
The Implied Sovereign Spread Model proposed by Erb, Harvey, and Viskanta (Erb et al., 1996: 46-58; Harvey, 2005)	1996	Sovereign spread is calculated by running a regression of observed sovereign spreads on country risk ratings. This is advised to calculate the sovereign spread as an alternative to the Goldman Sovereign Spread Model.
The Lessard Model (Lessard, 1996: 52-63; Pereiro, 2006: 160-183)	1996	Country risk premium is added to the CAPM and modified betas (*country beta and industrial beta*) are used.
Godfrey and Espinosa Model (Godfrey and Espinosa, 1996: 80-89; Pereiro, 2006: 160-183)	1996	Country risk premium is added to the CAPM and relative volatility of the market returns of the local and U.S. markets are used instead of beta.
The CSFB Model (Harvey, 2005)	1997	A relatively complex beta adjustment is used.
The Global CAPM (O'Brien, 1999: 73-79; Stulz, 1999: 8-25; Schramm and Wang, 1999: 63-72)	1999	The global parameters are used instead of local parameters. Due to its methodology, there is no need to include a country risk premium.
The Goldman Sachs Model (Mariscal and Hargis, 1999; Pereiro, 2006: 160-183)	1999	Country risk premium is added to the CAPM and instead of beta as a risk factor; the relative volatility of the market returns of the local and U.S. markets and the correlation of equity and debt markets of the local country are used.
The Ibbotson Bayesian Model (Harvey, 2005)	1999	A hybrid of the global CAPM.
The Beta Approach, the Lambda Approach, and the Bludgeon Approach (Damodaran, 2003a: 63-76; 2003b, 2009a, 2009b)	1999	Country risk premium is added to a) the base premium for mature equity market, b) U.S. market risk premium, or c) CAPM based cost of equity formula for a U.S. company by different measures of country risk.
Estrada’s Downside Risk Model (Estrada, 2000: 72-77)	2000	Market risk premium is multiplied by a risk measure instead of the beta factor.
The Adjusted Hybrid CAPM (Pereiro, 2001: 330-370)	2001	Country risk premium is added to the CAPM and an adjusted and modified beta is used.
The Adjusted Local CAPM (Pereiro, 2001: 330-370)	2001	Adjusted beta is used. The cost of equity estimated by the local CAPM is multiplied by the variance of equity volatility of the target company.
The SalomonSmithBarney Model (Zenner and Akaydin, 2002; Pereiro, 2006: 160-183)	2002	Country risk premium is added to the CAPM and an adjusted beta is used.
The Modified International CAPM (Sabal, 2004: 155-166)	2002	It uses weighted beta value when the company concerned operates in more than one country.
The Implied Cost of Capital Model (Damodaran, 2003b; Lee et al., 2003, 2009: 307-335)	2003	Its methodology is similar to the Gordon Growth Model. The model is based on calculating the cost of equity capital, which makes the present value of the forecasts of cash flows or dividends to the equity holders equal to the market price of the relevant common stock. Country risk premium is implicitly considered.

[a] This model was first implemented in the international setting by Solnik (1974: 48-54, 1977: 503-511).

For the cases where the country risk is not diversified away, either because the marginal investor is not globally diversified or because the risk is correlated across markets, Damodaran (2003a: 63-76, 2003b, 2009a, 2009b, 2010) states that this risk becomes market risk, then country risk should command a risk premium, and recommends the addition of a country risk premium to the base premium for a mature equity market to arrive at a market risk premium for an emerging market.

To this end, Damodaran reports 3 different measures of country risk premium associated with the following. 1. The rating assigned to a country's debt by a ratings agency, 2. The country risk assessments made by some services groups, and 3. Market-based measures such as bond default spread, credit default swap spreads, and the volatility in local stock market with regard to the local bond market or the mature equity market. It is important to note that the Law of One Price in theory informs us that return expectations are assumed to become unique by further integration of markets. When the integration process continues among markets, it is obvious that there will be less opportunity for investors to diversify unsystematic risks and in the end; investors will probably only face market risk, which is non-diversifiable (Bekaert, 1995: 75-107; Bekaert and Harvey, 2002: 429-448).

