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Do Brazilian REITs depend on Real Estate sector companies or Overall Market?

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Abstract

Real Estate investments have been considered a good tool to provide diversification without increasing risk in a portfolio. Real Estate Investment Trusts (REITs) are a well-known investment alternative to many investors who want to invest in real estate minimizing the liquidity problem, since they have traded shares. However, the fact that REITs have traded shares brings the following question: are these shares driven by a "real estate factor" or they simply follow the overall market variation? This paper aims to discover whether Brazilian REITs return depend on the real estate companies return, on if they follow the overall market, or even any of the alternatives. The correlation between Ifix (Brazilian REITs proxy) and Imob (a Brazilian real estate sector index), as well as the correlation between Ifix and Ibovespa index, which represents the overall Brazilian market, were estimated by the Dynamic Conditional Correlation (DCC) model of Engle (2002).Our results show that both correlations were not significant, although the correlation between REITs and Ibovespa appear to be slightly higher than the one between REITs and Imob. These results, combined with the fact that Ifix index presents higher average return and smaller standard deviation, indicate that it may be interesting for the investor to include a Brazilian REIT share in his portfolio, since it would contribute to increase portfolio return without assuming more risk.

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1. Introduction

Real Estate investments have been considered a good tool to provide diversification without increasing portfolio risk, especially considering a portfolio which contains stocks, although direct real estate investment has several disadvantages such as low liquidity and high transaction costs. Real Estate Investment Trusts (REITs) are a well-known investment alternative to many investors who aim to overcome these difficulties (Parker, 2011). REITs have been able to minimize the liquidity problem, since they have traded shares.

However, the fact that REITs have traded shares raises the following question: are these shares driven by a "real estate factor" or they simply follow the overall market variation? As a consequence, one could question if a REIT share effectively improves portfolio performance. A similar kind of fund has been the target of the same academic inquiry: the Exchange Traded Funds (ETF), which frequently shows that their shares depend more on the market than on their underlying assets.

In Brazil, REITs are a relatively new type of asset. The existing REITs, in general, have a short life period and few daily trades, what hampers to analyze their return. However, since January 1st, 2011, BMF&BOVESPA, the main Brazilian stock exchange, has been calculating the Ifix index, whose objective is to be a Brazilian REITs proxy. Also, since 2010, BMF&BOVESPA has been presenting the Imob index, a real estate sector index which serves as a proxy for the real estate companies performance. Considering the previous questioning and the data availability, this paper aims to discover whether Brazilian REITs return depend on the real estate companies return or they follow the overall market, or any of the alternatives. The answer to this question would define if a Brazilian REIT share adds value to a portfolio.

2. Theoretical Issues

Huang and Zhong (2013) analyzed the diversification benefits of Commodities, REITs and Treasury Inflation-Protected Securities (TIPS), using data from 1970 to 2010. Using the Dynamic Conditional Correlation (DCC) model of Engle (2002), they pointed that these asset classes are not substitutes, but their diversification benefits vary over time. Correlation between REITs and U.S. Equity (used as a benchmark) has increased from 0.5 in 2007 to 0.8 in 2009, impacting portfolio rebalances. Using DCC in asset allocations, investors would hold substantial portions of REITs in their portfolios before subprime crisis, but they would start unloading them and loading US Bond on the onset of the crisis.

They also examine the out-of-sample performance of portfolio strategies including these asset classes, concluding that the benefits of the three asset classes should be examined in a dynamic setting and investors need to appropriate correlation estimates to adjust for time-variation.DCC was chosen as the best correlation estimate due to adjust to the time variation of diversification benefits.

Boudry et al. (2012) used a cointegration approach in an attempt to gain further insight into the complex interactions between REIT markets and other financial markets, as well as between REIT returns and direct real estate returns. Using transaction rather than appraisal based data, they have found significant evidence that REITS and the underlying real estate markets are cointegrated. This relationship appears to be stronger at larger horizons and it holds in the aggregated as well as in the property type level. But if the securitized and unsecuritized real estate get out of equilibrium, both adjust back towards the equilibrium path, indicating that financial markets informationally lead the real estate markets.

