Cost of equity estimation for the Brazilian market: a test of the Goldman Sachs model

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ABSTRACT
As an approach to determining the degree of integration of the Brazilian economy, this paper seeks to test the explanatory power of the Goldman Sachs Model for the expected returns by a foreign investor in the Brazilian market during the past eleven years (2004-2014). Using data for the stocks of 57 of the most actively traded firms at the BM&FBovespa, it begins by testing directly the degree of integration of the Brazilian economy during this period, in an attempt to better understand the context in which the model has been used. In sequence, in an indirect test of the Goldman Sachs model, the risk factor betas (market risk and country risk) of the sample stocks were estimated and a panel regression of expected stock returns on these betas was performed. It was found that country risk is not a statistically significant explanation of expected returns, indicating that it is being added in an ad hoc fashion by market practitioners to their cost of equity calculations. Thus, although there is evidence of a positive and significant relationship between systematic risk and return, the results for country risk demonstrate that the Goldman Sachs Model was not a satisfactory explanation of expected returns in the Brazilian market in the past eleven years, leading us to question the validity of its application in practice. By adding a size premium factor to the model, there is evidence of a negative and significant relationship between companies’ size and return, although country risk remains not satisfactory to explain stock expected returns.

Keywords: Goldman Sachs Model; Degree of Market Integration; Country Risk; Systematic Risk.
1. Introduction

It certainly goes without saying how crucial the estimation of a firm’s cost of equity is, especially for practical purposes – for equity and firm valuation in mergers and acquisitions, security analysis for investment recommendation purposes, for the determination of value creation by managers, and various other essential corporate finance decisions.

The starting point in most of the current practice is to begin with the Sharpe-Lintner-Mossin (SLM) version of the capital asset pricing model (CAPM), in which values for the rate of return on a proxy for the risk free asset and a premium for exposure to market portfolio risk would be sufficient, including an estimate for the asset’s degree of exposure (beta).

However, in many cases practitioners add premiums for other risk factors, for at least two reasons: (a) they do not believe the SLM version of the CAPM is valid, as indicated by the Fama and French (1992) results, or (b) they feel the need to adjust the SLM version of the CAPM for conditions in the specific market in which an investment is to be evaluated. For the first reason, a premium for the companies’ size is frequently added (following the conclusions of Fama and French. 1992). Meanwhile, one example of the second reason is the addition of a premium for country risk, in the belief that the country’s market is not sufficiently integrated into the world market, and that this country risk would not be diversifiable, from the view point of an international investor. This procedure is reported in a survey by Keck et al. (1998).

The so-called Goldman Sachs model, attributed to Mariscal and Lee (1993), consists in the use of proxies from a developed, integrated market, such as that of the United States, for both the risk free asset (e.g., US Treasury bonds) and the market portfolio (e.g., the S&P500 index). With such data, a US investor would evaluate investments in her domestic market. However, if the investor were evaluating an investment opportunity, say, in Brazil, the Goldman Sachs model would recommend the addition of a premium for Brazil risk (e.g., the EMBI+ Brazil index, measuring the spread between the yields on Brazilian sovereign bonds and US Treasury bonds.

Even though it is not clear that the evaluation is being performed for the benefit of an international investor, local market evaluations make frequent use of the Goldman Sachs model. In a survey of 52 valuation reports for going-private purchase offers, as required by the corresponding Brazilian regulation, covering the 2008-2013 period,
Sanvicente (2014) finds that in all reports an adjustment is made for country risk, using, in over 50% of the cases, the EMBI+ published by JP Morgan. In turn, the risk free asset is proxied by 10- or 30-year US Treasury bonds, and the market portfolio is represented by the S&P500 index, the market risk premium being measured with average historical returns. Hence, it can be claimed that at least 50% of this particular application of cost-of-equity estimation methods make explicit use of the Goldman Sachs model.

The objective of the present paper is, therefore, to determine the empirical relevance of the Goldman Sachs model in the estimation of the cost of equity for the Brazilian market. This is accomplished both directly, through a test of the significance of a country risk premium for equity expected returns, and indirectly, by testing whether the Brazilian market is partially or fully integrated into the world market, using the incremental risk measure proposed by Keck et al. (1998). The paper also tests the significance of the size premium in a multifactor model, as in Fama and French (1992) for the equities’ expected returns.

The paper is structured as follows: following the Introduction, a discussion of the relevant literature is presented, the methodology used for both tests is explained, data definitions and sources are provided, results are displayed, and the paper then concludes.

2. Review of literature

One of the basic issues in the choice of a model as a basis for the estimation of cost of equity and discount rates in general, when dealing with investments outside the domestic economy, is the perception of how integrated the particular overseas market is, and whether one should adjust a basic model for non-diversifiable risks, such as country risk, or similar manifestations of emerging market risks, such as political or currency risk.

It is reported in the literature that investors tend to adjust their valuation methodology as a function of their perception of how much the particular market is integrated into the world market (KECK et al., 1998). Fuenzalida and Mongrut (2010), Stulz (1999) and Harvey (2005) emphasize that it is possible to construct a parallel between cost-of-equity computation methods and a market’s degree of integration.
For fully integrated markets, for example, Stulz (1999) argues that firms should adopt a discount rate treating them as part of the world stock portfolio. Global portfolio diversification would then lead to risk reduction and hence to the lowering of required returns.