As regards market-based measures, R_c is calculated by multiplying the country default spread with the volatility of the equity market in a country relative to the volatility of the bond market in the same country. Alternatively, the relative volatility of stock market index of the country concerned can be multiplied by the base premium for a mature equity market to arrive at the market risk premium for the relevant country (Damodaran, 2003a: 63-76, 2003b).

On the other hand, Damodaran (2003a: 63-76, 2003b) prefers to multiply the country risk premium with a parameter to convert the country risk premium to a premium value at the company level. This parameter is associated with the percentage of exports in the firm's or project's sales in the country concerned. This could be written as $R_e=R_{fu}+\beta_u(R_{mu}-R_{fu})+\lambda R_c$ (*The Lambda Approach*). Damodaran suggests that λ can be estimated by several approaches considering the percentage of the company’s revenue generated in the local market, the variations in accounting earnings and stock prices.

The alternative approach used by Voll et al. (1998) is relatively easy to apply, particularly when the data is not available for input to CAPM and DCF. Country risk premium is added in the calculations, either ex-ante or implicitly, assuming that the country long term debt rate includes a premium for country risk.

Group B models involve with the addition of country risk premium to the standard CAPM, assuming that country risk is systematic and investors must be rewarded for it. However, according to general acceptance by academicians, correlation coefficients among markets indicate that country risk is not systematic at all. Thus, it is possible for marginal investors to diversify the country risk.

On the other hand, as strongly argued by Sabal (2004: 155-166), these models do not distinguish companies in terms of country risk and the same country risk premium is applied to all projects in emerging markets. The main reason behind Sabal’s argument is that there would be some sectors in emerging markets with more stable earnings and better reputation and it would be misleading to apply the same country risk premium to the costs of equity of these companies. To overcome this deficiency, Damodaran (2003a: 63-76, 2003b) recommends the Lambda Approach, but it may not provide the cost of capital estimates in the utility level in emerging markets since energy utilities that provide network services for the domestic market are not listed in stock exchanges, and have relatively stable earnings due to revenue/price cap regulation with an annual adjustment for inflation.

Significantly, however, finance theory clearly indicates that the cost of capital should reflect only non-diversifiable risk. As stated by Copeland et al. (2005: 60-77, 140-160), most agree that diversifiable risk is handled better in the cash flows and thus, more and more companies are building the risks into their cash flows. In the case of rate setting by regulators, this adjustment can only be done by increasing allowed cash flows to the utility. Nevertheless, the adjustment of the cash flows would not be an answer to the regulator if the utility has different shareholders with different return expectations.

On the other hand, Harvey (2005) proposes that sovereign spread and volatility could be calculated by running regressions of observed country risk ratings. In addition, Harvey (2005) reports that the sovereign spread is the spread between a country's government yield for bonds denominated in U.S. Dollars and the U.S. Treasury bond yield. Usually this spread is used as the country risk premium (Pereiro, 2006: 160-183; Estrada, 2007: 72-77).

Group C models, in addition to the inclusion of country risk premium, make adjustments/modifications in the beta. For example, The SalomonSmithBarney Model requires the subjective inputs of γ_1, γ_2, γ_3 coefficients to the model to calculate the company specific country risk premium. As stated by Estrada (2007: 72-77), this model gives the cost of capital estimates at the company level. This is a favorable characteristic of the model and would help regulators in setting rates, eliminating the conversion of country or industry cost of equity figures to the utility basis. However, the subjectivity in the input would be a disadvantage for regulators.

Moreover, the Lessard Model deals with the modification of beta and then country and industry betas are included in the model. On the other hand, relative volatilities of returns in local and U.S. markets and the correlation of equity and debt markets of the local country are used in some models such as the Goldman Sachs Model, the Goldman Model, the Godfrey and Espinosa Model. For example, the Godfrey and Espinosa Model adjusts the beta and includes two types of country risk premiums; one is to the global risk free rate and the other to the market risk premium. Since the volatility of the stock market is large in emerging markets, the last three models would produce high cost of capital values.

While group D models only deal with the adjustments and modifications of the standard CAPM, group E models like Estrada's Downside Risk Model and APT introduce new risk factors instead of beta. The Fama and French’s three-factor model could be added to this group because this model is based on three economic parameters, including beta of CAPM. However, as said earlier, it has no widespread acceptance in the international market.

