# International Diversification for Brazilian Investors through Domestic Assets

## Diversificação Internacional para Investidores Brasileiros por meio de Ativos Domésticos

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## RESUMO

O objetivo deste trabalho é o de analisar os benefícios da diversificação internacional por meio de ativos domésticos para investidores brasileiros. A amostra contou com três tipos de ativos: os *Brazilian Depositary Receipts* (BDR), os fundos de investimento brasileiros com investimentos no exterior e as ações do mercado brasileiro. Foram elaborados portfólios com dez combinações diferentes para esses ativos. Para a análise dos dados, foram usados coeficientes de correlação e medidas para retorno ajustado ao risco e à volatilidade. Os resultados indicaram que os portfólios compostos, principalmente, por BDR foram os que apresentaram menor correlação com o mercado brasileiro e maior índice de Sharpe. Os portfólios com menor volatilidade foram aqueles, majoritariamente, compostos por fundos de investimentos. Este trabalho contribui para a literatura ao estudar possíveis benefícios da diversificação internacional, a partir da perspectiva de investidores, em um país emergente, uma vez que estudos sobre esse tema, geralmente, envolvem apenas investidores domésticos de países desenvolvidos, especialmente dos Estados Unidos.

**Palavras-chave:** diversificação internacional; ativos domésticos; BDR; fundos; ações.

## ABSTRACT

*We develop this study in order to analyze the benefits of international diversification through domestic assets for Brazilian investors. The sample contains three types of assets: Brazilian Depositary Receipts (BDRs), Brazilian investment funds that have part of their portfolios made up of investments in foreign companies and stocks listed on the Brazilian capital market. Additionally, portfolios with ten different combinations of these assets were elaborated. We analyzed the data using correlation coefficients, risk-adjusted return and volatility measures. The results indicated that portfolios mainly comprised of BDRs presented the lowest correlation with the Brazilian market index, as well as the highest Sharpe ratio. The portfolios with the lowest volatility in returns were those majoritarily linked toi nvestment*

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*funds. This study contributes to the literature by analyzing some possible benefits of international diversification from the perspective of investors in emerging countries, since studies on this subject usually involve domestic investors from developed markets, especially from the United States.*

**Keywords:** *international diversification, domestic assets, BDRs, funds, stocks.*

## 1  INTRODUCTION

Globalization and the opening up of different markets around the world have boosted multinational operations among countries and, consequently, intensified international investments. On this scenario, over the years, several studies, such as Dresden and Leaven (2007), Gupta and Donleavy (2009), You and Daigle (2010), Berger, Pukthuanthong and Yang (2011) and Sukumaran, Gupta and Jithendranathan (2015), have found data that international investments may benefit investors in terms of portfolio diversification.

Although the benefits of international diversification are recognized, their sources are not clearly identified. There are arguments that the benefits of international diversification come from the diversity of each country's economic policy, such as fiscal policy, monetary policy, interest rates, economic growth, among others. One of the ways to estimate the benefits of international diversification that has been usually employed is the correlation between the returns of foreign assets and the returns of a local index (Choi & Kim, 2000). For example, in the Brazilian context, a low correlation between the returns from foreign stock and returns from the Brazilian market index (Ibo Vespa) suggests a potential benefit from diversification.

Both market professionals and scholars have recommended diversification in foreign markets, because assets from different countries are exposed to different factors; consequently, these assets are expected to have a lower correlation than assets from the same market. Therefore, the total risk of a portfolio may decrease without necessarily reducing the expected return, due to the selection of international assets with a low correlation with other assets in the portfolio (Yuan, Gupta, & Roca, 2016).

However, even with the well-known benefits provided through international diversification, investors may neglect this type of investment because of the high transaction costs coming from investing in markets of certain countries (Thapa & Poshakwale, 2010). In addition, Chang, Eun and Kolodny (1995) argue that investors may also find difficulty to invest directly in certain foreign markets because of various barriers, such as capital market or exchange regulations, and excessive transaction and information costs. Suchobstacles have led intermediaries to organize domestic financial products related to foreign assets in order to facilitate international investments. Among these products, in the Brazilian context, the most prominent are Brazilian Depositary Receipts (BDRs) and investment funds, which also invest in foreign companies.

In this sense, from Brazilian investors' point of view, BDRs may be more attractive than direct investment in their underlying foreign stocks themselves, since they can be traded on the domestic market, similarly to stocks from Brazilian companies. Besides, BDRs provide greater convenience to investors: by acquiring them, the investor becomes a shareholder in the foreign company without dealing with the complexity of an international investment. Likewise, mutual funds that invest in foreign companies allow investors to access foreign

markets that would be hard to enter through other means, thus making international diversification feasible and practical.