However, investors in not fully integrated markets would have their diversification possibilities reduced. For Mishra and O’Brien (2001), asset pricing models in emerging markets divide risks in such markets into two components: a systematic risk component, captured by asset betas, and a non-systematic risk component, whose inclusion in such models is subject to much debate. If markets were fully integrated, for example, country risk would be irrelevant in the estimation of the cost of equity, since it could be eliminated via diversification (Harvey, 2005).

In integrated financial markets, home investors can freely invest in foreign assets, and international investors can invest in domestic assets (Bekaert et al., 2003). Hence, assets with identical risks (involving, for example, cash flow and leverage characteristics) would command identical expected returns, regardless of the market in which they are traded.

With the opening up of several emerging markets starting in the 1980’s, the interest in the effects of capital market integration on the economy as a whole has expanded. In an integrated market, an asset’s expected returns can be explained by the covariance with world market returns (Bekaert et al. 2002). However, in a segmented or partially integrated market, the covariance with a global factor may have low explanatory power for expected returns (Bekaert and Harvey, 1995).

According to Bekaert et al. (2002), Henry (2002), Bekaert and Harvey (1995), and Errunza and Miller (2000), when an economy moves from a segmented market regime to that of an integrated market, expected returns, return volatilities and correlations with major global market indices are affected in that economy, and it is apparent that market integration is key to the present discussion.

Henry (2002) observes that a country’s market index, when the economy is in a process of liberalization, achieves abnormal returns of approximately 3.3% on a monthly basis (in real US dollar terms) for eight months since the inception of liberalization policies. This result is consistent with the contention that liberalization policies help to lower the cost of equity level in a given country, since international risk diversification now becomes possible (Stulz, 1999).
Bekaert et al. (2002) discuss the effects of financial market integration using a broad set of macroeconomic indicators. Using data for 20 liberalizing emerging markets, they classify their variables into five groups: (a) changes in dividend yields; (b) market liquidity (measured by the ratio between market capitalization and GDP); (c) capital inflows (measured by the flow of US investments divided by total market capitalization); (d) stock dispersion in a particular market and correlation with world markets; and (e) local economic environment (volatility of exchange and inflation rates and the ratio between exports, imports to GDP). They conclude that integration is accompanied by an expanding and more liquid capital market, in addition to an increase in return volatility and in correlations with global markets.

Errunza and Miller (2000), Bekaert and Harvey (1999), Bekaert et al. (2002) and Henry (2002) state that increased integration leads to a reduction in the cost of equity, an improvement in the country’s credit rating, as well as currency appreciation and economic growth thanks to increasing investment.

Concerning the cost of equity, Bekaert et al. (2002) and Stulz (1995) posit that, once access is given to foreign investors to the local market, portfolio diversification opportunities produce higher domestic asset prices, which is equivalent to lower required returns.

It should pointed out, however, that many factors may be compatible with a market’s liberalization process, without leading to the effective and immediate integration of a country’s economy. Bekaert et al. (2002), for example, indicate that economic growth or currency appreciation, usually mentioned as the consequence of higher market integration, are not always the consequence of liberalization measures. This complicates controlling for the variables with which one assesses a market’s degree of integration.

According to Solnik (1974), six main factors can cause market segmentation: (a) legal and regulatory constraints; (b) transactions costs; (c) discriminatory taxation; (d) political risk; (e) psychological barriers; and (f) foreign exchange risks. However, Keck et al. (1998) point out that, for one to state that a market is integrated it is not sufficient to observe the above enumerated factors.

Such factors may cause a given market to become riskier, but do not necessarily require a multifactor model for the cost of equity, or even a new single factor model. Keck et al. (1998) argue that a revision in the cost of equity model would be justified only if the same risk were priced differently, or if different risks were priced.
The adoption of a distinct model for a particular national market, in contrast with an international and fully integrated market would have to be justified by how much they differ in terms of their integration to the world market, possibly because the particular national market imposes barriers to investment by foreigners (KECK et al. 1998).

Assuming that a Global CAPM were to describe precisely how assets are priced in the world market, the expected risk premium in a global stock portfolio would be identical for all investors, regardless of where they happened to be located geographically. Stulz (1999) argues that a Global CAPM should be used for computing assets’ capitalization rates, since in most markets the cost of equity is globally, and not locally determined.

However, Keck et al. (1998) argue that two hypothetical firms, with identical products, cash flows and capital structures, but located in different national markets, one fully integrated and the other partially integrated to the global economy, should have different expected returns.

The firm based in the partially integrated market, from an international investor’s viewpoint, faces a risk pricing process which is distinct from that faced by the firm based in the fully integrated market. Thus, when once compares the expected returns for the two firms, their cost of equity models should be as follows.

For the firm located in a fully integrated market (Home market):

\[
E(r_h) = r_f + (b_{HL} \times b_{LhG})[E(r_G) - r_f]
\]  

(1)

where \(b_{HL}\) is the slope of the regression of the integrated firm’s returns against the returns on its home country’s index. In turn, \(b_{LhG}\) is the slope of the regression of the fully integrated market’s index against the returns on a global market index.