In addition, there are other models - Group F models, as named by Pereiro (2006: 160-183) are not based on CAPM. Pereiro (2006: 160-183) classifies other models as non-CAPM models. However Sabal (2004: 155-166) classifies them as empirical models. As these models have no common characteristics similar to other groups, they are classified under other models. For example, the Implied Cost of Capital Model, which assumes the full integration of markets, has a similar methodology to DCF, and would only provide reliable estimates in the existence of perfect capital markets. Therefore, it is doubtful that this model will help many regulators in emerging markets.

Another non-CAPM based model is the Erb, Harvey, and Viskanta Model. According to Pereiro (2001: 330-370), this model would be an alternative, especially where there is no efficient local stock market, and thus, no reliable input data such as beta and market risk premium as in the case of CAPM models. However, the model produces estimates of cost of equity for a country and consequently this would be its disadvantage for energy regulators because the estimated value must be adjusted for incorporating utility specific risks before it is used. However, this model has shown some success in predicting returns in emerging markets with a reasonable history of country risk rating (Butler, 2004: 375-402).

Alternatively, in the existence of a local stock market, Pereiro (2001: 330-370) suggests the use of the Estrada Model, which is based on risk factors other than beta. Again, this model requires good quality data from functioning stock markets in emerging markets. In addition, the Bekaert and Harvey Model, an empirical model as defined by Sabal (2004: 155-166) is a mixture of local and global CAPMs, including a lambda parameter measuring the degree of integration. This model is developed to consider the time-varying characteristic of the integration process. In practice, regulators fix in advance a certain rate of return for the implementation period of tariffs. However, the Bekaert and Harvey Model will require regulators to design and implement a dynamic tariff design, which is unfortunately contrary to current tariff regimes.

Even though a large number of models are developed for the international setting, there are no common approaches accepted by academicians and practitioners. For example, Sercu (2009: 663-690) advises to look at first whether there is integration between the concerned markets or not. Thus, he is actually of the opinion that either the standard CAPM for the country or the international CAPM would be selected. Having chosen the model, then the next stage is to obtain estimates of the model's parameters.

Alternatively, Shapiro (2003: 513-523), despite being in favor of the global CAPM, recommends a pragmatic approach for U.S. based companies to measure the betas of international operations against the U.S. market portfolio, due to the quality of U.S. capital markets data derived over a long period.

In contrast, Sabal (2004: 155-166) proposes something very different and argues that what is important is not the degree of integration, but the key issue is the diversification status of the investor. Sabal (2004: 155-166), however, does not answer the question of which shareholders one is supposed to look at and analyses their degrees of diversification. In practice, there would be utilities whose direct shareholders are not diversified at all, whereas indirect shareholders would be diversified at the national or global level. In essence, in energy utilities, the controlling owners do not shown up as direct shareholders even though in many cases, they are indirect shareholders.

In addition to the models included in Table 2, Butler (2004: 375-402) and Pratt and Grabowski (2008: 307-325) mention a model, which is called as Globally Nested CAPM and formulated as $R_e=R_{fu}+\beta_c(R_{mw}-R_{fw})+(\beta_{cr}\delta_r)$. However, no further information was accessed regarding the proponent of the model and its first appearance in the literature. According to this model, required returns are a function of a country's systematic risk relative to the world stock market portfolio plus the country's systematic risk relative to regional risk that is not included in the world market portfolio return. Harvey (2005) states another model, which is proposed to estimate the cost of equity in Latin America (The CSFB model). This model is formulated as $R_e=R_{fb}+\beta_l(R_{mu}-R_{fu})*A\}K$, K is assumed to be 0.60. In addition, the model uses a relatively complex beta adjustment. It is based on the Brady bonds process that was ended in the 1990s. In addition, Harvey (2005) reports another alternative, which is the application of the same cost of equity capital to all countries, ignoring cross border risk differentials.

It is difficult to generalize which methods are mainly used in emerging markets because relatively few empirical studies are published. The next section discusses some of these empirical studies.

4. EMPIRICAL STUDIES

There are some empirical studies, which are worth mentioning. For example, Pereiro (2006: 160-183) conducts a survey about the application of traditional valuation techniques in Argentina and finds that CAPM is the most popular asset-pricing model, frequently modified to account for country specific risk, and U.S. betas are applied rarely adjusting for the differences in two countries. On the other hand, there are some practical studies conducted by consultancy companies for energy regulators in developed countries, which are available at the internet sites of the relevant agencies, such as Ofgem (*UK energy regulator*) and Energiekamer (*Dutch energy regulator*).