In view of the arguments about the benefits of international diversification and the relevance of mechanisms that indirectly allow access to such investments, such as BDRs and mutual funds, this study aims to analyze the potential advantages of international diversification through domestic assets for Brazilian investors. In order to meet this general objective, the following specific objectives are enumerated: i) analyze the correlation between returns from different assets (BDRs, funds and stocks) and the Ibovespa returns; ii) develop portfolios with different combinations of assets and verify their correlation with Ibovespa ; iii) verify the volatility and risk-adjusted return of the elaborated portfolios; iv) make comparisons between the different assets and portfolios.

Our empirical model considers portfolios comprised of different assets (Brazilian stocks, quotas from investment funds and BDRs). We collected data in the period from January 2014 to December 2015 and created portfolios with 15 assets from the three categories mentioned. The main results indicated that the inclusion of BDRs and quotas of investment funds, invested in foreign companies could reduce the volatility of Brazilian investors' portfolios. Furthermore, these assets can improve the risk-adjusted returns from portfolios.

Through this study, we expect to present three contributions. First, by studying some possible benefits of international diversification from the perspective of investors in an emerging country, we can indicate some pathways to reach diversification with relatively low transaction costs. Usually, studies on this subject involve domestic investors from developed markets, especially from the United States. Furthermore, Jiang, Ma and An (2013) affirm that there is a gap in studies on this subject regarding perspectives of investors from emerging countries on international diversification, since their economies are not as diversified as those of developed ones. Besides, emerging markets are relatively immature, with less financial products available. Second, this study also advances the literature by providing empirical evidence regarding the potential of BDRs for diversification purposes. Moreover, the results of this paper indicate another kind of asset that Brazilian investors can use to diversify without directly investing in foreign entities: mutual funds that hold stocks from foreign companies. Third, as the main contribution of this paper, we analyzed and highlighted the potential benefits that Brazilian investors can obtain by diversifying their portfolios given characteristics of returns different from those available on the local market, and still use local assets (BDRs and quotas from Investment Funds).

Given the need to identify the benefits of international diversification from the perspective of investors in emerging countries, studying the Brazilian market becomes relevant. According to Leal, Silva and Austin (2000), Brazil is the most important emerging market in Latin America and one of the largest emerging markets in the world. In addition, the Brazilian market is an interesting case to be studied because, according to Brière and Signori (2013), Brazil is a large nation with well-developed financial markets and prominent institutional investors, such as pension funds, insurance companies and mutual funds.

The remainder of the paper is organised as follows. Section 2 describes the literature review and it starts with international portfolio diversification; then we present the studies that address international diversification through domestic assets. Section 3 discloses the data, sample period, criteria to create the portfolios and to analyze the potential benefits of international diversification considering domestic assets. The results are available in section 4, and in section 5 we present the discussion/comparison with previous research. In the sixth section, we present the conclusions, recommendation for further research and main limitations.

## 2  LITERATURE REVIEW

### 2.1 International Portfolio Diversification

To estimate the benefits of investing in foreign stocks achieved by individual investors from the United States, Bailey *et al.* (2008) compared the performance of internationally diversified portfolios with those of investors who only held domestic stocks, using different measures of performance, such as average monthly portfolio return, Sharpe ratio, three-factor model and portfolio volatility. The results indicated that the average monthly return of internationally diversified portfolios was similar to domestic ones, being 1.28% and 1.33%, respectively. However, a significant reduction in portfolio average volatility was verified at -0.892% from international investments. Therefore, from these two measures, the Sharpe ratio was higher for those investors who invest abroad.

Moreover, from the US investors' point of view, Hatemi-J and Roca (2006) examined international portfolio diversification involving US, UK and Japan markets during the period 1970-2000, using traditional portfolio analysis and causality and correlation tests through bootstrap technique. In general, the results indicated that diversifying internationally across these three markets provides increases in the risk-adjusted return.

In considering the Chinese investors' perspective, Jiang *et al.* (2013) examined the benefits of international diversification by maximizing the expected returns that could be achieved by Chinese investors through stock diversification on foreign markets to a given level of risk. The results indicated that Chinese investors may improve their returns by diversifying between international markets, so that this improvement comes mainly from investments on the Brazilian market. In addition, substantial gains, in terms of risk reduction, have been verified by diversifying on any of the international markets; these benefits are higher in investments in developed than in emerging markets.

Driessen and Laeven (2007) investigated, from a sample of 52 countries, whether foreign equities investment opportunities provide benefits to domestic investors who invest only in their respective local markets. Among the main results, they observed substantial benefits from international diversification to domestic investors from both developed and emerging countries, but the benefits of international portfolio diversification were higher for emerging countries than for developed ones. The country risk was a good determinant of the benefits of diversification, so the countries with higher levels of risk presented higher benefits in terms of international diversification.