For the firm located in a partially integrated market (Away market):

\[
E(r_a) = r_f + (b_{AL} \times b_{LaG})[E(r_G) - r_f]
\]  

(2)

where \(b_{AL}\) is the slope of the regression of the partially integrated firm’s returns against the returns on its own local market index, whereas \(b_{LaG}\) is the slope of the regression of the local market index returns against those of the global market index.

If both markets were fully integrated into the world market, the expected returns for both firms would be identical, so that \((b_{HL} \times b_{LhG})\) would be equal to \((b_{AL} \times b_{LaG})\).
(STULZ, 1999). For the firm located in the Away market, when it is not fully integrated, the cost of equity would be given by:

\[
E(r_a) = r_f + (b_{aL} \times b_{LaG} + b_a) \left[ E(r_G) - r_f \right]
\]

with \( b_a \) indicating the incremental risk, according to Keck et al. (1998), associated with the fraction of the Away market’s returns that co-vary with the global market, but not with the local market. Thus, risk in such a market is priced differently, from the international investor’s viewpoint.

Asset pricing models may be classified into three main categories: segmented, fully integrated, and partially integrated markets (BEKAERT and HARVEY, 1995). According to Pereiro (1999), Stulz (1999) and Fuenzalida and Mongrut (2010), it is possible to associate cost-of-equity estimation methods and a market’s degree of integration. This association is illustrated in Table 1.

Table 1 – Cost of Equity and Market Integration.

<table>
<thead>
<tr>
<th>Cost of equity estimation method</th>
<th>Market portfolio proxy</th>
<th>Systematic risk measure</th>
<th>References</th>
<th>Degree of market integration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local CAPM</td>
<td>Local market index</td>
<td>Local index beta</td>
<td>Sharpe (1964); Lintner (1965); Mossin (1966)</td>
<td>Segmented</td>
</tr>
</tbody>
</table>

Table 1 shows that, as pointed out by Keck et al. (1998), with greater uncertainty and market complexity in markets not fully integrated investors tend to resort to multifactor models, such as the Goldman Sachs version, and to the addition of ad hoc risk premiums.

The basic approach to estimating the cost of equity is the CAPM developed by Sharpe (1964), Lintner (1965) and Mossin (1966). It says that an asset’s expected return is a
linear function of the risk free rate, the asset’s systematic risk and the market portfolio’s risk premium. The CAPM characterizes the asset’s systematic risk as its contribution (beta) to the variance of returns on a diversified market portfolio. Black et al. (1972) and Fama and MacBeth (1973) find, as predicted by the CAPM, that stock returns and their betas are positively associated in the pre-1969 period. However, later tests of the CAPM lead to questioning the model’s applicability. Fama and French (1992) find that the positive association between betas and expected returns disappears in the 1963-1990 period. In contrast, they find significant association between returns and size, leverage, earnings/price and book-to-market ratio. In the case of size (whose significance is tested in this paper), Fama and French (1992) assign, for each year, stocks into 12 portfolios (including all New York Stock Exchange stocks that have reported price series) using the ranked values of market cap. The authors find that average returns of smaller stocks are too high given their beta estimates and average returns of larger stocks are too low. In addition, Fama and French (1992) find that there is a negative and statistically significant relation between size and average returns. Similarly, Harvey (1995) does not find a significant association between returns and betas measured against a global portfolio for over 800 firms in 20 emerging markets. This could be explained by the lack of integration of those markets into the global economy, making the use of a global beta unfeasible, by the assumption that betas are constant over time, or by the fact that emerging markets are more susceptible to local than to global factors. This is evidence that asset pricing models that are predicated on full market integration would not be able to explain expected returns in partially integrated markets (HARVEY, 1995).

In contrast with Harvey (1995), Pereiro (1999) argues that the increasing integration and free intermarket capital flows have allowed investors from any part of the world to enter and exit any given market at minimal transactions costs. Stulz (1999) argues that the removal of barriers to the free flow of capital leads to lower risk premiums in emerging markets, since risks can now be globally diversified. In reality, emerging markets, such as those in South America, have undergone significant development as a result of liberalization programs that have encouraged international investment (STULZ, 1999). Hence, for the firms with access to the global stock market, the use of the Sharpe-Lintner-Mossin CAPM that presumes market segmentation (BEKAERT and HARVEY,
1995) will tend to overestimate the cost of equity, since diversifiable risks in a local market investment could now be diversified internationally (STULZ, 1999).

Thus, Stulz (1999) proposes a Global CAPM approach, in which any investment is part of a global portfolio, using a global market index such as the MSCI World Index as a proxy for the market portfolio.

However, according to Harvey (1995), when the Global CAPM is used for stocks in emerging markets, and a regression is run against the global market proxy, such as the MSCI World Index, betas are negative or close to zero.

Given the low correlations between many emerging markets and developed markets, in addition to the preponderance of local factors as explanations for expected returns, Harvey (1995) states that the Global CAPM should not be used when investments in not fully integrated markets are contemplated. He emphasizes that, when one uses an asset pricing method based on the Global CAPM, as in Stulz (1999), one is assuming that the market examined is fully integrated into the world market. The rejection of such a global model, therefore, could be explained by the failure of the full market integration assumption.

One adaptation that is widely used by many investment banks and consulting firms is the Goldman Sachs Model, developed by Mariscal and Lee (1993). It is one of the first models to assume partial market integration, especially in emerging markets (FUENZALIDA and MONGRUT, 2010).