Here it is worth mentioning a working paper and some studies published in academic journals. In all these studies, cost of capital is estimated for the industry and there are no attempts to do this on the utility basis.

The working paper authored by Voll et al. (1998) involves estimating the cost of capital for privatized electricity distribution companies in India. Considering data availability and market conditions in India, they conduct calculations using three methods, namely the risk premium approach, DCF, and global and local versions of CAPM. In the global version, all CAPM parameters are based on the global market, considering the U.S. data representing the global market. A country risk premium for India is added to the CAPM formula. When the result obtained from global CAPM is ignored, due to the segmented nature of the Indian market at the time of the study, Voll et al. (1998) calculate cost of capital values relatively very close to each other, ranging between 18.08% and 20.16%.

Green and Pardina (1999: 94) estimate the cost of capital for the natural gas transport and distribution industry in Argentina. In their estimations, they first formulate the cost of capital for a U.S. company and add country risk premium to both the risk free rate and the cost of equity estimated for a U.S. company to arrive at a cost of capital value for the natural gas network industry in Argentina. In another study by Rocha et al. (2007: 2526-2537), the same methodology is used to estimate the cost of capital for electricity distribution companies in Brazil, Argentina, and Chile. These two studies have one common application in which country risk premium is added to both the U.S. risk free rate and U.S. market risk premium.

Alternatively, Estrada (2007: 72-77) studies a case analysis for an oil investment in Argentina to estimate the discount rate and net present value. For this purpose, Estrada uses four models - the Lessard Model, the Godfrey and Espinosa Model, the Goldman Sachs Model, and the SalomonSmithBarney Model and obtains substantial different discount rates from these four models. For example, while the result of the Lessard Model is 8.2%, the results for the Godfrey and Espinosa Model and the Goldman Sachs Model are 17.7% and 18.4% respectively. The results for the SalomonSmithBarney Model vary between 7.9% and 12.9% depending on the limit values of γ_1, γ_2, γ_3 coefficients. Estrada (2007: 72-77) then reports the lack of a sound, well-accepted theory in estimating the discount rate for emerging markets.

There is one study which calculates the cost of capital for electricity distribution companies in Turkey (Gozen, 2012: 62-79). Gozen (2012) first estimates cost of equity and then calculates real pre-tax WACC values for Turkish electricity distribution companies. The results for real pre-tax WACC values vary from 4.86% to 11.34%. In addition, Gozen (2012) reports that the models based on addition of a country risk premium instead of the U.S. market risk premium provide unrealistic results while Damodaran's proposal of country risk premium based on the relative volatility of Turkey's equity market to the U.S. market provides relatively higher results compared with those of other models. On the other hand, Turkish energy regulator (EMRA) estimated a real pre-tax WACC of 10.49% for the second implementation period between January 1, 2011 and December 31, 2015 (EMRA, 2013). This means that the approved WACC is reasonable when compared with the results of different models (Gozen, 2012: 62-79). From the study of Gozen (2012), depending upon the model selection, the results for cost of equity values are different and the variability in the results makes the task of the regulator even more difficult.

In another study by Gozen (2011: 20), capital cost is calculated for two electricity companies. The first one is Zorlu Enerji Elektrik Üretim A.Ş. (ZOREN), which is an electricity generator whose shares are traded in Borsa Istanbul. The second is regional electricity distribution companies. According to the results of the study by Gozen (2011: 24), the real pre-tax WACC for electricity distribution utility changes from 8.41% to 8.52% and for ZOREN from 9.85% to 10.18%. The results of this study are compatible with business risks of the respective companies because electricity distribution companies are less risky and they are guaranteed a certain level of revenue.

5. SUMMARY AND CONCLUDING REMARKS

Estimation of the capital cost for emerging countries presents greater difficulties as it is much more complex. In order to include the additional risk that emerging markets have, the proposed models, mainly, involve adding a country risk premium, adjusting or modifying the beta, or using other risk parameters instead of beta in CAPM (Bekaert and Harvey, 2002: 429-448; Sabal, 2004: 155-166; Pereiro, 2006: 160-183). The models are competing to receive acceptance and general implementation. As regards the proposed models, there is no regular pattern which can be used to predict the future direction of research and which model will gain widespread acceptance.