In a similar study, Chiou (2008) investigated the benefits of international diversification to domestic investors in 34 countries (21 developed and 13 emerging). Among the main results, the author found empirical evidence that investors from emerging countries, particularly from East Asia and Latin America, benefit more than those in developed countries from international diversification in terms of risk-adjusted return. In addition, the inclusion of securities from European or Latin American countries generally led to the largest increase in premiums and the insertion of North American or European assets proved to reduce portfolio risks for investors in other countries.

Despite the benefits of international diversification, as reflected in the literature, Didia (2015) affirms that there are certain complications involved in this process, such as problems with foreign exchange operations, difficulty in collecting dividends, difficulty in transferring certificates of ownership of foreign securities, high transaction costs and the strong influence of institutional, political and economic factors. To eliminate much of these problems,

investors may choose to invest in domestic assets that are related to foreign assets. Therefore, the next subsection of this paper highlights studies that investigated some possible benefits of international diversification through investments in domestic assets.

## 2.2 International Diversification through Domestic Assets

In view of the complications involved in the process of investing directly in foreign assets, such as problems with foreign exchange operations, difficulty in collecting dividends, difficulty in transferring foreign securities certificates of ownership, high transaction costs and strong influence of institutional, political and economic factors, investors may choose to invest in domestic assets that are in some ways related to foreign assets, for example, the American Depositary Receipts (ADRs) for US investors or, in the case of Brazilian investors, the Brazilian Depositary Receipts (BDRs). The practical advantage of these investments compared to other forms of international diversification lies in the fact that they are an alternative for domestic investors who aim to achieve the benefits of international diversification without facing the complexity of and problems involved in direct foreign investments (Didia, 2015).

Errunza *et al*. (1999) investigated the ability of investors to mimic returns from foreign market indices (nine indices from emerging and seven from developed markets) through domestically traded securities on US market, in order to verify the possibility to obtain benefits of international diversification without necessarily investing directly on foreign assets. To do so, diversified portfolios were considered based on industrial indices, multinational companies stocks, ADRs and country funds during the period from 1976 to 1993. Among the results, the authors observed that the increasing availability of domestic assets on the US market, which represent foreign assets, decreases the benefits of holding foreign assets, since data indicated no difference, in terms of international diversification, between domestic assets in 11 of the 16 foreign markets analyzed.

Arnold *et al.* (2004) found that adding ADRs to a domestic portfolio on the US market extends diversification. From a sample of 85 ADRs from developed and emerging countries traded between 1990 and 1999, they found that the addition of ADRs from developed markets to the portfolio provides better performance than emerging market ADRs, although the latter's ADRs showed less correlation and, consequently, higher diversification benefits for US investors.

In a similar study, Kabir *et al.* (2011) analyzed ADRs from 23 different countries, among Latin America, Asia and developed markets, with a sample divided into three periods, 1981 to 1990, 1991 to 2000 and 2001 to 2007. The aim was to verify if US investors could achieve the benefits of international diversification, through ADRs, rather than investing directly in foreign market indices. Among the results, in general, the ADRs may be a substitute for foreign markets indices, but the gains from diversification vary according to the country and the time horizon. Higher diversification gains were achieved over longer periods of more than four months for ADRs from France, Italy, Spain, Germany, Ireland, Switzerland and Brazil. The ADRs from Australia, Japan, Netherlands, Sweden, United Kingdom, New Zealand, Mexico and Chile indicated benefits for US investors overa shorter term.

Besides Depositary Receipts, the benefits of international diversification without direct investment in foreign assets may be obtained through investment funds. Chang *et al.* (1995) highlight country funds which, according to these authors, are considered as one of the most popular forms of international investment in the United States, since these funds are listed on the US market exchanges so that investors can trade them as well as any other securities.

Based on a sample of investment funds, eight from developed markets and fifteen from emerging markets, considering data from 1993 to 2002, Charitou *et al.* (2006) found evidence that these internationally exposed investment funds proved to be able to mimic the corresponding foreign market indices and to be more influenced by their respective foreign markets than the US market, which was taken as the domestic market in the study. Therefore, these results suggest that US investors that invest in these funds may benefit from international diversification without necessarily having to invest directly in foreign market indices. The advantages and benefits of international diversification by using investment funds were also explored in the study from Chang *et al.* (1995).

Considering the content available in the literature review of this paper, Table 1 summarizes some previous studies that addressed the benefits of international portfolio diversification.