In the Goldman Sachs model, a regression is run between stock returns and returns on the S&P 500. The betas thus estimated are multiplied by the risk premium on the S&P 500 index. Finally, a country risk premium is added, in an ad hoc fashion, to correct for an allegedly low cost of equity. Such a premium can be based on the Emerging Markets Bond Index Plus (EMBI+), computed by JP Morgan, measuring the spread between yields on sovereign debt instruments issued by the country of interest, traded overseas, and yields on US Treasury securities with similar time to maturity (ZENNER et al. 2008).

According to Fama and MacBeth (1973) and Sanvicente (2014), the Sharpe-Lintner-Mossin model presupposes the use of a single risk factor in the determination of an asset’s expected returns, which is proportional to the quantity of non-diversifiable (beta) risk of the asset. Thus, the inclusion of any premium beyond that of the market portfolio would be an ad hoc procedure without theoretical basis. Fama and MacBeth (1973), for
example, determined that risk measures other than beta do not contribute to the construction of an efficient portfolio.

Sanvicente (2014) tested the significance of country risk for observed returns, using a sample of 204 firms in the Brazilian market. Observing that the performance of the local proxy for the market portfolio is already affected by country risk, the addition of a country risk premium would then be unnecessary, a result that would provide support for the use of Local CAPM when assessing the cost of equity in Brazil, even from the viewpoint of international investors.

When testing for the relevance of various common risk factors, a measure of asset expected returns is required. As proposed in Harris et al. (2003), Sanvicente and Minardi (1999), and Sanvicente and Carvalho (2013), expected returns, as a measure of an investment’s opportunity cost, is best extracted from the corresponding asset’s intrinsic value, defined as the present value of all payments to the investor, including dividends and terminal selling price, discounted at a risk-adjusted interest rate. In equilibrium, current market price would reflect intrinsic value estimates. Assuming that dividends grow perpetually at a constant rate, the stock price may be written as:

\[ P = D_0 (1 + g) / (r - g) \]  

(4)

Where:

\( D_1 = D_0 (1 + g) \) = next period’s expected dividend

\( r \) = rate of return required by the investor

\( g \) = rate of growth of dividends

Proposed by Gordon (1959), the formula is known as Constant Growth Discounted Dividend Model, that allows us to extract the stock’s required rate of return \( r \) from a security traded at its intrinsic value as:

\[ r = (D_1/P) + g = \text{dividend yield} + \text{expected dividend (and earnings) growth} \]

Fama and French (2002) favor the use of dividend and expected growth fundamentals in the estimation of expected returns, as opposed to the use of average historical returns as a proxy for expected returns, adding that the standard deviation of expected market risk
premiums obtained with the Discounted Dividend Model is less than half the standard deviation resulting from the use of historical returns.

Elton (1999) claims that the use of historical returns as a proxy for expected returns is based on the belief that informational surprises that are capable of altering expectations would tend to cancel each other over time and, therefore, average historical returns would be an unbiased estimate of expected returns. However, he shows that, with the possibility of large and persistent surprises, an inertial effect may result. Their cumulative effect could be sufficiently large to invalidate the use of historical returns as proxies for expected returns.

According to Keck et al. (1998), global market integration implies that investors, be they local or international, should use Global CAPM to estimate the cost of equity. For those investors in relatively segmented markets, however, the use of Local CAPM would be justified.

However, even professionals that adopt the Sharpe-Lintner-Mossin version of the CAPM differ in their approach when dealing with overseas investments.

In a survey involving 2,700 University of Chicago students, Keck et al. (1998) indicate that increasing market uncertainty and complexity appear to led investors to resort to heuristic procedures when valuing their investments, such as, for example, the choice of discount rate estimation method as a function of their perception how integrated the market is.

Contrasting with one of the central results of the CAPM, that beta is sufficient for pricing an asset’s risks, most survey respondents said that they used multifactor models, adding political, credit and currency exchange risk premiums to the discount rate. The uncertainty associated with a perception of less than complete market integration, in certain instances, also led to the use of international (e.g., the S&P500) market proxies, to the detriment of local market indexes.

The results in Sanvicente (2014), as in Keck et al. (1998) and Harvey (2005), are evidence of the use of heuristic procedures when there is greater uncertainty and complexity involving the emerging market invested in.

3. Methodology

The present paper initially determines the level of integration of the Brazilian market in the 2004-2014 period, with the help of the Keck et al. (1998) methodology.
Subsequently, the paper tests the Goldman Sachs model in terms of its prediction of how expected returns are determined. Both the full period (2004-2014) and two five-year sub-periods (2004-2008 and 2009-2014) are considered. Finally, the paper tests a multifactor model by adding to the Goldman Sachs model factors a size premium, as in Fama and French (1992).

Elton et al. (2006) state that, even though there exist methods to test the CAPM and other expected return models empirically, more robust tests involve a two-stage procedure. In the first stage, time series regressions are used for estimating betas for the various risk factors contemplated; the second stage consists in using such estimated betas as predictors in cross section regressions.

Therefore, in accordance with Harris et al. (2003) and Elton et al. (2006), the paper first calculates betas for the risk factors considered, and then regresses expected returns against the first-stage betas.

