# Brazilian REIT as an Alternative Investment to Real Estate, Stock and Bonds– Empirical Evidence.

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## ABSTRACT

Given the recent expansion of real estate securities in the Brazilian market, the present study examines Brazilian REIT (FII) returns' exposure to underlying market returns (real estate, stock and bond markets) in order to assess evidence of diversification power provided by this investment type in light of Modern Portfolio Theory. The research considers a sample of REITs listed on the Stock Exchange of São Paulo, during the period of 2008-2014 applying methodology developed by Clayton and Mackinnon (2003), where the econometric model explaining REIT returns is decomposed into three market factors: real estate, stock market and bonds. Correlation matrix, regression analysis and variance decomposition indicate that although Brazilian REIT returns, in a way, reflects their hybrid nature, the three factor model is not sufficient to explain their total returns, suggesting that Brazilian REIT performance is not primarily driven by any of these underlying markets. More importantly, results suggest that FII consists of a unique asset class and as such may provide diversification benefits in a mixed portfolio by broadening the efficient frontier. Analysis of subsamples by property type also indicate that the diversification role of real estate securities is tied to property type, since the explanatory factors and their impact on returns differ from one type of REIT to another. Present findings shed light on Brazilian REITs nature and have important implications for the selection criteria to be adopted by investors and also real estate fund managers regarding product formatting and management.

**Keywords:** Brazilian REIT, Modern Portfolio Theory, Real Estate Market; Diversification.

## 1. INTRODUCTION

Brazilian REITs – Real Estate Investment Trusts" - known in Brazil as FII (or "Fundos de Investimento Imobiliário"), were created in Brazil in 1993 and have experienced rapid expansion over the last five years, boosted by regulation changes initiated in 2008. Total primary emissions increased from BRL 1 billion in 2007 to BRL 11.5 billion in 2012, and the secondary emissions reached BRL 3.5 million in the same year (UQBAR, 2009).

REITs combine features of different markets: the real estate market - main source of REIT income - and the stock market, environment in which they are traded. REITs benefits from taxes incentives, however, investment is subject to specific regulatory

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obligations that limit investment management, when compared to stock investments. Moreover, REITs tend to be compared to bonds, as part of gains comes from regular rent distributions (Bertin, Kofman, Michayluk, & Prather, 2005).

The impact of each of these underlying markets in behavior, performance and risk of this investment type, however, has not been clearly defined, being one of the major themes under analysis, both in the academic literature, as in the international funds industry.

Understanding the nature of this financial asset has implications that go beyond the analysis of this investment alone. To support this, we can resort to Modern Portfolio Theory (Markowitz, 1952). According to this approach, the characteristics of the investments, mainly its correlation/covariance with other asset classes, can maximize returns and/or minimize the total risk of a multi-asset portfolio, through diversification. Thus, by increasing the total return of a portfolio, with no increase in risk, or by keeping the return of this portfolio, with reduced volatility, efficiency frontier can be increased (Case, Yang, & Yildirim, 2012).

The main objective of this paper is to analyze whether listed real estate securities distinctive features can characterize Brazilian REITs as an alternative investment despite exposure to real estate, stock or bonds markets, considering the Modern Portfolio Theory approach.

Therefore, we developed an empirical study, from a sample of Brazilian REITs listed on the São Paulo Stock Exchange in the period of 2008-2014.

Additionally, the present study aims to contribute to the expansion of national and international researches on Brazilian REITs, taking into account that scientific analysis of Brazilian REITs is still scarce in Finance literature.

Finally, our findings have practical implications for REIT industry and investors as well.

The remainder of this paper is organized as follows. Section 2 presents theoretical background and brief overview of related literature. Section 3 introduces the selected data during the examination period, the model framework and the variables description; Section 4 provides empirical evidence and Section 5 presents concluding remarks.

## 2.BACKGROUND

### *Brazilian REIT*

The Securities and Exchange Commission of Brazil (CVM) defines FII- Fundo de Investimento Imobiliário (or Brazilian REIT) as a capital communion raised through the securities distribution system, intended for application in real estate projects. Therefore, Brazilian REIT may invest in real estate assets, fixed income and other real estate securities, provided that at least 75% of fund assets are applied to real estate properties or rights (Securato, Amato, Takaoka, & Lima Jr, 2005).

Brazilian REIT is a closed-end investment fund, which means it is publicly traded, raising capital through an initial public offering and investors are not allowed to redeem their investment from the fund. Thus, REIT shares shall be traded at secondary market.

Dividend yield comes from income distribution related to lease contracts or asset sale, both exempt from taxes, which attracts mainly individual investor. At least 95% of income must be distributed every semester. In addition, investor may profit from shares traded at stock exchange.

Regulation changes in 2008 and 2009 significantly expanded the types of real estate investment allowed for REITs and the entry of pension funds, driving a new and stronger expansion of this market.