**Table 1 -** Summary of previous studies

| Authors | Domestic Market | Results |
|---|---|---|
| Bailey, Kumar and Ng (2008) | United States | Similar monthly average return between portfolios with foreign assets and domestic assets. Lower volatility for portfolios with foreign assets. |
| Hatemi-J and Roca (2006) | United States | Diversifying by US, UK and Japan assets increases the portfolios' risk-adjusted return. |
| Jiang *et al.* (2013) | China | Better returns and lower levels of risk when investing in foreign assets. |
| Driessen and Laeven (2007) | Several countries | Evidence of benefits from international diversification for domestic investors in both developed and emerging countries. |
| Chiou (2008) | Several countries | Evidence of benefits from international diversification for domestic investors in both developed and emerging countries. However, emerging market investors benefit more than those investors from developed countries in terms of portfolio diversification. |
| Errunza, Hogan and Hung (1999) | United States | Assets traded on the US market related to foreign assets have equivalent benefits from investing directly in foreign assets. |
| Arnold, Nail and Nixon (2004) | United States | Adding ADRs to a domestic portfolio extends diversification. |
| Kabir, Hassan and Maroney (2011) | United States | ADRs may be substituted through direct investment in foreign market indices, although the benefits of diversification vary according to country and time horizon. |
| Chang, Eun and Kolodny (1995) | United States | Country funds opened both to factors inherent to the US market and to the markets of their underlying foreign assets, hint at benefits of international diversification for US investors. |
| Charitou, Makris and Nishiotis (2006) | United States | Investment funds with international exposure proved to be able to mimic their corresponding foreign market indices. They are also influenced by their respective foreign markets than by the US market itself. |

Notes: This table presents some previous studies that addressed international portfolio diversification benefits.

Given the literature review, as well as the content summarized in Table 1, we argue that, in general, the benefits of international diversification can be obtained through investments in domestic assets that are related to foreign markets. In the case of this study, these assets are BDRs and investment funds that invest in foreign companies.We consider this content to develop the main hypothesis of this study: H1 –international diversification through domestic assets reduces volatility and improves the risk-adjusted returns of portfolios of Brazilian investors.

## 3  METHODOLOGY

The aim of this paper is to analyze the potential benefits of international diversification through domestic assets for Brazilian investors. To do so, we construct different portfolios based on a combination of three kinds of assets available on the Brazilian market:

i) Brazilian Depositary Receipts (BDRs);

ii) Brazilian investment funds (mutual funds and multimarket funds) that hold foreign companies in their portfolios; and

iii) stocks of Brazilian companies, used for comparison purposes during the composition of the portfolios.

Therefore, in this study, BDRs and investment funds represent domestic assets that, in some way, are related to international markets. We selected these two modalities based on previous research, such as the studies of Errunza *et al.* (1999), Arnold *et al.* (2004) and Kabir *et al.* (2011) about the Depositary Receipts, and Chang *et al.* (1995), Errunza *et al.* (1999) and Charitou *et al.* (2006) about investment funds. We collect data about these assets using Economatica and the Information System of ANBIMA (SI-ANBIMA) sources.

The period of analysis comprises the months from January 2014 to December 2015. We choose this period exclusively due to the availability of data for monthly returns from each kind of asset (BDRs, investment funds and stocks). Data from investment funds and stocks are available for other periods, but data on BDRs are available (according to our search) since 2012. Nevertheless, up to the year 2014, we found that monthly returns from BDRs were sparse and not enough to develop quantitative analysis, due to many cases of missing values. The period ends on December 2015 because it was the month with the most recent data available when the research was started.

For this reason, all stocks in Brazilian companies listed on the Brazilian market with monthly return data available for the 24 months were included in the sample: 256 stocks. Likewise, all mutual funds and multimarket funds (multimarket funds are similar to international hedge funds) with complete data for the sample period were selected and included in the sample. Then, we kept in the sample study only investment funds with at least 25% of their portfolio invested in foreign assets on December 31 of 2015. This criterion resulted in 476 investment funds.

Regarding the BDRs of the sample, even for the 24-month period, only 4 BDRs presented complete monthly returns. In this way, we selected the 31 BDRs with data for at least 18 of the 24 months, since there were missing values in some months. To solve this problem of missing data in some months, first, we calculate the average return by month, of these 31 BDRs in the sample. Then, we replaced each missing value of a given BDR in a given month by the respective average retun of the respective month. It should be emphasized that the correlation between the returns of each BDR and the monthly average return of the 31 BDRs in the sample was strong and statistically significant, showing that the use of the average monthly return represented a good alternative to replace the missing values of the

BDRs sample. Therefore, the final sample contains 31 BDRs, all linked toUS assets. In Table 2, we summarize the information on the assets in the sample for this study.

**Table 2 -** Assets in the sample, period of analysis and source of monthly returns

| Asset | Sample Period | # Assets | # Observations | Database (source) |
|---|---|---|---|---|
| Stocks | Jan./2014 to Dec./2015 | 256 | 6,144 | Economatica |
| BDRs | Jan./2014 to Dec./2015 | 31 | 744 | Economatica |
| Investment Funds | Jan./2014 to Dec./2015 | 476 | 11,424 | SI-ANBIMA |
| **Total** | | **763** | 18,312 | |

As Table 2 discloses, the sample of the study is comprised of three kinds of assets: BDRs, Investment Funds and Stocks. Based on different combinations of these three kinds of assets, we created portolios (equally weighted, randomly selected) and estimate the volatility and performance of each portfolio.