Case et al. (2012) analyzed the Dynamic Conditional Correlation between REIT and Stock returns. Using Engle (2002) DCC model, they have found that the REIT-stock correlation form three distinct periods. In the first period, before 1991, correlations were high, never dipping below 59% and with no trend. The second period ended in 2001 when REITS were included in broad stock market indexes, correlations declined to around 30%, enabling higher portfolio allocations without increasing volatility. During the third period, correlations increased steadily, reaching 59% in late 2008.

Fei et al. (2010) explore asymmetries in conditional correlation based on the multivariate asymmetric dynamic conditional correlation (AD-DCC) GARCH. They found that there is little asymmetry between the correlation among REITs direct real estate and stocks and that the time-varying correlation can be explained by macroeconomic variables. Also, when the correlation between REITS and S&P500 is the lowest, the future performance of REITS is the best.

Hoesli and Oikarinen (2012) examined whether securitized real estate reflect direct real estate returns or general stock markets returns using international data for the U.S., U.K. and Australia. Based on sectorial data level, they estimated Vector Error Correction models and investigated the forecast error variance decomposition and impulse responses. Both techniques suggest that the long-run REIT market performance is much more closely related to the direct real estate market than to the general stock market. Consequently, they should be relatively good substitutes in a long-horizon investment portfolio.

The effect of monetary policy stance changes in US equity real estate investment trust (EREIT) returns was analyzed by Chen et al. (2012). They found that in bull markets changes in monetary policy have negative effect on EREIT when investors have lower expectations of real estate price increases, but are not effective when investors have higher expectation about this. During bear and volatile markets, EREIT returns are not sensitive to changes in monetary policy stance.

Chiang et al. (2013) investigated the time-varying relationship between REITs and the stock markets of several Asian countries using a multivariate GARCH-vech model to capture the time-varying correlation. Their results show that the conditional risks have increased abruptly after the subprime mortgage crises. Besides, REITs have been positively correlated with stock markets since the subprime crisis unfolded, suggesting that they are not as defensive as they are in times of stable markets and may not be good shelter during financial chaos.

3. Method

Brazilian REITs are the object of study of this paper. The analyzed data consists in three time-series: the Ifix index, a Brazilian REITs share return index, the Imob index, a Brazilian real estate sector index, and the return of Ibovespa Index, used as an overall market proxy. Both Ifix and Imob indexes were provided by BMF&BOVESPA, the largest Brazilian stock exchange, and they are dividend-adjusted. The sample period was chosen according to Ifix data availability and it ranges from 01/03/2011 to 01/31/2013, with daily observations.

Firstly, the descriptive statistics analysis will be proceeded. Since the objective of this work is to analyze the dependence of Brazilian REITs represented by the Ifix index, the correlation between Ifix and Imob (a real estate sector index), as well as the correlation of Ifix and Ibovespa index, which represents the entire market, will be estimated by the Dynamic Conditional Correlation model of Engle (2002).

The correlation is perhaps the most traditional way of measuring the association between two variables, and it is of great importance for the assembly of hedging strategies and portfolio management. However, Engle (2002) draws attention to the problems generated by the unsteadiness of the correlation over time, which makes it necessary to recalculate the correlation of each period and adjust these strategies to embed recent information. This understanding also raises the need for predictive models for correlation.

Thus, Engle (2002) proposed the use of Dynamic Conditional Correlation, previously developed by Engle and Sheppard (2001), Tse and Tsui (2002) as a way to estimate the conditional correlation between two variables. To enable the estimation of the DCC model, it is necessary to calculate and understand the estimation of univariate conditional volatility