### *Modern Portfolio Theory*

According to Modern Portfolio Theory - MPT, systematized by Harry Markowitz (1952), an optimal allocation of resources consists of selection of financial assets that promote the maximization of returns, given a risk limitation (Geltner, & Mcgrath, 2007).

Markowitz (1952) proposed a methodology for portfolio selection through quantitative analysis of mean-variance characteristics of assets, where expected values (mean) is a measure of return and the variance of the overall rate of return (or standard deviation) is a measure of risk (Muller,1988).

More importantly, Markowitz mathematically demonstrated that the mere selection of different assets do not necessarily incur in diversity benefits, but the optimal combination of assets with low or negative correlation would improve risk-return characteristics of overall portfolio, since the total variance is impacted by covariance between these assets (Markowitz, 1990). Thus, combinations of low or non-correlated assets would maximize return and minimize the risk of a portfolio comprising the so-called efficient frontier. A point on the efficient frontier corresponds to the lowest volatility for a given return or the maximum return for a given level of risk.

The benefit of diversification of a portfolio assumes that different asset classes react differently to economic changes, in other words, different asset classes do not substantially share common characteristics of risk-return.

Alternative investments are asset classes that have significantly different risk and return characteristic when compared to traditional investments (eg. bonds and stocks), and consequently are expected to provide risk diversifying benefits in mixed portfolios by broadening the efficient frontier set (Donald, 2013, Ibbotson, 2006).

Academic studies indicate real estate as an investment alternative for diversification (Bekkers, Doeswijk, & Lam, 2009). Real estate securities due its hybrid characteristics of real estate, stock and fixed income, on the other hand, is subject of further investigation.

### *Literature Review*

The study of influence of real estate, stock and bonds market on REIT returns and real estate securities as alternative investment have been the focus of major scientific research efforts (Bouldry, Coulson, Kallberg, & Liu, 2012; He, Webb, & Myer, 2003), however, there is no general consensus on findings.

According Glascock, Lu, So (2000), considering that relevant percentage of the REIT´s capital resources have to be invested in real estate assets, it is intuitive that REIT prices follow property market, however, as there are more market participants, especially non individual investors, it is possible that the stock market factors have a greater influence on return behavior, partially due to increase in the volume of transactions and the proper monitoring of the market.

Westerheid (2006) found evidence that international REITs (samples from 1990-2004 of 8 countries) are a different asset class from bonds and stocks, and that REITs tend to function as substitute to direct real estate investments in the long term. Other empirical researches on international REITs, and especially US REITs concluded that REITs behavior differ in time, tending to behave as stocks in the short term and as

direct real estate investments in the long term (Bouldry et al., 2012; Clayton; &Mackinnon, 2003; Hoesli, Oikarinen, 2012; Ling, & Naranjo, 1999;). On the other hand, cointegration with bonds was found by Giliberto (1990) and He, Webb and Myer (2003).

Lee e Stevenson (2005) and Sebastian and Zhu (2012) focused on the diversification role of REITs in a mixed portfolio and their benefits concluding that despite major influence of real estate market in return behavior in the long term, their characteristics of the risk-return make them an unique alternative asset class, different from stocks, bonds or real estate itself. Muller and Muller (2003) reached the same conclusion, through sensitivity analysis on hypothetical mixed portfolio comprised of bonds and stocks and bonds, stocks and direct real estate. Applying Markowitz approach, they demonstrated that the inclusion of REIT in a mixed portfolio substantially improves efficient frontier design in both scenarios.

*Brazil.* While international research on REITs is quite vast, the subject was still little explored in Brazilian literature, especially after 2008, when the Brazilian REITs had its greatest expansion.

Securato et al. (2005) concluded that the price of Brazilian REIT´s shares were impacted by dividends payment; secondly, that FIIs were perceived as non-liquid assets with high risk when compared to other investments available in the market and that the profitability was in general heavily influenced by real estate industry. Consentino and Alencar (2011) and De Castro (2012) found that the increase in prices of FII shares, samples from 2007-2011/2012, also followed property market.

On the other hand, FII shares appreciation indicated gains not only by dividends distribution, but probably from greater exposure to the capital markets. No cointegration with stock market was found also suggesting that REITs would function as hedge for stock investments (De Castro, 2012).

Considering sample from 2011-2013, Milani and Ceretta (2013) have not found significant correlation between FII returns and construction companies' performance, but have concluded that REIT relative high average returns and low standard deviation suggest that these funds are an interesting alternative to the investor, since further increase in return of the portfolio did not incur in additional risk.

## 3. METHODOLOGY

### *Sample and Data*

The overall sample includes 37 real estate funds listed on the Stock Exchange of São Paulo (BM&F Bovespa), extracted from ComDinheiro data base, representing approximately 32% of total listed funds. Only the actively traded funds with monthly data available for at least 3 consecutive years were selected, covering the period of 2008 to 2014.