Expected returns, as in Fama and French (2002), Sanvicente and Minardi (1999) and Harris et al. (2003), are computed with the Discounted Dividend Model.

The test proposed by Keck et al. (1998) identifies the incremental risk, interpreted as a proxy for market integration, on the basis of the regression betas in two distinct scenarios: in the first scenario, it is assumed that a particular firm is located in an integrated market, and in the second one used the market in which it is in fact located (Brazil, in this case).

The proxy chosen for an integrated market was the United States, and the market portfolio was represented by the S&P 500. For Brazil, the market proxy was the IBrX 100 index.

Finally, for a global market portfolio, the proxy used was the MSCI World Index.

Given the sample selection procedure for each year, betas were first estimated, with historical excess returns over a 60-month period, provided at least 36 months were available. Thus, two betas are calculated for each firm: one for the integrated market (US), and the other for the Brazilian market.

The incremental risk measure \( (b_a) \), proposed by Keck et al. (1998), was assessed for each sample year and for the full 2004-2014 period, resulting in annual and full-period averages. For each of those results a one-tail test of the null hypothesis of a zero mean was performed, against the alternative hypothesis that the incremental risk measure is positive, indicating less than full integration of the Brazilian market.
As for testing the Goldman Sachs model, initially stocks’ excess returns were regressed against S&P 500 excess returns and the EMBI+ Brazil series to obtain estimates for betas according to the Goldman Sachs model, for each year. Each regression used the previous 60 months of data, when available. Subsequently, the estimated betas were used as explanatory variables in panel data regressions. Since data were not available for all sample firms in every year, an unbalanced panel was used.¹ The analysis was performed for three periods: 2004-2014 (the full sample period), 2004-2008, 2009-2014, in an attempt to determine the impact of the 2008-2009 financial crisis on the relevance of the Goldman Sachs model.

Panel data estimation was chosen in order to account for the possibility of correlation between regressors and the error term. Even though the Hausman test did not reject the random effects model as a null hypothesis, the fixed effects model was used. Rejection of the null hypothesis in the Hausman test indicates that the main assumption of the random effects model, that is, that the unobserved effect is not correlated with the explanatory variables is not true. This means that the fixed effects estimator should be used. However, even when the Hausman test fails to reject the null hypothesis, it is possible to use the fixed effects model. In this case, the estimator is consistent, but it is less efficient than the random effects estimator.

Furthermore, the paper tested the significance of a multifactor model that comprises both the country risk premium factor (as in the Goldman Sachs Model), and the size premium factor, as in Fama and French (1992). For the analysis of the size premium, the small minus big factor (SMB) provided by Nefin Center at the Department of Economics, University of São Paulo, was used. The SMB factor is the return of a portfolio long on stocks with low market cap (small) and short on stocks with high market cap (big). Every January of each year, the eligible stocks are sorted according to their previous December market cap, and separated into 3 quantiles. The SMB factor is the return of the small stock portfolio minus the return of the big stock portfolio. These premiums were used, as the country risk premium, in a time series regression. Stocks’ excess returns were regressed against S&P 500 excess returns, the EMBI+ Brazil series and SMB factor to obtain estimates for betas for each year. Subsequently, the estimated betas were used as explanatory variables in panel data regressions.

¹ Since the sample size in each year was not large enough, individual stock betas were used, and not portfolios, as was the case in Harris et al. (2003). According to Claessens et al. (1995), the use of panel data and estimation with the fixed effects model, because the data are centered are around their means, tends to attenuate the estimation bias caused by the use of individual stocks.
4. Data and data sources

In the present paper, the following data are used:

a) Monthly log returns of all stocks included in the IBrX 100 index\(^2\), from December 1999 to December 2014.

b) Annual dividends, in US dollars, as well as return on equity and payout ratios for all stocks included in the IBrX100 index, for the 2004-2014 period, as required by the calculation of expected returns according to the Dividend Discount Model.

c) Monthly yields to maturity of 10-year US Treasury Bonds, as a proxy for the risk free rate faced by international investors in emerging markets, as in Harris et al. (2003).

d) Monthly values of EMBI+ Brazil, a measure of the country’s default risk on its sovereign debt, and the commonly used instrument for country risk.


f) Monthly returns on the MSCI World Index, as a proxy for the global market portfolio, also for the period from December 1999 to December 2014.

g) Monthly returns on the IBrX 100, as a proxy for the local market portfolio, used in the market integration tests, and also from December 1999 to December 2014.

h) Small minus big factor (SMB) provided by Nefin Center at the Department of Economics, University of São Paulo, for each year.

Stock prices were collected in the Economática database, converted into US dollars and adjusted for dividends and stock splits. Annualized dividends, as well as values for return on equity and payout ratios were obtained in the IQ Capital Markets database. Yields to maturity for 10-year US Treasury Bonds and the historical series for the S&P500, MSCI World, EMBI+ Brazil and the IBrX 100 indexes were provided by Bloomberg.

\(^2\) This is a capitalization-weighted index computed by the BM&FBovespa for the Brazilian market. It includes the 100 securities with the largest share of trading volume in the preceding 12 months. The capitalization weights are based on the securities’ free float.
The list of stocks considered in each year was defined according to the composition of IBrX 100 portfolio as of January of each year. The portfolio is rebalanced once a year as a function of each stock’s liquidity and the market value of its free float.