The modeling of univariate conditional volatility began with ARCH models (Engle, 1982), which were later supplemented by Bollerslev (1986). The GARCH model of Bollerslev (1986) is a generalization of ARCH, which is a stochastic conditional process on information at *t-1*. A variation of the GARCH model, proposed by Glosten, Jagannathan and Runkle (1993) as a way to model the asymmetry in conditional volatility will be used. Thus, the estimation of univariate volatility can be understood by Equations (1), (2) and (3):

$$r_{i,t} = \mu_i + \sum \phi_{i,m} r_{i,t-m} + \sum \theta_{i,n} \varepsilon_{i,t-n} + \varepsilon_{i,t}. \quad (1)$$

$$\varepsilon_{i,t} = h_{i,t} z_{i,t}, z_{i,t} \sim t_v. \quad (2)$$

$$h_{i,t} = \omega_i + \sum \alpha_{i,m} \varepsilon_{i,t-m} + \sum \beta_{i,n} h_{i,t-n} + \tau_{i,m} \varepsilon_{t-m} I(\varepsilon_{t-m} > 0) + \varepsilon_{i,t}. \quad (3)$$

Where $r_{i,t}$is the log-return of asset *i* in period *t*; $h_{i,t}$ is the conditional variance of an asset *i* in period *t*. μ_i, ϕ_i, θ_i, ω_i, α_i and β_i are parameters;$I(\varepsilon_{t-1} < 0)$ is a dummy that assumes value 1 when $\varepsilon_{t-1}$is negative, and null when $\varepsilon_{t-1}$is greater than or equal to zero;$\varepsilon_{i,t}$ is the innovation of the conditional average of the asset *i* in period *t*; $z_{i,t}$ represents a white noise.

The univariate volatility, in this article, is estimated by model (3), assuming a multivariate t-asymmetric distribution, and then used as the first step in calculating the DCC, i.e. the correlation in each period, replacing the traditional static index. The DCC model can be represented by Equation (4).

$$H_t = J_t R_t J_t. \quad (4)$$

Where H_t is the matrix of correlation between variables; R_t satisfies $R_t = (1 - \theta_1 - \theta_2)\bar{R} + \theta_1 \varepsilon_{t-1} \acute{\varepsilon}_{t-1} + \theta_2 R_{t-1}$; J_t is the matrix $J_t = diag\left(h_{11,t}^{-1/2} \ldots h_{NN,t}^{-1/2}\right)$, which serves as a normalization to ensure that *H* is the matrix of correlation; $h_{ii,t}$ is the conditional variance of asset *i* in period *t*; ε_t is the vector of standardized innovation in period *t*; $\bar{R}$ is the unconditional covariance matrix of ε_t. θ_1 and θ_2 are nonnegative scalar parameters that satisfy $0 < \theta_1 + \theta_2 < 1$.

Francq and Zakoian (2010) emphasizes that Equation (4) is reminiscent of a GARCH model (1,1), in which θ_1 is similar to parameter α_i, and $\theta_2$is similar to parameter β_i. Todorov and Bidarkota (2012) argue that the conditional correlation between two variables is summarized as the conditional covariance between the standardized disturbances (ε).

Then, it is possible to understand that the dynamic correlation is a process with two stages. At first, the univariate conditional volatility is estimated by a GARCH model. The coefficients generated are pre-requisite to calculate the standard disturbances. These, on the other hand are required for the second stage: calculating the conditional covariance between them, which is precisely the same as the Dynamic Conditional Correlation between the two variables.

Therefore, the original DCC model is estimated under the assumption of multivariate normality (maximum likelyhood) or a mixture of elliptical distributions (almost maximum likelyhood). The use of a copula function considers the marginal distributions and the dependence structure both separately and simultaneously (HSU, TSENG and WANG, 2008). This way it is possible to model the combined distribution of the innovations of each asset in the model based on a proper copula, rather than assuming multivariate normality. Finally, the combined distribution of asset returns can be specified with complete flexibility, being more realistic.

In this paper, we estimate the Dynamic Conditional Correlation between Ifix and Imob and the DCC between Ifix and Ibovespa. The estimated model used a copula function to calculate the DCC model based on the univariate volatility estimated by an ARMA (1,1) GARCH with multivariate t-distribution. Section 4 presents the results and discussion.

4. Results

Firstly, we present the summary statistics on Table 1. After, we will present the estimated DCC coefficients for Ifix and Imob and then, finally, the DCC coefficients for Ifix and Ibovespa.