### *Research Design*

The econometric model applied to the empirical study is based on the methodology developed by Clayton and Mackinnon (2003), which assumes that the market returns can act as proxies for unobservable state variables that are common to REITs, Stocks, real estate and bonds. The linear regression and decomposition of the

total variance of REIT is analyzed against these three components: Real Estate Market, Stock Market, Bond Market, as described below:

$$\mathbf{R_{FII} = \alpha + \beta_1 * R_{RE} + \beta_2 * R_S + + \beta_3 * R_B + \varepsilon} \quad (1)$$

where the $R_{FII}$ corresponds to the Brazilian REIT return, calculated by the monthly variation in the share's closing price adjusted for dividends paid; $R_{RE}$ the return of the direct real estate market, calculated by the monthly variation of a rate of return of the property market; $R_S$ is the return of the stock market, calculated by the monthly variation in the closing price of a stock index; $R_B$ the return on bonds, calculated by the monthly variation of a fixed income security.

Clayton and Mackinnon (2003) assumed that regression residual or error term (ε) represents the idiosyncratic risk. Nevertheless, as they highlighted, this portion of REIT returns not explained by the market factors may comprise other variables not stated in the model, not necessarily idiosyncratic risk. Thus, we will not address the error term as idiosyncratic risk at this point.

***Pure factors***

According to Clayton and Mackinnon (2013), the pure form of variables was extracted through orthogonalization method, which consists in regressing each return variable, in this case RRE (real estate) and RB (bonds) against the other return factors. The final variables included in the model will be, then, the residuals of those regressions. Thus, residuals represent the pure influence of each market.

$$R_{RE} = \varsigma + \psi_1 R_S + \psi_2 R_B + \upsilon \quad (2)$$

where: $R_{RE}$: real estate market return; ς is the constant term; ψ1 and ψ2: regression coefficients (or beta); RS: Stock market returns; RB: Bonds market returns and υ: regression residual that corresponds to real estate market pure factor ($R_{RE}$*).

$$R_B = \nu + \omega_1 R_{RE} + \omega_2 R_S + e \quad (3)$$

where: ν is the constant term; $\omega_1$ and $\omega_2$ : regression coefficients (or beta); $R_S$: Stock market returns; e: regression residual that corresponds to bonds market pure factor (RB*).

This way, final econometric model correspondents to the equation bellow:

$$\mathbf{R_{FII} = \alpha\ \beta_1 *} R_{RE}^* \mathbf{+ \beta_2 * R_S + \beta_3 * R_B * + \varepsilon} \quad (4)$$

***Variance decomposition***

Thereafter, we proceeded to the decomposition of the variance of the Brazilian REIT returns, calculating the portion attributable to the variance of each independent variable as applied by Mackinnon and Clayton (2003, p. 43):

$$\boldsymbol{\sigma^2_{RFII} = \beta_1^2 * \sigma^2_{RRE*} + \beta_2^2 * \sigma^2_{RS} + \beta_3^2 * \sigma^2_{RB*} + \sigma^2_{\varepsilon}} \quad (5)$$

The individual contribution of each component is calculated by dividing each component ($B_i^2 * \sigma^2$) by the total variance of Brazilian REIT returns ($\sigma^2_{RFII}$).

### *Variables Description*

*Brazilian REIT Returns ($R_{FII}$)*

The proxy selection for Brazilian REIT market (dependent variable) is a sensitive step of the study, due to data limitation. Although created in early 90s, the Brazilian REIT market was only recently expanded.

The IFIX – Brazilian REIT return index published by Sao Paulo Stock Exchange was adopted by Milani and Ceretta (2013) in their study, however, this index began only in 2011, making its period of analysis very limited to the purposes of our study. Also the index construction does not allow further analysis by property type.

As such, a return index of Brazilian REIT from a hypothetical portfolio was built, composed of the individual REITs available in each period, selected according to the criteria described in Sample and Data.

The monthly return of each REIT was calculated from the natural logarithm of REIT closing price as of the last day of each month in relation to previous month. Price corresponds to share price adjusted by dividends paid, as to capture gains distribution in the total REIT return index. The final index of the hypothetic portfolio was then calculated from the average of the returns weighted by the size of the individual measure by equity value.

It is noteworthy that this return calculation differs from the dividend yield, commonly considered a return measure in the Brazilian REIT market. The dividend yield considers only the rent paid per share divided by the share´s price. This metric shows the relative return on investment, and does not capture the appreciation/ depreciation of the REIT shares.

*Real Estate Market Returns ($R_{RE}$)*

Structured information and statistics on the Brazilian real estate market are quite scarce. Information about real estate transactions, valuations and market studies are considered strategic for companies operating in the sector and therefore rarely available to external users. Therefore, a major challenge of this kind of study is the selection of a suitable proxy for the direct property market returns.