On the other hand, estimation methods look at the issue from the perspective of a global investor with a diversified portfolio. Many local emerging markets are not integrated within the global market and frequently there are restraints on the ability of local investors to invest outside their home market.

When regulators use the models developed for mature markets such as the U.S. and Western European countries, they do not take into consideration the return expectations of local investors. By setting cost of capital for utilities using these models, regulators most probably allow the cost of capital that global investors with diversified portfolios would expect, but they ignore return expectations of local investors, and instead possibly allow a lower rate of return for local investors when compared with their risk profile. In conclusion, both in practice and theory, there are very diverse and controversial proposals, which do not provide good guidelines for energy regulators in emerging countries.

REFERENCES

BEKAERT, G. (1995). "Market integration and investment barriers in emerging equity markets", The World Bank Economic Review, 9(1): 75-107.

BEKAERT, G. and HARVEY, C.R. (1995). "Time-varying world market integration", Journal of Finance, 50: 403-444.

BEKAERT, G. and HARVEY, C.R. (2002). "Research in emerging markets finance: Looking to the future", Emerging Markets Review, 3: 429-448.

BLACK, F. (1972). "Capital market equilibrium with restricted borrowing", Journal of Business, 45(3): 444-455.

BREALEY, R.A., MYERS, S.C., and ALLEN, F. (2008). "Principles of Corporate Finance", Ninth Edition, McGraw-Hill Education (Asia), Singapore.

BRUNER, R. F., CONROY, R. M., ESTRADA, J. and KRITZMAN, M. (2002). "Introduction to Valuation in Emerging Markets", Emerging Markets Review 3: 310-324.

BUCKLEY, A. (2004). "Multinational Finance", Fifth Edition, Pearson Education Limited, Essex, UK.

BUTLER, K. C. (2004). "Multinational Finance", Third Edition, Thomson & South-Western, Mason, Ohio.

COPELAND, T. E., WESTON, J. F. and SHASTRI K. (2005). "Financial Theory and Corporate Policy", Fourth Edition, Pearson Addison Wesley, Boston, 60-77, 140-160.

DAMODARAN, A. (2003a). "Country risk and company exposure: Theory and practice", Journal of Applied Finance, Fall/Winter: 63-76.

DAMODARAN, A. (2003b). "Valuation in emerging markets", Choi, F.D.S. (ed.), International Finance and Accounting Handbook, Third Edition, Chapter, 9, John Wiley & Sons, Inc., New Jersey.

DAMODARAN, A. (2009a). "Volatility rules: Valuing emerging market companies", September, http://pages.stern.nyu.edu/~adamodar/pdfiles/papers/emergmkts.pdf, 24.06.2012.

DAMODARAN, A. (2009b). "Equity risk premiums (ERP): Determinants, estimation and implications", October 22, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1492717, 22.06.2012.

DAMODARAN, A. (2010). "Measuring country risk", http://www.qfinance.com/contentFiles/ QF01/g4fqn4jz/10/0/ measuring-country-risk.pdf, 17.07.2012.

ERB, C. B., CAMPBELL, R. H. and VISKANTA, T. E. (1995). "Country risk and global equity selection", Journal of Portfolio Management, 21: 74-83.

ERB, C. B., CAMPBELL, R. H. and VISKANTA, T.E. (1996). "Expected returns and volatility in 135 countries", Journal of Portfolio Management, Spring: 46-58.

ESTRADA, J. (2000). "The cost of equity in emerging markets: A downside risk approach", Emerging Markets Quarterly, 4: 19-30.

ESTRADA, J. (2007). "Discount rates in emerging markets: Four models and an application", Journal of Applied Corporate Finance, 19(2): 72-77.

GODFREY, S. and ESPINOSA, R. (1996). "A practical approach to calculating costs of equity for investments in emerging markets", Journal of Applied Corporate Finance, Fall: 80-89.

GOZEN, M. (2011). "Cost of Capital Estimation for Energy Network Utilities: Revisiting from the Perspective of Regulators", Dokuz Eylül Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi, 26(2): 37-68

GOZEN, M. (2012). "Determining the cost of capital for Turkish electricity distribution utilities: Analysis and recommendations", Istanbul University Journal of the School of Business Administration, Vol:41, No:1, 62-79.