	Mean	Median	Minimum	Maximum	Standard Deviation	Skewness	Excess Kurtosis
Ifix	0.0009	0.0007	-0.0186	0.0177	0.0043	0.0824	1.5347
Imob	-0.0003	0.0002	-0.0735	0.0733	0.0182	-0.0293	0.9377
Ibovespa	-0.0003	-0.0004	-0.0843	0.0498	0.0145	-0.3031	2.5803

Table 1 - Summary statistics of Ifix, Imob e Ibovespa series. Sample period ranges from 03/01/2011 to 31/01/2013.

Summary statistics show that Ifix is the only variable with positive mean, signaling that Brazilian REITs, in average, presented higher return during the analyzed period. Also, Ifix amplitude and standard deviation are smaller than the others, indicating that these funds are less risky. Still, the Ifix index is the only one with positive skewness, meaning that there is a larger probability of extreme high values than extreme low values, what could be expected, given the minimum and maximum values presented. Ibovespa presents the larger negative skewness and, the smaller minimum value, what, joined with the mean analysis, gives evidence that Ifix and Imob had better performance during the analyzed period.

All series present positive excess kurtosis, indicating a leptokurtic distribution, a normal feature of financial time series. Ibovespa presented the higher excess kurtosis, indicating that its distribution has a more acute peak around the mean and fatter tails. So, the Ifix series presents desirable statistical characteristics, from an economic perspective, such as positive skewness and low standard deviation. Considering also its positive mean, Ifix appears to present the best risk/return relationship.

		Coefficient	Std. Error	t-value	t-prob
Ifix	Cst(M)	0.0008	0.0001	5.7520	0.0000
	AR(1)	-0.2192	0.0504	-4.3450	0.0000
	Cst(V) x 10^6	8.6299	3.0703	2.8110	0.0051
	ARCH(Alpha1)	0.2134	0.0790	2.7000	0.0072
	GARCH(Beta1)	0.2984	0.1760	1.6950	0.0907
	GJR(Gamma1)	-0.0094	0.1272	-0.0737	0.9412
Imob	Cst(M)	-0.0004	0.0007	-0.6355	0.5254
	AR(1)	0.0309	0.0435	0.7085	0.4790
	Cst(V) x 10^4	0.0158	0.0252	0.6293	0.5295
	ARCH(Alpha1)	0.0124	0.0210	0.5918	0.5543
	GARCH(Beta1)	0.9381	0.0294	31.8800	0.0000
	GJR(Gamma1)	0.0949	0.0320	2.9660	0.0032
DCC	rho_21	0.0683	0.0501	1.3640	0.1732
	θ_1	0.0315	0.0487	0.6452	0.5191
	θ_2	0.5707	0.8907	0.6407	0.5220
	df	16.2239	6.0480	2.6830	0.0075
Log-Likelyhood		3482.90			

Table 2 - Estimated coefficients of the Dynamic Conditional Correlation between Ifix and Imob series, jointly with their univariate volatility coefficients. The model is an AR(1)-GJR-GARCH(1,1). Multivariate *t* distribution was assumed. The period is from 03/01/2011 to 31/01/2013.

The Dynamic Conditional Correlation coefficients estimated to analyze the dependence of Brazilian REITS are presented in Table 2 and Table 3. The first one presents the conditional correlation between Ifix and Imob to verify how much REITs are correlated with their sector companies.

As estimated by Equation (4), Table 2 presents the estimated univariated and multivariated coefficients of the dynamic conditional correlation between Ifix and Ibovespa, willing to verify how much REITs shares depend of the overall market.

Table 2 highlights that the Ifix univariate volatility Beta and Gamma coefficients are not significant at a 5% significance level meaning that the past volatility does not explain present volatility and there is not an asymmetric effect on volatility. The Alpha and the autoregressive coefficient of the Imob univariate volatility estimation are either significant, which indicates that these series suffer a week autoregressive effect on returns and on past errors, although Imob past volatility explains more than 95% of present volatility due to its high Beta coefficient.