De Castro (2012) tested two indexes in his cointegration model: the IMOB and the INCC. Milani and Ceretta (2013) also used the IMOB index as a *proxy* for the real estate market.

The IMOB published by São Paulo Stock Exchange measures the performance of shares of leading real estate companies traded on the stock exchange. The INCC (National Index of Construction Cost) is an inflationary price index published by the Getúlio Vargas Foundation, which measures the evolution of housing construction costs, equipment, service and hand labor.

Although IMOB and INCC may provide some sense of the real estate market performance, these rates do not directly address the not securitized real estate market returns. IMOB is highly correlated with stock market, so its inclusion in the model as a proxy of the real estate market may lead to a biased conclusion of influence of this market on Brazilian REIT returns. In the other hand, the INCC is also highly correlated

with the economy interest rate (Selic), and as such, probably would present multicolinearity with NTN-B.

Therefore, this study broke new ground by adopting a proper index return of the property market, the IGMI-C index from Fundação Getúlio Vargas (FGV).

According to the definition provided by Fundação Getúlio Vargas (FGV): *"IGMI-C is a profitability index of the Brazilian market of commercial real estate, which aims to portray the most comprehensive way possible the evolution of price appreciation and income of the commercial property segment throughout Brazil* ".

The composition of this index has resemblance to the composition of Brazilian REIT type's distribution in the hypothetical portfolio in the full sample, covering commercial offices, malls, hotels, industrial and logistic facilities and others. It is noteworthy that the highest concentrations are found in commercial offices (about 50% of the total) and malls (about 25% of total) (FGV, 2011).

The IGMI-C presents data available since 2000, but on a quarterly basis. Due to the limitation of REIT observations in the sample, it was necessary to adopt a monthly frequency. The IGMI-C index aggregates both income returns (IGMIC income) as capital gains (IGMIC capital).

*Stock Market Returns ($R_S$)*

The IBRX-100 index measures the return on a theoretical portfolio composed by 100 stocks selected among São Paulo Stock Exchange's most actively traded stocks in terms of number of trades and financial value. This index was selected as proxy for overall Brazilian Stock Market.

*Bond Market Returns ($R_B$)*

International studies (Giliberto, 1990; He, Webb, & Myer, 2003) have concluded that investment in real estate funds have similar behavior to investment in fixed income securities, since a significant part of their income comes from space lease.

The NTN-B is a leading Brazilian direct treasury bill and was chosen as a proxy variable for Brazilian bond market. In order to capture investor's future expectations a long maturation bond (2025 bond) was selected.

## 4. EMPIRICAL RESULTS

### *Descriptive Statistics*

Means and standard deviations of monthly returns variables $R_{FII}$, $R_{RE,}$ $R_S$ and $R_B$ are presented in Table 1.

**Table 1– Descriptive Statistics: mean, standard deviation, minimum and maximum returns.**

| Variable | | Full sample | | | |
|---|---|---|---|---|---|
| | | Mean | Std Dev. | Min. | Max |
| **RFII** | | **0.012** | **0.024** | **-0.039** | **0.075** |
| RE | IGMI-C | 0.049 | 0.013 | 0.029 | 0.081 |
| RS | IBRX100 | -0.001 | 0.064 | -0.289 | 0.124 |
| RB | NTN-B | 0.003 | 0.001 | 0.002 | 0.005 |

RFII: Brazilian REIT return; $R_{RE}$: real estate market return; Rs: stock market return; $R_B$: bond market return.

Brazilian REIT Portfolio´s return ($R_{FII}$) was on average superior to stock and bonds average returns in the sample. The standard deviation as a measure of return´s volatility, or risk, of $R_{FII}$ was lower than stock market measured by IBRX100 index; however, higher than direct real estate market (IGMI-C) and bonds (NTN-B).

### *Correlation*

Pearson correlation matrix is presented in table 2.

**Table 2 – Correlation Matrix**

| | RFII | IGMI-C | IBRX100 | NTN-B |
|---|---|---|---|---|
| RFII | 1.00 | | | |
| IGMI-C | 0.20 | 1.00 | | |
| IBRX100 | 0.25 ** | 0.02 | 1.00 | |
| NTN-B | -0.05 | 0.37 *** | -0.11 | 1.00 |

RFII: Brazilian REIT return; IGMI-C: real estate market return proxy ($R_{RE}$); IBRX100: stock market return proxy (Rs); NTN-B: bond market return proxy ($R_B$). ** 5% significance level; ***1% significance level

As observed, despite general belief, correlation between $R_{FII}$ and IGMI-C (Real estate variable) and NTN-B (bonds variable) was not statistically different from zero. $R_{FII}$ was positively correlated with stock market, but less than 50%.