The choice of the IBrX 100 index, instead of the Ibovespa, was based on the fact that in the former, market capitalization is used as a source of stock weights in the portfolio, instead of its share in total trading volume.

The initial sample was adjusted for the following criteria:

a) Firms for which dividend, return on equity or payout ratio data were not available in a given year, were excluded from that year’s sample data.

b) Stocks without complete 12-month price series for a particular year were excluded from that year’s sample data.

c) Stocks with less than 36 months of historical price series were ignored, since beta estimation required the use of at least 36 months of price data.

d) Only the most actively traded security for a given firm was used, when at least two security classes for the firm were contained in the index portfolio.

The effect was the reduction to the use of data for 57 firms, on average, over the 11-year period. The total number of observations was 628 firm-years.

5. Results

5.1. Incremental risk

Using the methodology described in Keck et al. (1998), incremental risk was calculated for each sample firm in each year. It should be recalled that incremental risk was estimated by the difference between the betas calculated for each sample firm, in two different markets: the US, integrated market, and the Brazilian market, for which the degree of integration is being assessed. The averages of the incremental risk measure were calculated across firms for each sample year and for the full period. The corresponding descriptive statistics are presented in Table 2 for the full 11-year period.
Table 2: Descriptive statistics: incremental risk (2004-2014).

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Value</th>
</tr>
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<tbody>
<tr>
<td>Average</td>
<td>-0.05</td>
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<tr>
<td>Standard error</td>
<td>0.04</td>
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<tr>
<td>Median</td>
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<td>Standard deviation</td>
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<td>Minimum</td>
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<td>Maximum</td>
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<tr>
<td>Number of observations</td>
<td>628</td>
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</tbody>
</table>

Table 3 displays the sample averages obtained for incremental risk in each of the sample years, as well as the results of t-tests for the null hypothesis of full integration (incremental risk measure equal to zero, against the alternative of partial integration, under which the risk measure would be positive). This one-tail test is done at the 5% level, for which the critical t-value is approximately equal to 1.67.

Table 3: Test of integration with annual incremental risk measures, 2004-2014.

<table>
<thead>
<tr>
<th>Period</th>
<th>Average incremental risk</th>
<th>Degrees of freedom</th>
<th>t-statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004-2014</td>
<td>-0.05</td>
<td>627</td>
<td>-1.02</td>
</tr>
<tr>
<td>2004</td>
<td>-0.07</td>
<td>46</td>
<td>-1.62</td>
</tr>
<tr>
<td>2005</td>
<td>0.06</td>
<td>52</td>
<td>2.43</td>
</tr>
<tr>
<td>2006</td>
<td>-0.15</td>
<td>54</td>
<td>-0.80</td>
</tr>
<tr>
<td>Year</td>
<td>Value 1</td>
<td>Value 2</td>
<td>Value 3</td>
</tr>
<tr>
<td>------</td>
<td>---------</td>
<td>---------</td>
<td>---------</td>
</tr>
<tr>
<td>2007</td>
<td>-0.13</td>
<td>54</td>
<td>-0.60</td>
</tr>
<tr>
<td>2008</td>
<td>0.25</td>
<td>56</td>
<td>4.98</td>
</tr>
<tr>
<td>2009</td>
<td>0.10</td>
<td>50</td>
<td>4.30</td>
</tr>
<tr>
<td>2010</td>
<td>-0.01</td>
<td>56</td>
<td>-0.48</td>
</tr>
<tr>
<td>2011</td>
<td>-0.03</td>
<td>59</td>
<td>-0.95</td>
</tr>
<tr>
<td>2012</td>
<td>-0.05</td>
<td>60</td>
<td>-1.13</td>
</tr>
<tr>
<td>2013</td>
<td>-0.24</td>
<td>58</td>
<td>-4.32</td>
</tr>
<tr>
<td>2014</td>
<td>-0.20</td>
<td>73</td>
<td>-4.10</td>
</tr>
</tbody>
</table>

The results indicate that, for the full period, there is no evidence for rejecting the null hypothesis of full integration. When examined on an annual basis, it is observed that the same result is obtained for 8 of the 11 years, with rejection clearly occurring in the 2008-2009 period encompassing the financial crisis.

5.2. Goldman Sachs model

For testing purposes, the following specification was used:

\[ R_{it} = \gamma_0 + \gamma_1 \beta_{1it} + \gamma_2 \beta_{2it} + \gamma_3 \beta_{3it} + \eta_{it} \]  \hspace{1cm} (5)

Where:

- \( R_{it} \) = excess expected returns for stock i in year t.
- \( \beta_{1it} \) = estimated beta for market risk, for stock i in year t, by multiple regression of past observed excess returns against excess returns on the market index (the S&P 500) and the country risk indicator (EMBI+ Brazil).
- \( \beta_{2it} \) = estimated beta for country risk, for stock i in year t, resulting from the same multiple regression with the stock’s excess expected returns, the excess returns on the proxy for the market portfolio (the S&P 500), and the country risk index.

The necessary calculation of expected returns for individual stock using the Discounted Dividend Model, which are used as the dependent variable in regression equation (5), generated the following results over the 2004-2014 period.
Figure 1: Average stock expected returns in the Brazilian market, 2004-2014.