GREEN, R. and PARDINA, M. R. (1999). "Resetting Price Controls for Privatized Utilities: A Manual for Regulators", EDI Development Studies, The World Bank, Washington, D.C.

HARVEY, C. R. (1995). "Predictable risk and returns in emerging markets", The Review of Financial Studies, 8(3): 773-816.

HARVEY, C. R. (2005). "12 ways to calculate the international cost of capital", October 14, http://faculty.fuqua.duke.edu/ ~charvey, 24.05.2012.

KENNEDY, D. (2004). "Role of Regulatory Arrangements in Developing the Power Markets", Bielecki, J. and Desta, M.G. (eds.), Electricity Trade in Europe: Review of the Economic and Regulatory Challenges, Kluwer Law International, The Netherlands, 155-178.

LEE, C., NG, D. and SWAMINATHAN, B. (2003). "International asset pricing: Evidence from the cross section of implied cost of capital", 14th Annual Conference on Financial Economics and Accounting (FEA), November 1, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=485762, 20.07.2012.

LEE, C., NG, D. and SWAMINATHAN, B. (2009). "Testing international asset pricing models using implied costs of capital", Journal of Financial and Quantitative Analysis, 44(2): 307-335.

LESSARD, D. (1996). "Incorporating country risk in the valuation of offshore projects", Journal of Applied Corporate Finance, 9: 52-63.

LINTNER, J. (1965). "The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets", The Review of Economics and Statistics, 47(1): 13-37.

MARISCAL, J. O. and HARGIS, K. (1999). "A long-term perspective on short-term risk: Long-term discount rates for emerging markets", Global Emerging Markets Report October 26, 1-23, Goldman Sachs Portfolio Strategy, USA, http://pages.stern.nyu.edu/~jmei/hargis.pdf, 19.07.2012.

MARISCAL, J. O. and LEE, R. M. (1993). "The Valuation of Mexican Stocks: An Extension of the Capital Asset Pricing Model to Emerging Markets", Goldman Sachs Latin American Research 1-18, http://faculty.fuqua.duke.edu/~charvey/Teaching/BA456_2006/GS_The_valuation_of_mexican_stocks.pdf, 19.07.2012.

MCRAE, T. W. (1996). "International Business Finance: A Concise Introduction", John Willy & Sons, Inc., New York.

O'BRIEN, T. J. (1999). "The global CAPM and a firm's cost of capital in different currencies", Journal of Applied Corporate Finance, 12: 73-79.

PEREIRO, L. E. (2001). "The valuation of closely-held companies in Latin America", Emerging Markets Review, 2: 330-370.

PEREIRO, L. E. (2002). "Valuation of Companies in Emerging Markets: A Practical Approach", John Wiley & Sons, Inc., New York, 14-56, 104-107.

PEREIRO, L. E. (2006). "The practice of investment valuation in emerging markets: Evidence from Argentina", Journal of Multinational Financial Management, 16: 160-183.

PRATT, S.P. and GRABOWSKI, R.I. (2008). "Cost of Capital: Applications and Examples", Third Edition, John Wiley & Sons, Inc., New Jersey.

ROCHA, K., CAMACHO, F. and BRAGANCA, G. (2007). "Return on capital of Brazilian electricity distributors: A comparative analysis", Energy Policy, 35: 2526-2537.

ROSS, S.A. (1976). "The arbitrage theory of capital asset pricing", Journal of Economic Theory, December: 341-360.

SABAL, J. (2004). "The discount rate in emerging markets: A guide", Journal of Applied Corporate Finance, 16(2-3): 155-166.

SCHRAMM, R.M. and WANG, H.N. (1999). "Measuring the cost of capital in an international CAPM framework", Journal of Applied Corporate Finance, 12: 63-72.

SERCU, P. (2009). "International Finance: Theory into Practice ", Princeton University Press, Princeton, New Jersey, USA.

SHAPIRO, A.C. (2003). "Multinational Financial Management", Seventh Edition, John Wiley & Sons, Inc., New York.

SHARPE, W. (1964). "Capital asset prices: A theory of market equilibrium under conditions of risk", Journal of Finance September, 19(3): 425-442.

SOLNIK, B. (1974). "The international pricing of risk: An empirical investigation of the world capital market structure", Journal of Finance, 29: 48-54.