### *Regression Analysis and Variance Decomposition*

Implemented model framework was evaluated for heteroskedasticity problems and model specification significance, as well multicolinearity issues. Preliminary analysis indicated that model framework meets the econometric requirements for linear regression analysis. Robust regression was applied in order to control for high influential observations and outliers in the sample.

Table 3 presents regressions main results: regression coefficients, p-value, sample size, F-statistics and coefficient of determination ($R^2$). The regression coefficient

indicates the impact of each variable on the dependent variable and the p-value shows the significance of the variable for the model. Significance levels of 1% and 5% were adopted. The F-statistic refers to the model predictive capacity as a whole and resulted significant p-value of 0.0042. Coefficient of determination ($R^2$) refers to the explanatory power of the model, resulting 16%.

**Table 3 – Linear regression– Full sample**

$$R_{FII} = \alpha\ \beta_1 * R_{RE} * + \beta_2 * R_S + + \beta_3 * R_B * + \varepsilon$$

| Variables | Full sample | |
|---|---|---|
| | B | p-value |
| Constant | 0.009 *** | 0.006 |
| RE (IGMI-C) | 0.644 *** | 0.007 |
| RS (IBRX100) | 0.142 *** | 0.002 |
| RB (NTN-B) | -0.770 | 0.869 |
| **sample size** | 84 | |
| **F (p-value)** | 0.0042*** | |
| **$R^2$** | 16% | |

RFII: Brazilian REIT return; $R_{RE}$ : real estate market return; Rs: stock market return; $R_B$: bond market return; B: regression coefficient (or beta); F(p-value): significance of F-statistics;$R_{2:}$ coefficient of determination .** 5% significance level; ***1% significance level

Table 4 presents the variance decomposition computed according to Clayton and Mackinnon (2003) methodology. Variance decomposition provides each independent variable's contribution to total variance of REIT returns in the sample.

**Table 4 – Variance Decomposition – Full sample**

$$\sigma^2_{RFII} = \beta_1^2 * \sigma^2_{RRE*} + \beta_2^2 * \sigma^2_{RS} + \beta_3^2 * \sigma^2_{RB*} + \sigma^2_{\varepsilon}$$

| Variables | Variance decomposition |
|---|---|
| RE (IGMI-C) | 7% |
| RS (IBRX100) | 9% |
| RB (NTN-B) | 0% |
| Residual | 84% |
| | 100% |

$R_{RE}$: real estate market return; Rs: stock market return; $R_B$: bond market return; $\beta^2$**:**squared bet; $\sigma^2$**:**variance; **ε:** residual. Components divided by $\sigma^2_{RFII}$.

Regression results indicated that real estate market ($R_{RE}$) as measured by IGMI-C, is significant in the model, at significance level of 1%, as well as the stock market variable (Rs), both with positive coefficient's signs: 0.64 and 0.14, respectively. Bond market factor ($R_B$), in the other hand, does not appear to have influence on Brazilian REIT returns in the sample.

Variance decomposition reveals that although real estate market and stock market can explain part of Brazilian REIT returns, their influence on total return does not surpass 16%. Stock market responds for 9% and real estate market responds for 7% of variance in the full sample.

These results support the notion that REIT returns reflect its hybrid characteristics, however, Brazilian REIT returns are not primarily driven by real estate, stock or bonds market return performances.

### *Results for subsamples by REIT property type*

Brazilian REIT formatting structures can have different configurations, depending on property focus (i.e. office, industrial, shopping mall, hotel, retail and others) and the project development stage (i.e. constructed, built-to-suit, sale-leaseback and development projects). REIT funds can also be composed of shares of other REITs and investments on fixed income financial instruments, such as debentures, certificates of deposit, real estate receivables and mortgage notes, known as Fixed Income REITs. Multiclass REITs in the other hand is a mix of several REIT types, according to UQBar classification (UQBAR, 2013). In order to verify the consistency of results for the overall sample, subsamples were extracted by prevailing Brazilian REIT types: Offices, Malls, Fixed Income, and Multiclass.

The subsample Offices consisted of REITs focused on lease or sale transaction of corporate space. The subsample Malls is composed of REITs focused on retail space. The subsample Fixed Income refers to funds backed by real estate receivables, mortgage notes, and shares of other REITs as well. The subsample Multiclass comprises REIT funds that invest in different types of REITs, such as residential, office buildings, industrial / logistics and receivable credits. REITs based on housing, industrial/logistics, hospitals and education facilities did not totaled enough observations to linear regression purposes, and therefore they were not analyzed.