All generated portfolios were made up of 15 assets in total, because studies about portfolio composition on the Brazilian market, such as Caldeira and Portugal (2010), Rubesam and Beltrame (2013) and Santiago and Leal (2014), suggested that the concentration of a small number of securities, usually ranging from 8 to 18 securities on average, is sufficient to minimize portfolio variance. According to Brito (1981), most diversification gains can be obtained with portfolios with very few assetsin a way that these gains are negligible for portfolios with more than 15 stocks.

Table 3 presents the portfolios generated, their respective assetcombinations and the amount of each portfolio. For example, the first line of Table 3 represents 1,000 porfolios, each one comprised of the monthly returns of 15 stocks randomly selected from the sample of 256 stocks. The second line of Table 3 represents 1,000 portfolios with monthly returns of 10 stocks randomly selected from the sample of 256 stocks and monthly returns of 5 BDRs randomly selected from the sample of 31 BDRs. The same reasoning was employed to create the other portfolios.

**Table 3 -** Composition of the portfolios generated and number of portfolios

| Portfolio compositions | Portfolios amount |
|---|---|
| 15 stocks | 1,000 |
| 10 stocks, 5 BDRs | 1,000 |
| 10 stocks, 5 funds | 1,000 |
| 15 BDRs | 1,000 |
| 10 BDRs, 5 funds | 1,000 |
| 10 BDRs, 5 stocks | 1,000 |
| 15 funds | 1,000 |
| 10 funds, 5 BDRs | 1,000 |
| 10 funds, 5 stocks | 1,000 |
| 5 stocks, 5 funds, 5 BDRs | 1,000 |
| **Total** | **10,000** |

Notes: This table presents the portfolio compositions and the amounts of each portfolio.

The analysis of the potential benefits of international diversification through domestic assets from the perspective of Brazilian investors was developed in two stages. Initially, the correlation coefficients for the monthly returns between each of the 763 assets of the sample (see Table 2) and the Bovespa Index (Ibovespa) were calculated; then, based on these results, descriptive statistics of the coefficients obtained were used for analysis, such as mean, standard deviation, maximum and minimum. In a second moment (based on the analysis of the portfolios presented in Table 3), the Sharpe ratio, the volatility and the correlation coefficient with the Ibovespa for each the 10,000 generated portfolios were calculated; then, based on these results, we generated the statistics for analysis.

For the calculation of the Sharpe ratio, which indicates the average excess return of the risk-free rate weighted by the volatility of returns, we considered as a proxy forthe risk-free rate, the SELIC rate, which represents the Brazilian economy's basic interest rate. According to Castro and Minardi (2009), even with the lower volatility provided by the savings account interest rate, it is believed that an investor who invests in mutual funds, for example,  has the same ease, knowledge and information when investing in assets that are related to the SELIC interest rate.

In this paper, to avoid the limitation of Sharpe ratios based on portfolios with negative risk-premium, we employed the procedure available in Israelsen (2005). In other words, when the risk-premim is positive, the Sharpe ratio calculation remains the same; when the risk-premium is negative, instead of a division of the risk-premium by volatility, we multiply the negative risk-premium by the volatility of the respective portfolio.

It is important to highlight some limitations in this study. Initially, due to the difficulty in data availability, a short sample period was considered (from January 2014 to December 2015), and incomplete series were used (only 4 of 31 BDRs presented complete data). In addition, all BDRs of the sample refer to U.S. assets, while we did not identify the foreign assets held by investment funds in the sample; therefore, the results should be interpreted with caution given the possibility of performance comparison between assets targeted solely at the U.S. market and assets targeted at other markets. Finally, Brazilian investment funds were also studied with at least 25% of their portfolio invested in foreign assets, so the results may have been sensitive to this criterion.

## 4  RESULTS

According to Yuan *et al.* (2016), asset diversification in foreign markets may reduce the total risk of a portfolio without decreasing the expected return. However, Thapa and Poshakwale (2010) affirm that, even with the well-known benefits provided by international diversification, investors may neglect this type of investment because of the high transaction costs and the market barriers from investing in other countries. In light of this, intermediaries organize domestic financial products related to assets abroad in order to facilitate international investment.

In this context, although transaction costs were not considered in this paper, this study aims to analyze the potential benefits of international diversification through domestic assets for Brazilian investors. The correlation coefficients of the monthly average return between each of the 763 assets of the sample and the Ibovespa, which is considered the main index of the Brazilian capital market, were calculated, since, according to Bailey et al. (2008), the benefits of diversification  in foreign assets result from the relatively low correlations between the securities returns in different countries.