Consequently, the DCC coefficients θ_1 and θ_2 were not significant, showing that there is not a significant conditional correlation between Brazilian REITs return and the return of real estate companies. This result is confirmed by the low static correlation (rho), which is only 0.0683 and not significant. These results show that the Brazilian REITs volatility do not depend of the real estate sector companies volatility, what means that this shares prices variation may be due to another economic feature, or Imob is not a good proxy. Other features like liquidity may be influencing REITs variation, causing it to be considered a special case of fund between those that have traded shares, because they appear to have different characteristics in relation, for example, the ETFs and the CEFs.

Table 3 presents the estimated coefficients of Ifix and Ibovespa univariated and multivariated dynamic conditional correlation.

		Coefficient	Std. Error	t-value	t-prob
Ifix	Cst(M)	0.0008	0.0001	5.9130	0.0000
	AR(1)	-0.2126	0.0503	-4.2270	0.0000
	Cst(V) x 10^6	8.6478	2.9951	2.8870	0.0041
	ARCH(Alpha1)	0.2144	0.0805	2.6640	0.0080
	GARCH(Beta1)	0.3004	0.1731	1.7350	0.0833
	GJR(Gamma1)	-0.0060	0.1294	-0.0465	0.9629
Ibovespa	Cst(M)	-0.0007	0.0006	-1.3160	0.1888
	AR(1)	-0.0113	0.0409	-0.2757	0.7829
	Cst(V) x 10^4	0.0367	0.0186	1.9710	0.0492
	ARCH(Alpha1)	-0.0233	0.0149	-1.5670	0.1178
	GARCH(Beta1)	0.9528	0.0165	57.8800	0.0000
	GJR(Gamma1)	0.1112	0.0355	3.1300	0.0019
DCC	rho_21	0.0807	0.0646	1.2490	0.2123
	θ_1	0.0423	0.0251	1.6870	0.0923
	θ_2	0.8571	0.0642	13.3500	0.0000
	df	10.9826	2.8647	3.8340	0.0001
Log-Likelyhood		3600.95			

Table 3 - Estimated coefficients of Dynamic Conditional Correlation between Imob and Ibovespa return series, jointly with their univariate volatility coefficients. The model is an AR(1)-GJR-GARCH(1,1). Multivariate *t* distribution was assumed. The period is from 03/01/2011 to 31/01/2013.

Similarly to Table 2, Table 3 presents little evidence that there is a GARCH effect in the Ifix return series. Concerning Ibovespa return series, volatility does not depend of past error, but depends heavily on past volatility, due to the non significant Alpha coefficient and the significant high Beta coefficient. More than 95% of volatility can be explained by past volatility. Also, there is not an auto-regressive effect on Ibovespa returns.

The DCC θ_1 coefficient is not significant, although θ_2 coefficient is, showing that similarly to Ibovespa univariate volatility, the DCC does not depend on past error, but it does depend on past correlation, since θ_2 is an auto-regressive vector. The static correlation (rho) is only 0.0807 and it is not significant, pointing out that in average there is no correlation between the two series. It must be also pointed out that the log-likelihood of this estimation is higher than the previous, indicating that this DCC has a better fit.