**Table 5 - Linear regression results – Subsamples by property type**

$$R_{FII} = \alpha\ \beta_1 * R_{RE} * + \beta_2 * R_S + + \beta_3 * R_B * + \varepsilon$$

| Variables | Office | | Malls | | Fixed Income | | Multiclass | |
|---|---|---|---|---|---|---|---|---|
| | B | p-value | B | p-value | B | p-value | B | p-value |
| Constant | 0.010 *** | 0.001 | 0.007 | 0.08 | 0.009 | 0.230 | .007 | .213 |
| RE (IGMI-C) | 0.815 ** | 0.015 | 0.270 | 0.422 | 1.281 | 0.053 | .491 | .435 |
| RS (IBRX100) | 0.122 | 0.754 | 0.231 *** | 0.000 | 0.122 | 0.228 | .143 | .084 |
| RB (NTN-B) | -1.541 *** | 0.002 | -4.675 | 0.505 | 1.665 | 0.882 | 4.794 | .542 |
| **sample size** | 84 | | 84 | | 55 | | 84 | |
| **F (p-value)** | 0.0052*** | | 0.0002*** | | 0.1117 | | .318 | |
| **$R^2$** | 15% | | 16% | | 9% | | 5% | |

RFII: Brazilian REIT return; $R_{RE}$ : real estate market return; Rs: stock market return; $R_B$: bond market return; B: regression coefficient (or beta); F(p-value): significance of F-statistics;$R_{2:}$ coefficient of determination .** 5% significance level; ***1% significance level

Linear regression of Office subsample indicated that the returns of these funds are at 5% significance level, explained by variables real estate market (IGMI-C) and stock market (IBRX100 index) with positive beta signs. The results of Office subsample are the closest of the full sample, which was expected, since such funds are the most frequent in the full sample.

In the subsample formed of retail developments (Malls subsample), only stock market return was a significant explanatory variable, at 5% level of significance. Explanatory power of model remained at 15%-16%.

On the other hand, F-statistics significance results on Fixed income and Multiclass subsamples indicated that model or its components are not statistical significant at 5% significance level, as informed by F (p-value) at table 6. F-statistics p-value ranged 0.11 and 0.32, respectively, to fixed income and multiclass subsamples. Robust regressions were used in order to control for outliers and heteroskedasticity. Variables were orthogonalized as described in the methodology as to apply pure factors in the model; as such model was also controlled for multicolinearity issues.

In order to allow further examination of these subsamples, control variables were included in the model: inflation index, measured by IGP-M (General Price index), published by Fundação Getúlio Vargas, and two real estate market parameters: property vacancy and lease price.

The IGP-M inflation index is the most common inflation index used in lease agreements in Brazil.

Vacancy corresponds to the vacant stock percentage, considering corporate lease offer in the cities of São Paulo and Rio de Janeiro - vacant space divided by total lease space offer. Lease price refers to natural logarithm variation of average asked price for AA and A corporate space rental. Data was extracted from real estate consulting firm, Jones Lang LaSalle´s quarterly market reports.

Table 6 presents regression results with inclusion of control variables: inflation, vacancy and lease price.

**Table 6 - Results of linear regression with inclusion of control variables - Subsamples by property type.**

$$R_{FII} = \alpha\ \beta_1 * R_{RE} * + \beta_2 * R_S + {}_{+}\ \beta_3 * R_B * + \beta_4 * \text{Control variables} + \varepsilon$$

| Variables | Office | | | Malls | | | Fixed Income | | | Multiclass | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | B | | p-value | B | | p-value | B | | p-value | B | | p-value |
| Constant | 0.346 | *** | 0.001 | 0.019 | | 0.422 | -0.017 | | 0.082 | .026 | | .159 |
| RE (IGMI-C) | 0.764 | | 0.795 | -0.274 | | 0.350 | 0.102 | | 0.869 | -.012 | | .988 |
| RS (IBRX100) | 0.118 | | 0.065 | 0.188 | *** | 0.000 | 0.130 | | 0.177 | .178 | ** | .035 |
| RB (NTN-B) | -7.091 | | 0.196 | -6.254 | | 0.384 | -8.478 | | 0.394 | .367 | | .968 |
| inflation (IGP-M) | 0.073 | | 0.886 | -0.104 | | 0.874 | 2.591 | *** | 0.002 | 1.127 | | .225 |
| vacancy | -0.002 | ** | 0.007 | 0.011 | | 0.127 | | | | -.002 | | .144 |
| lease price | 0.093 | ** | 0.059 | 0.127 | *** | 0.016 | 0.302 | ** | 0.028 | | | |
| **sample size** | 81 | | | 81 | | | 55 | | | 84 | | |
| **F (p-value)** | 0.007*** | | | 0.002*** | | | 0.003*** | | | .067 | | |
| **$R^2$** | 29% | | | 23% | | | 36% | | | 9% | | |

RFII: Brazilian REIT return; $R_{RE}$ : real estate market return; Rs: stock market return; $R_B$: bond market

return; B: regression coefficient (or beta); IGP-M: inflation index (general price index); vacancy: property vacancy (vacant lease space/total space offer); lease price: logarithmic variation of lease asked price; F(p-value): significance of F-statistics;$R_{2:}$ coefficient of determination .** 5% significance level; ***1% significance level

Results for Office and Malls subsamples suggest that substantial part of explanatory power of real estate market return (IGMI-C) covers other real estate parameters, such as vacancy and lease price information. Model specification for fixed income subsample becomes significant with inclusion of control variables inflation and lease price. Both variables were also significant at 5% level. This result is consistent with subsample´s characteristics, since fixed income REIT returns are mainly comprised of lease receivables and mortgage letters.