Table 4 presents the descriptive statistics for these correlation coefficients, considering the values of the coefficients both in modulus and in real values (as the coefficients were observed), in order to verify the strength of the association between the returns.

**Table 4 -** Descriptive statistics for the correlation coefficients between the assets of the sample and Ibovespa

| Asset | Statistics | Mean | Standard Deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| Stocks | (corr. coeff. without transf.) | 0.363 | 0.266 | -0.334 | 0.957 |
| | (corr. coeff. in modulus) | 0.388 | 0.226 | 0.006 | 0.957 |
| BDRs | (corr. coeff. without transf.) | -0.107 | 0.174 | -0.443 | 0.278 |
| | (corr. coeff. in modulus) | 0.162 | 0.121 | 0.004 | 0.443 |
| Funds | (corr. coeff. without transf.) | 0.082 | 0.412 | -0.592 | 0.983 |
| | (corr. coeff. in modulus) | 0.333 | 0.256 | 0.003 | 0.983 |

Notes: This table presents the descriptive statistics (mean, standard deviation, minimum and maximum) for the correlation coefficients between each asset and the Ibovespa (the main Brazilian index for the stock market), segregated by class (Stocks, BDRs and Funds). We present the statistics considering the values of the coefficients in modulus, as well as their real values (without any transformation). For each asset in the sample, we calculate the correlation of its returns and the returns of Ibovespa. Then, by kind of asset, we calculate the descriptive statistics of the correlation coefficients obtained.

In order to verify the performance of portfolios with 10 different compositions of these assets and, consequently, to deepen the analysis, Table 5 presents the mean for volatility, Sharpe ratio and correlation of returns with Ibovespa for the portfolios elaborated.

**Table 5 -** Mean for volatility, Sharpe ratio and correlation with Ibovespa of the portfolios

| ID | Portfolio Composition | n | Mean Standard Deviation | Mean Sharpe Ratio (Israelsen, 2005) | Mean Sharpe Ratio (Traditional) | Mean Correl. with Ibovespa |
|---|---|---|---|---|---|---|
| 01 | 10 stocks, 5 BDRs | 1,000 | 4.614 | -4.404 | -0.212 | 0.523 |
| 02 | 10 stocks, 5 funds | 1,000 | 4.362 | -7.011 | -0.386 | 0.626 |
| 03 | 10 BDRs, 5 stocks | 1,000 | 4.425 | -0.072 | 0.125 | 0.190 |
| 04 | 10 BDRs, 5 funds | 1,000 | 3.952 | 0.343 | 0.343 | -0.086 |
| 05 | 10 funds, 5 stocks | 1,000 | 2.952 | -2.447 | -0.287 | 0.525 |
| 06 | 10 funds, 5 BDRs | 1,000 | 2.759 | 0.256 | 0.258 | -0.017 |
| 07 | 15 stocks | 1,000 | 5.753 | -14.367 | -0.452 | 0.686 |
| 08 | 15 BDRs | 1,000 | 5.254 | 0.390 | 0.390 | -0.132 |
| 09 | 15 funds | 1,000 | 1.707 | -0.084 | 0.012 | 0.170 |
| 10 | 5 stocks, 5 funds, 5 BDRs | 1,000 | 3.498 | -0.959 | -0.038 | 0.343 |

Notes: This table presents some information regarding the behavior of the 10,000 different portfolios considered in this study. First, we create a portfolio with 10 stocks (randomly selected in the sample of 256 stocks) and 5 BDRs (randomly selected in the sample of 31 BDRs); the second portfolio also considers 10 stocks (randomly selected) and 5 BDRs (randomly selected), and so on (in the case of the first line of Table 5). The same reasoning (with random selection) was applied in constructing the other 10 kinds of portfolios. In each portfolio, returns are equally weighted. The composition was made on January/2014 and the same assets are kept over the 24-month analysis of each portfolio. The traditional Sharpe ratio does not involve any adjustment. The Sharpe ratio based on the study of Israelsen (2005) considers an adjustment for portfolios with negative risk-premium.

According to Table 4, the correlation coefficients (considering values in modulus for these coefficients) between the different assets and the Ibovespa, on average, were lower for the BDRs (0.162), compared to stocks (0.388) and funds (0.333). These differences (0.162 x 0.388 and 0.162 x 0.333) are statistically significant at 1% (based on a t-test of mean

comparison; t=5.474 and t=3.677 respectively). These results suggest that the correlation between the returns of BDRs and the returns of Ibovespa were lower than the correlation obtained by stocks and quotas for investment funds. Therefore, it indicates some evidence about the benefits of BDRs in terms of international diversification, due to the low correlation (average= 0.162; min= 0.004; max=0.443) with the main Brazilian stock market index.