SOLNIK, B. (1977). "Testing international asset pricing: Some pessimistic views", Journal of Finance, 32: 503-511.

STULZ, R. (1999). "Globalization, corporate finance and the cost of capital", Journal of Applied Corporate Finance, 12: 8-25.

VOLL, S.P., BHATTACHARYYA, S. and JURIS, A. (1998). "Cost of Capital for Privatised Distribution Companies: A Working Paper for a Calculation for India", NERA Working Paper October, NERA, Washington, D.C., http://www.nera.com/image/3867.pdf, 29.06.2012).

WATERSON, M. (1988). "Regulation of the firm and natural monopoly", Basil Blackwell Inc., New York. 1-15.

ZENNER, M. and AKAYDIN, E. (2002). "A practical approach to the international valuation and capital allocation puzzle", Global Corporate Finance Report July 26, SalomonSmithBarney, New York, London, http://finance.wharton.upenn.edu/~benninga/hungary/solomon2002.pdf, 20.05.2012.

APPENDIX

Nomenclature for Table 1

Parameter	Definition
R_e	The cost of equity
R_f , R_{fl} , R_{fu} , R_{fw} , R_{fb} , R_s	The risk free rate, the local risk free rate, the U.S. risk free rate, the global risk free rate, the stripped yield of a Brady bond, and the sovereign spread respectively
R_{ml} , R_{mu} , R_{mw}	The local market return, the U.S. market return, and the global market return respectively
β_l	The beta of the local company computed against the local market index
β_u	The beta of the U.S. company computed against the U.S. market index
β_w	The beta of the local company computed against the global market index
R_c	The country risk premium
R_a	Additional risk premium depending on the country where the investment is made.
β_p	The beta of the relevant industry with respect to the world market. This parameter refers to the industry beta in the SalomonSmithBarney Model. On the other hand, it refers to the beta of a U.S. based project, which is a proxy for a foreign project in the Lessard Model.
β_c	The beta of the relevant country with respect to the world/U.S. market. This refers to the relative sensitivity of the returns of the local stock market to the U.S. market returns in the Lessard model. It refers to the slope of the regression between the local equity market index and the global market index in the Adjusted Hybrid Model.
β_{cr}	The beta of the relevant country with respect to the region concerned.
β_{gu}	The average unlevered beta of comparable companies listed in the global market. It requires relevering with the target leverage.
β_n	The sensitivity to factor *n*.
B_{wp}	The weighted beta of projects in different locations (Sabal, 2004: 155-166).
ρ_{sb}	The correlation between the stock and bond markets of the country
σ_c, σ_{ce} , σ_{cd}	The standard deviation of returns in the local equity market
σ_u	The standard deviation of returns in the U.S. equity market
γ_1	A firm related score indicating access to capital markets, $0 \leq \gamma_1 \leq 10$, and a score of 0 indicates the best access.
γ_2	The susceptibility of the industry to political intervention, $0 \leq \gamma_2 \leq 10$, a score of 0 indicates the least susceptibility.
γ_3	The portion of the firm's total assets at the local level, $0 \leq \gamma_3 \leq 10$, a score of 0 indicates that the investment at the local level constitutes only a small portion.
CR	Country credit rating of the relevant country
λ	For the Bekaert and Harvey Model, it measures the degree of integration and $0<\lambda<1$. If $\lambda=1$, it means that markets are fully integrated. If $\lambda=0$, it means that markets are fully segmented. For the models recommended by Damodaran (2003a: 63-76, 2003b), λ can be estimated by several approaches considering the percentage of the company's revenue generated in the local market, the variations in accounting earnings and stock prices.
A	*A* is the coefficient of variation in the local market divided by the coefficient of variation of the U.S. market, where the coefficient of variation is defined as the standard deviation divided by the mean (Harvey, 2005).
RM	A downside risk measure, the ratio between the semi-standard deviation of returns with respect to the mean in the market concerned and the semi-standard deviation of returns with respect to the mean in the world market.
CF_t	Expected cash flows to equity holders in time *t*.
P_t	Market price of the equity traded in an organized stock exchange.
f_n	Factors affecting expected return.
R_i^2	The amount of variance in the equity volatility of the target company that is explained by the country risk.
R^2	The coefficient of determination of the regression between the equity volatility of the local equity market against the variation in country risk.
δ_r	Regional risk not included in the world market risk premium.