Figure 1 indicates that, over the period, there was a reduction in the average cost of equity in the Brazilian market, with the exception of a slight increase in 2008, as would be expected as a reflection of the financial crisis. As was pointed out in the review of literature, a reduction in cost of equity, equivalent to an increase in security prices, accompanies an increase in a particular market’s integration into the world market.

The Goldman Sachs model will be validated if (a) we cannot reject the null hypothesis that $\gamma_0$ is equal to zero; (b) we reject the null hypotheses that $\gamma_1$ and $\gamma_2$ are equal to zero, against the alternative that they are positive. In particular, we are interested in the significance of the country risk premium (positive $\gamma_2$), since this is how the Goldman Sachs model differs from both Global and Local CAPM. Table 4 summarizes the hypotheses involved in our tests.

### Table 4: Hypotheses being tested.

<table>
<thead>
<tr>
<th>Hypotheses</th>
<th>t test</th>
<th>F test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Null</td>
<td>$H_0$: $\gamma_1 = 0; \gamma_2 = 0$</td>
<td>$H_0$: $\gamma_1$ and $\gamma_2 = 0$</td>
</tr>
<tr>
<td>Alternative</td>
<td>$H_1$: $\gamma_1 &gt; 0; \gamma_2 &gt; 0$</td>
<td>$H_1$: $H_0$ is not true</td>
</tr>
</tbody>
</table>

5.2.1. Results for the full period (2004-2014)

Although the Hausman test did not lead to the rejection of the null hypothesis that the random effects model would be appropriate (chi-square = 2.8196, p-value = 0.4026), equation (5) was estimated with the fixed effects model. According to Wooldridge
(2008), the assumption that unobserved effects are uncorrelated with the explanatory variables is an exception to the rule, and for this reason the fixed effects model is widely used. In addition, for time-varying explanatory variables, the random effects model is recommended only when the sample is randomly selected. This is not the case in the present paper, in which, for every year, the stocks selected were those included in the IBrX 100 index. Still, even when the Hausman test does not reject the null hypothesis, the fixed effects estimator is still consistent. Robust standard errors were used, and Table 5 presents the results for the full period.

Table 5: Panel data regression with fixed effects, 2004-2014. Dependent variable: individual expected stock returns (t statistics in parentheses).

<table>
<thead>
<tr>
<th>$\gamma_0$</th>
<th>$\gamma_1$</th>
<th>$\gamma_2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0989</td>
<td>0.0175</td>
<td>-0.0002</td>
</tr>
<tr>
<td>(5.184)</td>
<td>(1.814)</td>
<td>(-0.387)</td>
</tr>
</tbody>
</table>

$R^2 = 0.3811$

F-statistic = 2.3499

p (F statistic) = 0.0000

Total observations = 627

The results displayed in Table 5 indicate that: (a) the significant intercept suggests that additional factors may be required for explaining expected returns, or that the risk free rate is not adequately measured, as was the case in Fama and MacBeth (1973); (b) the hypothesis that market risk is relevant is not rejected, there being a positive market risk premium in expected returns; (c) the main contribution of the Goldman Sachs model, with the inclusion of a country risk premium, does not seem to be appropriate, since no significant premium was detected. As pointed out by Harvey (2005), in a fully integrated market, as the results of our tests on incremental risk seem to indicate is the Brazilian case, country risk premium would be irrelevant, since it could be diversified away.
5.2.2. Results for the 2004-2008 and 2009-2014 sub-periods

In an attempt to ascertain the impact of the 2008-2009 financial crisis, we analyze our data for two 5-year sub-periods, before and during the financial crisis versus after the crisis. Table 6 displays the results obtained for the two sub-periods.


a) 2004-2008

<table>
<thead>
<tr>
<th>$\gamma_0$</th>
<th>$\gamma_1$</th>
<th>$\gamma_2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1714</td>
<td>-0.0018</td>
<td>-0.0012</td>
</tr>
<tr>
<td>(9.773)</td>
<td>(-0.234)</td>
<td>(-1.217)</td>
</tr>
</tbody>
</table>

$R^2 = 0.5417$
F-statistic = 2.6701
$p$ (F statistic) = 0.0000
Total observations = 265

b) 2009-2014

<table>
<thead>
<tr>
<th>$\gamma_0$</th>
<th>$\gamma_1$</th>
<th>$\gamma_2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0204</td>
<td>0.0566</td>
<td>-0.0020</td>
</tr>
<tr>
<td>(1.150)</td>
<td>(5.368)</td>
<td>(-2.847)</td>
</tr>
</tbody>
</table>

$R^2 = 0.5524$
F-statistic = 3.1342
$p$ (F statistic) = 0.0000
Total observations = 362

The sub-period results show that the support for rejecting the null of no market risk premium is basically found in the 2009-2014 period. The results for the relevance of a country risk premium, if anything, are even more unfavorable in the latter period.
5.3. Including the size premium in a multifactor model

For testing purposes, the following specification was used:

\[ R_{it} = \gamma_0 + \gamma_1 \beta_{1it} + \gamma_2 \beta_{2it} + \gamma_3 \beta_{3it} + \eta_{it} \]  

(6)

Where:

\( R_{it} \) = excess expected returns for stock i in year t.
\( \beta_{1it} \) = estimated beta for market risk, for stock i in year t, by multiple regression of past observed excess returns against excess returns on the market index (the S&P 500), the country risk indicator (EMBI+ Brazil) and the size premium.
\( \beta_{2it} \) = estimated beta for country risk, for stock i in year t, resulting from the same multiple regression with the stock’s excess expected returns, the excess returns on the proxy for the market portfolio (the S&P 500), the country risk index and the size premium.
\( \beta_{3it} \) = estimated beta for size risk, for stock i in year t, resulting from the multiple regression with the stock’s excess expected returns, the excess returns on the proxy for the market portfolio (the S&P 500), the country risk index and the size premium.