Table 4 also discloses that the correlation coefficients between the assets and the Ibovespa, on average, were also lower for the BDRs (-0.107) and for the funds (0.082) compared to the stocks (0.363). These differences (-0.107 x 0.363 and 0.082 x 0.363) are statistically significant at 1% (based on a t-test of mean comparison; t=9.585 and t=9.825 respectively). These results reinforce the evidence presented previously for the BDRs, suggesting the existence of international diversification benefits provided by these assets due to the inverse association (or the absence of association, in some cases) with Brazilian market returns. In addition, the returns of investment funds in the sample also indicate some favourable options for the purposes of diversification; therefore, we can expect some benefits by using quotas of investment funds for diversification in purposes portfolios comprised mainly of stocks from Brazilian companies.

## 5  DISCUSSION

There are some reasons for why BDRs provide greater benefits in terms of international diversification, in comparison with Brazilian investment funds that investin foreign companies. One of them is that, since the funds in the sample have at least 25% of their portfolio invested in foreign assets, their portfolio is also made up of domestic assets, which could be correlated with the Brazilian market index, while the BDRs represent foreign assets directly. In addition, this situation applies even for the funds with a high percentage of investments in foreign assets when these foreign assets present a higher correlation with Ibovespa.

It is also important to comment that the dispersion of the correlation coefficients was higher for the funds and stocks, with respective standard deviations of 0.256 and 0.226 in modulus values (Table 4) and 0.412 and 0.266 in real values (Table 4). On the other hand, the correlation coefficients between the BDRs and the Ibovespa showed a lower dispersion, with standard deviations of 0.121 in modulus values (Table 4) and 0.174 in real values (Table 4). This result can also be observed through analysis of the maximum / minimum values of the correlation coefficients of returns.

In Table 4, all the investment modalities in this study presented at least one asset with returns that have a weak correlation with the Ibovespa, considering the minimum values observed for the stocks (0.006), BDRs (0.004) and funds (0.003). Likewise, at least one asset in each investment modality presented a negative correlation with the Ibovespa, considering the minimum values observed for the stocks (-0.334), BDRs (-0.443) and funds (-0.592).

On the other hand, the maximum values indicated that for stocks (0.957) and for funds (0.983), there were assets with almost a perfect correlation with the Ibovespa, that is, the returns of these assets proved to follow the same trend as the returns of the main index for the Brazilian stock market. The maximum values observed by the BDRs, 0.443 (Table 4) and 0.278 (Table 4), were lower than those of stocks and funds, demonstrating once again the potential of these assets for international diversification.These results were consistent with the literature about international diversification benefits through Depositary Receipts (Errunza *et al.*, 1999; Choi & Kim, 2000; Arnold *et al.*, 2004; Wang & Yang, 2004; and Kabir *et al.*, 2011).

According to Table 5, regarding the correlation with the Ibovespa, the portfolios with the lowest correlation coefficients were those comprised of BDRs (Portfolio 8), with mean correlation coefficient of -0.132, followed by those that combine BDRs and funds (Portfolio 4 and Portfolio 6), with mean correlation coefficients of -0.086 and -0.017, respectively. On the other hand, the higher the composition of stocks in the portfolios, the higherthe correlation coefficient with Ibovespa (Portfolio 7, Portfolio 2 and Portfolio 1), with averages of 0.686, 0.626 and 0.523, respectively.

Evidencesuggest that Brazilian investors are able to obtain international diversification benefits using domestic assets due to the low correlations between returns from these securities (BDRs and investment funds) and the main index on the Brazilian market. Moreover, these results are in line with H1 and with most of the studies in this field related to DRs or investment funds, such as Chang *et al.* (1995), Errunza *et al.* (1999), Choi and Kim (2000), Arnold *et al.* (2004), Wang and Yang (2004), Charitou *et al.* (2006), Kabir *et al.* (2011).

In addition, Table 5 indicates that the portfolios with the lowest volatility of returns were those that had the largest share of assets composed by funds (Portfolio 9, Portfolio 6 and Portfolio 5), with average volatility of 1.707, 2.759 and 2.952, respectively. On the other hand, portfolios composed only by stocks (Portfolio 7), only by BDRs (Portfolio 8) or that combined these two assets (Portfolio 1 and Portfolio 3) were the ones that presented the highest volatility of returns, with average of 5.753, 5.254, 4.614 and 4.425, respectively.

According to Bekaertand Harvey (1997), it is well known that stocks from emerging capital markets have different characteristics compared to developed market ones, so that there are four main characteristics of emerging market returns that distinguish them, which are: i) higher average returns; ii) low correlation with developed markets; iii) higher predictability of returns; and iv) higher volatility. Thus, considering that Brazil is an emerging market, a higher volatility of portfolios composed mainly of stocks was expected.