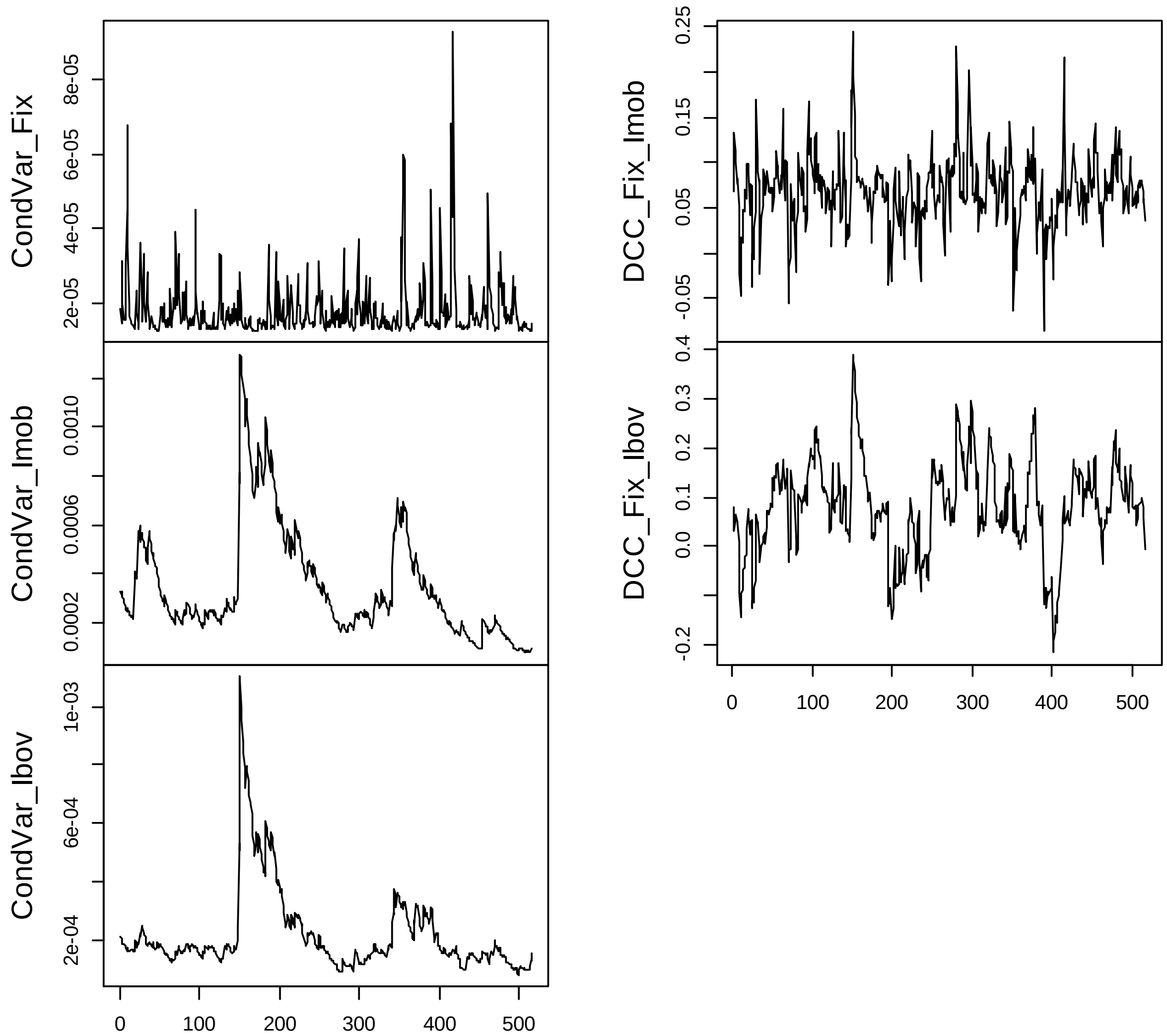

Figure 1 - Dynamic Conditional Correlation between Ifix and Imob and between Ifix and Ibovespa, jointly with their univariate volatility estimated for each individual series, from 03/01/2011 to 31/01/2013.

So, Ifix volatility does not appear to depend on Ibovespa volatility, turning its pricing into a puzzle. Their volatility is not linked to the real estate companies volatility, nor to the overall market. On one hand, this becomes a difficulty for a portfolio manager who wants to price the return of these funds to decide on its entry in the portfolio but on the other hand it may represent opportunities for diversification, since its variation is not linked to real estate business sector or to the overall market variation. Considering this features and the apparent good risk/return relation showed on the summary statistics, we can conclude that REITs, during the analyzed period, were a good investment opportunity, because they were able to present average return higher than the market, low standard deviation and low volatility correlation. Figure 1 brings evidence to help these interpretations.