The necessary calculation of expected returns for individual stock using the Discounted Dividend Model, which are used as the dependent variable in regression equation (6), generated the following results over the 2004-2014 period.

The multifactor model will be validated if (a) we cannot reject the null hypothesis that \( \gamma_0 \) is equal to zero; (b) we reject the null hypotheses that \( \gamma_1, \gamma_2 \) and \( \gamma_3 \) are equal to zero, against the alternative that they are positive. Table 7 summarizes the hypotheses involved in our tests.

Table 7: Hypotheses being tested.

<table>
<thead>
<tr>
<th>Hypotheses</th>
<th>t test</th>
<th>F test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Null</td>
<td>( H_0: \gamma_1 = 0; \gamma_2 = 0; \gamma_3 = 0 )</td>
<td>( H_0: \gamma_1, \gamma_2 ) and ( \gamma_3 = 0 )</td>
</tr>
<tr>
<td>Alternative</td>
<td>( H_1: \gamma_1 &gt; 0; \gamma_2 &gt; 0; \gamma_3 &lt; 0 )</td>
<td>( H_1: H_0 ) is not true</td>
</tr>
</tbody>
</table>

5.2.1. Results for the full period (2004-2014)
Although the Hausman test did not lead to the rejection of the null hypothesis that the random effects model would be appropriate (chi-square = 1,174, p-value = 0.5557), equation (6) was estimated with the fixed effects model. Robust standard errors were used, and Table 8 presents the results for the full period.

Table 8: Panel data regression with fixed effects, 2004-2014 Dependent variable:

<table>
<thead>
<tr>
<th>$\gamma_0$</th>
<th>$\gamma_1$</th>
<th>$\gamma_2$</th>
<th>$\gamma_3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0,1168</td>
<td>0,0138</td>
<td>-0,0002</td>
<td>-0,0050</td>
</tr>
<tr>
<td>(8,463)</td>
<td>(1,865)</td>
<td>(-0,392)</td>
<td>(-2,468)</td>
</tr>
</tbody>
</table>

$R^2 = 0,3990$
F-statistic = 2,5133
p (F statistic) = 0,0000
Total observations = 628

The results displayed in Table 8 indicate that: (a) the significant intercept suggests that additional factors may be required for explaining expected returns, or that the risk free rate is not adequately measured, as was the case in Fama and MacBeth (1973); (b) the hypothesis that market risk is relevant is not rejected, there being a positive market risk premium in expected returns; (c) the main contribution of the Goldman Sachs model, with the inclusion of a country risk premium, does not seem to be appropriate, since no significant premium was detected. As pointed out by Harvey (2005), in a fully integrated market, as the results of our tests on incremental risk seem to indicate is the Brazilian case, country risk premium would be irrelevant, since it could be diversified away; (d) the hypothesis that size premium is relevant is not rejected, indicating a negative and significant relationship between the companies’ size and the expected return, as was the case in Fama and French (1992).

6. Conclusion

This paper is concerned with determining the appropriateness of the widely used Goldman Sachs model for the setting of cost of equity in the Brazilian market. Since the model is predicated on the assumption that such a market is not fully integrated to the
world market, it includes a premium for country risk. That type of risk would be diversifiable, hence, not priced, if the market were fully integrated.

Besides testing the model’s implication that the country risk premium is positive and significant, in addition to a premium for market risk proxied by an international index, to reflect how the model is used in practice, the paper tests the significance of a direct measure of market integration, as developed by Keck et al. (1998).

In contrast with previous attempts at testing some version of the CAPM, such as Fama and French (1992), this paper uses expected excess returns implicit in current stock market prices, following Harris et al. (2003).

Both analyses, using annual data for more than 50 firms in the Brazilian market over the 2004-2014 period, lead to negative conclusions regarding the relevance of the Goldman Sachs model. If anything, the results point to the validity of using the S&P 500 index as a proxy for market risk in integrated markets. The results also indicate that the estimated intercept in our version of a two-factor model is positive and significant, suggesting the need for including other risk factors – possibly those empirically determined by Fama and French (1992) – for Brazilian stocks, an avenue for future study. By the inclusion of a third factor (size premium), as in Fama and French (1992), the significance of the model was also tested, indicating that size premium has a negative and significant relationship with expected returns, albeit not implying the validity of the multifactor model (intercept continues positive and significant and country risk premium is not statistically significant).

Finally, competing explanations, such as Global CAPM and Local CAPM could also be considered. Since both the S&P500 and the local market index (Ibovespa) are highly correlated with the MSCI World Index, it is likely that both would be appropriate predictors of expected Brazilian stock returns. It is at least clear that the Brazilian market is sufficiently integrated in order to render the use of the Goldman Sachs invalid.

7. References