Regarding the BDRs, despite the low correlation with the Brazilian market, the high volatility observed for the returns on portfolios composed mainly of these assets is also supported by the literature. Arnold *et al.* (2004), from the US domestic investor's point of view, have shown an optimum point for the percentage invested in ADRs for portfolios combining ADRs and S&P 500 to minimize portfolio volatility. According to this research, the percentage of ADRs in the portfolio composition for minimum volatility was 20% for developed market ADRs, 30% for emerging market ADRs and 20% for ADRs on developed and emerging markets. It is also important to note that by combining BDRs with other assets, volatility is significantly reduced, leading to better risk-adjusted returns.

Finally, the portfolios with higher Sharpe ratios were those with only BDRs in their compositions (Portfolio 8) and those that combined BDRs and funds (Portfolio 4 and Portfolio 6), with averages for the Sharpe ratio of 0.390, 0.343 and 0.256, respectively. The portfolios with lower Sharpe ratio were those with the larger share of portfolio composition with stocks (Portfolio 7, Portfolio 2 and Portfolio 1), with averages for the Sharpe ratio of -14.367, -7.011 and -4.404, respectively (considering the adjustment proposed by Israelsen, 2005 for the Sharpe ratio).

The fact that portfolios mainly made up of stocks had the lowest Sharpe ratio may be related with the high volatility of emerging capital market stocks, as pointed out by Bekaert Bekart and Harvey (1997). However, the higher Sharpe ratio for portfolios composed only by BDRs is surprising, since no evidence was found in this regard in similar previous studies about the Depositary Receipts. For example, Arnold *et al.* (2004) concluded that a portfolio with optimal performance, measured by the Sharpe ratio, should consist of 84% of US

domestic stocks and 16% of ADRs from developed markets. Therefore, the results for the Brazilian market presented in this study suggest that, in addition to the international diversification benefits, BDRs also provide advantages in terms of risk-adjusted return compared to domestic stocks.


## 6. CONCLUSION

The purpose of this paper was to analyze the potential benefits of international diversification through domestic assets for Brazilian investors. Therefore, to represent the domestic assets available to Brazilian investors that are also related with international markets, we considered the Brazilian Depositary Receipts (BDRs) and the Brazilian investment funds (mutual funds and hedge funds) that invest in foreign companies. In addition, for purposes of comparison, stocks listed on the Brazilian market were included in the sample.

When analyzing the correlation coefficients of the monthly average returns between the 763 assets of the sample and Ibovespa, BDRs have, on average, the lowest correlation coefficients, indicating some benefits related to international diversification through these assets. The average correlation coefficients for funds were also lower when compared to the coefficients obtained for stocks.

In addition, 10,000 portfolios were elaborated for 10 different asset combinations to verify the benefits of diversification through the allocations of BDRs, funds and stocks in these portfolios. The results indicated that the portfolios that had only BDRs in their composition were the ones that presented the lowest correlation with the Ibovespa and the highest Sharpe ratio, that is, the BDRs besides providing the inherent benefits of international diversification, also offer better risk-adjusted returns than the stocks on the Brazilian domestic market.

In view of these results, this study contributes to the literature by providing new perspectives on the benefits of international diversification through domestic assets, especially from an investors' point of view on emerging countries. Our research corroborated previous studies that have highlighted the potential of Depositary Receipts and investment funds for international diversification from domestic investors in developed countries, such as Chang *et al.* (1995), Errunza *et al.* (1999), Arnold *et al.* (2004), Charitou *et al.* (2006) and Kabir *et al.* (2011), but now considering Brazilian investors. In addition, the evidence from this research suggest that international diversification through domestic assets provides higher benefits for Brazilian investors when compared to investors in developed countries, since the Brazilian assets related to foreign assets not only showed low correlation coefficients between the main domestic market index, but also indicated higher risk-adjusted returns.

The main limitation of this study is data availability. Our sample had only 31 BDRs, a small amount compared to the other assets considered, 476 funds and 256 stocks. In addition, for the same reason, all considered BDRs were related only to US assets. Another limitation is about the elaboration of the portfolios, considering that optimization techniques were not employed to estimate the compositions for the portfolios with maximum returns or minimum risk, and transaction costs were not included (as well as liquidity constraints and minimum balance of investment eventually imposed by some investment funds in the sample).

Finally, we suggest for future studies to look at Depositary Receipts within other emerging markets, in order to verify if they present a similar behavior to BDRs. Researchers interested in finding more evidence about BDRs themselves should consider BDRs from other countries than the US, already analyzed in this paper. Furthermore, these results could be

compared to Brazilian mutual funds that hold assets from the domestic market(since this paper considered Brazilian stocks as domestic assets), as well as consider assets from out of the estimated portfolios so as to improve the robustness of the comparative analysis.

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