The inclusion of lease price variable did not improve the model statistical significance for Multiclass subsample. Inclusion of inflation and vacancy variable, on the other hand, resulted in F(p-value) statistics of 0.07 against 0.32 of original model, although these variables were not individually significant, according to t-statistics. The stock market return variable emerged as the only significant explanatory variable for Multiclass returns.

In the overall, we can observe that REIT return sensitivity to explanatory variables differ from a subsample to another, grouped by property type. This finding can be more easily observed through variance decomposition at table 7:

**Table 7 - Variance decomposition - Subsamples by property type.**

$$\boldsymbol{\sigma^2_{RFII} = \beta_1^2 * \sigma^2_{RRE*} + \beta_2^2 * \sigma^2_{RS} + \beta_3^2 * \sigma^2_{RB*} + \beta_4^2 *} \sigma_{2\text{Control variables}} + \boldsymbol{\sigma^2_{\varepsilon}}$$

| | Variance decomposition | | | |
|---|---|---|---|---|
| **Variables** | **Office** | **Malls** | **Fixed Income** | **Multiclass** |
| RE (IGMI-C) | 8% | 0% | 0% | 0% |
| RS (IBRX100) | 5% | 3% | 4% | 5% |
| RB (NTN-B) | 2% | 0% | 1% | 0% |
| inflation (IGP-M) | 0% | 0% | 12% | 2% |
| vacancy | 12% | 74% | - | 4% |
| lease price | 5% | 2% | 28% | - |
| Residual | 68% | 21% | 55% | 89% |
| | 100% | 100% | 100% | 100% |

$R_{RE}$ : real estate market return; Rs: stock market return; $R_B$: bond market return; $\beta^2$**:**squared bet; $\boldsymbol{\sigma^2}$**:**variance; IGP-M: inflation index (general price index); vacancy: property vacancy (vacant lease space/total space offer); lease price: logarithmic variation of lease asked price; **ε:** residual. Components divided by $\boldsymbol{\sigma^2_{RFII}}$.

Relatively, real estate market return seems to have a higher impact on Office subsample return's variance (8%), followed by stock market return (5%), however, as similarly observed at full sample results, their total influence is not higher than 13% of total variance. Results also reinforces that other real market parameters can affect REIT return. Stock market responds for around 3% of variance of Malls hypothetic portfolio return and vacancy although not statistical significant responds for 74% of variance. Stock market influence on variance was 4% for Fixed income and 5% for Multiclass subsamples. Lease price variation responds for nearly 28% of fixed income REITs variance, followed by inflation with 12%. Property vacancy was responsible for 4% of

variance in Multiclass returns. Real estate market returns and bonds presented no significant influence on variance of this subsample.

Again overall findings suggest that investment markets' performance is not primary drives of Brazilian REIT returns, although these investments may share common explanatory variables as indicated by inclusion of control variables.

## 5. CONCLUSION

This paper examined listed Brazilian REIT as an alternative investment in a multi-asset portfolio by questioning whether Brazilian REIT returns are significantly and predominantly driven by real estate market, general stock market or bond market returns.

Descriptive statistics and correlation matrix indicated that Brazilian REITs have the potential for diversification in a mixed portfolio since sample data presented slight superior performance of Brazilian REITs both in average return and standard deviation in comparison with the other types of investments, except from not securitized real estate, for the observed period and there was no evidence of strong positive correlation among the variables.

Regression analysis indicated that real estate market and stock market have significant explanatory power towards REIT returns; however, variance decomposition shows that overall impact is not higher than 15%. These results lead us to believe that the hybrid nature REIT is reflected somehow in returns, but performance does not predominantly depend on underlying market returns, reinforcing the conclusion that Brazilian REITs consist of a unique asset class. This result is consistent with findings on US REITs by Fisher and Sirmans (1994), Muller and Muller (2003), Lee and Stevenson (2005) and Westerheide (2006), Case, Yang and Yildirim (2012) and Sebastian and Zhu (2012).

More importantly, the subsample analysis indicates that the diversification power of this asset class is significantly influenced by REIT property/asset type, since the explanatory factors and their impact on returns differed from one type to another. This result has also an important practical implication since we can understand that the choice of the investor is not limited to whether to include REITs in portfolio, but what kind of real estate fund as well.