Figure 1 clearly shows that there is not a strong graphical pattern between Ifix and Imob univariate volatility, probably due to the bad model fit of the univariate volatility, especially concerning to Ifix univariate volatility. We can perceive that Imob volatility present three peaks. The first and the third corresponds to small increases in Ifix volatility, but the second one (the strongest) apparently has no effect on Ifix.

However, Imob and Ibovespa univariate volatility present considerable similarities, although Ibovespa volatility is smaller, what could be expected, since it represents maximum diversification. The second and the third Imob volatility peak correspond to Ibovespa volatility peaks. So, the first volatility peak was shared by Ifix and Imob indicating that in this situation the REITs were affected by the volatility of the real estate sector companies. The second volatility peak was shared by Imob and Ibovespa, indicating that the real estate companies were affected by the market volatility but that does not affect REITs. The third volatility peak is shared by the three indexes and it seems to be higher (in relative terms) in Ifix and Ibovespa, showing that maybe this volatility was originated in real estate sector and, then, affected the overall market.

In regards to the DCC, we can perceive that there is a conditional effect, especially on the DCC between Ifix and Ibovespa, which increased from the series beginning until June, 2011, where reaches its peak, jointly with their univariate volatility. Then, it decreases until October, 2011 when it started to rise until the next peak, which corresponds to Imob's third volatility peak, reached around July, 2012. After this, there is a strong decrease, followed by a rising trend until the series end.

The DCC between Ifix and Imob followed the same trends as the DCC between Imob and Ibovespa, but in smaller intensity, presenting smoother variations. We notice that the DCC between Ifix and Ibovespa reach higher extreme values. In a general way, Ifix volatility is smaller than Imob and Ibovespa and it is more affected by the overall market than by the Imob index.

Considering the estimated coefficients and the graphical analysis, in a general way it is possible to state that there is no significant conditional correlation between the Brazilian REITs, represented by Ifix index and the real estate sector companies, represented by Imob index, as well as there is no significant conditional correlation between Ifix and the market proxy, Ibovespa. This non-significance and the differences on Ifix univariate volatility dynamics reinforce the conclusion that REITs are a good opportunity for diversification.

5. Conclusion

This paper aimed to analyze if Brazilian REITs returns depend on the real estate companies returns, on the overall market or none of the alternatives. Previous studies brought ambiguous results, advocating one side and another. Using the dynamic conditional correlation, we estimate the correlation between the Ifix index, a proxy of Brazilian REITs, and the Imob, a proxy of Brazilian real estate companies, as well as the DCC between Ifix and Ibovespa, the overall market proxy.

Results show that both correlations were not significant, although the correlation between REITs and Ibovespa appear to be higher than the correlation between REITs and Imob, when we consider that one DCC coefficient is significant in the first case, its static correlation is higher as well as the log-likelyhood. These results, combined with the fact that Ifix index presents higher average return and smaller standard deviation, indicate that there may be interesting, for an investor, to include a Brazilian REIT share in his portfolio, since it would contribute to increase return with low standard deviation and low volatility correlation with the market.

However, diversification benefits of including a REIT share in a portfolio varies over time, as verified by Huang and Zhong (2013), who found that the correlation between U.S. REITs and their benchmark (U.S. Equity) reached 0.9 during subprime crisis, although it was much smaller years before. Our analysis of Brazilian REITs showed that, even during a crisis period (more volatile period), correlation between Ifix and the Brazilian Market does not exceed 0.4. The DCC between Ifix and Imob, the Brazilian REITs benchmark, did not exceeded 0.25 during the most volatile period. Also, differently of Huang and Zhong (2013), our estimated DCC coefficients are not significant.

Our results opposed Hoesli and Oikarine (2012), Chiang et al. (2013), Fei et al. (2010) and Case et al. (2010) concerning the REITs-market volatility relationship during the analyzed period. They are also opposed to Boudry et al. (2012) and Fei et al. (2010) in the sense that REITs volatility is not related with its underlying market, i.e., the real estate sector companies. For future studies, we suggest the analysis of the relationship with macroeconomic variables, such as suggested by Fei et al. (2010) and Chen et al. (2012).

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