In light of the Modern Portfolio Theory, these results indicate that the inclusion of REITs may provide potential diversification benefit in a multi-asset portfolio, by increasing the total return of a portfolio consisting of stocks and bonds, without an increase in risk; or keeping the return of this portfolio, with reduced volatility, thereby broadening the efficient frontier of the portfolio. This result put in question the traditional equilibrium fund of portfolios composed only by stocks and bonds, as REITs emerges as an alternative investment, and mainly as a unique asset class.

It is worth noting that our results do not rule out the hypothesis that some other common factors acting in these markets could have some influence on Brazilian REIT return/risk structure, such as vacancy rates and rental rates of the direct real estate market, as well as macroeconomic variables, such as inflation and interest rates not captured by return variables.

Among possible developments for empirical verification of the present findings, it is possible to build a multi-asset portfolio, applying sensitivity analysis with the inclusion of REIT shares in the portfolio, analyzing the issue of asset allocation.

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# EXHIBIT 1

| Number of shares (1000) | REIT name | Property type | Administrator |
|---|---|---|---|
| 750 | FII A Branca (FPAB11) | Office | Coinvalores |
| 40000 | FII Abc Imob (ABCP11) | Malls | Rio Bravo Investimentos S/A DTVM |
| 105 | FII Almirant (FAMB11B) | Office | BTG Pactual Serviços Financeiros |
| 381 | FII Anh Educ (FAED11B) | Education | BTG Pactual Serviços Financeiros |
| 5 | FII Bc Ffii (BCFF11B) | Fixed income | BTG Pactual Serviços Financeiros |
| 11000 | FII Bc Office Fund (BRCR11) | Office | BTG Pactual Serviços Financeiros |
| 2710 | FII C Jardim (BBVJ11) | Office | Votorantim Asset |
| 167 | FII Campusfl (FCFL11B) | Education | BTG Pactual Serviços Financeiros |
| 200 | FII Criança (HCRI11B) | Hospital | BTG Pactual Serviços Financeiros |
| 105 | FII CSHG Cri (HGCR11) | Fixed income | Credit Suisse Hedging Griffo |
| 165 | FII Cshgjhsf (HGJH11) | Office | Credit Suisse Hedging Griffo |
| 60 | FII Cshgshop (HGBS11) | Malls | Credit Suisse Hedging Griffo |
| 69 | FII Cx Cedae (CXCE11B) | Office | CEF |
| 1629 | FII D Pedro (PQDP11) | Malls | BTG Pactual Serviços Financeiros |
| 355 | FII Europar (EURO11) | Industrial | Banco Banif |
| 275 | FII Excellence (FEXC11B) | Fixed income | BTG Pactual Serviços Financeiros |
| 48 | FII Floripa (FLRP11B) | Malls | BTG Pactual Serviços Financeiros |
| 441 | FII Gwi Log (GWIC11) | Industrial | BTG Pactual Serviços Financeiros |
| 80 | FII HG Real (HGRE11) Atual: CSHG Real Estate FII | Multiclass | Credit Suisse Hedging Griffo |
| 531 | FII Higienop (SHPH11) | Malls | Rio Bravo DTVM |
| 655 | FII Hotel Mx (HTMX11B) | Hotel | BTG Pactual Serviços Financeiros |
| 59 | FII Max Ret (MAXR11B) | Malls | BTG Pactual Serviços Financeiros |
| 508 | FII Memorial (FMOF11) | Office | Coinvalores |
| 236 | FII Ourinvest (EDFO11B) | Office | Oliveira Trust |
| 195 | FII P Vargas (PRSV11) | Office | BEM DTVM (Bradesco) |
| 758 | FII Panamby (PABY11) | Multiclass | Brascan |
| 927 | FII Rb Cap I (FIIP11B) | Multiclass | Oliveira Trust |
| 1852 | FII Rb II (RBRD11) | Multiclass | Pentagono |
| 800 | FII Rbprime1 (RBPR11) | Housing | Citibank |
| 113 | FII Rbresid2 (RBDS11) | Housing | Citibank |
| 10 | FII Rep 1 (RCCS11) | Malls | Credit Suisse Hedging Griffo |
| 38810 | FII Riob Rc (FFCI11) | Malls | Rio Bravo Investimentos |
| 69033 | FII S F Lima (FLMA11) | Multiclass | Unitas |
| 105 | FII Torre Al (ALMI11B) | Multiclass | BTG Pactual Serviços Financeiros S.A DTVM |
| 3936 | FII Torre no (TRNT11B) | Office | BTG Pactual Serviços Financeiros S.A DTVM |
| 891 | FII Trx Log (TRXL11) | Industrial | Oliveira Trust |
| 959 | FII W Plaza (WPLZ11B) | Malls | BTG Pactual Serviços Financeiros S.A DTVM |