Dynamic Correlation between Share Returns, NAV Variation and Market Proxy of Brazilian ETFs

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Introduction

Exchange Traded Funds (ETFs) have become one of the largest investment opportunities today. They present special features that differentiate them from other investment funds, in which the most important are their traded shares. Their share prices are market oriented and are not necessarily strongly correlated with the value of their portfolio, i.e., their Net Asset Value (NAV). Then, the relationship between share return, net asset value variation and market return goes beyond the understanding of traditional models, like CAPM, puzzling investors. Hence, the objective of this paper is to analyze the dynamics of share return and NAV variation of Brazilian ETFs and how they behave in relation to the Brazilian Market. We use the Dynamic Conditional Correlation of Engle (2002) to analyze these dynamics. Our results point that the correlation between Share and Market returns were higher that the correlation between NAV variation and Market return, indicating that an investor who buys ETF share is more exposed to Market risk than the risk of the ETF fund portfolio. Another important issue regarding the crisis periods is that the DCC between Share and Market return showed that before the subprime crisis, there was a correlation drop, indicating that ETF market suffers some kind of effect that could be a crisis forecast. But during the Euro zone debt crisis, the correlation drop happened concomitantly with the volatility increment, i.e., with the crisis. That can be because of different natures of the crises, since the former was a financial crisis and the latter an economic crisis. We also find that when not in a financial crisis period, the ETF’s returns are more linked with the overall market, but during financial crisis periods, investors seek to trade ETF shares by their NAV value. During the economic crisis, however, the opposite effect seems to occur: the correlation between Share and Market return remains higher than 0.95, but the correlation between Share return and NAV variation drops to very low standards.

We use the Dynamic Conditional Correlation of Engle (2002) to analyze these dynamics. Our results point that the ETFs performance (how successfully are they achieving their objectives, measuring the difference between NAV returns and underlying index returns); (c) the effects of ETF trading on their underlying securities.

Exchange Traded Funds of emerging markets have received even less academic attention, although they have become increasingly important for investors, due to their fast growing economies. In an attempt to reduce this gap, the objective of this study is to analyze the pricing efficiency of Brazilian ETFs. As evidenced by Charupat and Miu (2012), we analyze if ETF return is adjusted with its NAV variation. But we also analyze how much of ETF return is due to the overall market (systematic risk, like in the traditional model) and if this relation overcomes the first.

To comply with that, we aim to estimate the Dynamic Conditional Correlation, a method proposed by Engle (2002), between ETF share returns, NAV variations and market returns and analyze their behavior during the period of 2004–2012. Our results point, basically, that ETFs share returns are more correlated with Market returns than with their own NAVs and that the subprime and Euro zone debt crisis cause different reactions on ETFs traders. Section 2 highlights the Brazilian ETF market; Section 3 brings a brief theoretical review on earlier studies; Section 4 presents our method; Section 5 discusses the results and Section 6 resumes the results and points out some conclusions.
Exchange Traded Funds and the Brazilian context

Exchange traded funds (ETFs) are passive investment funds which have become increasingly popular in a relatively short period of time. Their main difference in relation to conventional index funds is that, similarly to individual stocks, ETFs shares can be bought and sold throughout the trading day in an exchange market. Over the past twenty years, the number of ETFs has grown from zero to over 2000 in the United States, holding assets of more than US$ 1.000 billion under management (Blackrock, 2010). Studies that have examined the performance of ETFs that mimic U.S. equity indexes conclude that ETF performance is predictable to a high degree of accuracy, generally managing to stay close to their benchmark indexes with low levels of tracking error.

Brazilian ETFs were created in January 2002 by the instruction nº 359 of Comissão de Valores Mobiliários (CVM), a governmental institution that regulates the Brazilian financial market. As international ETFs, they should track a reference index, commonly the Ibovespa Index, which represents Brazilian market. But differently than ETFs of the US, they don’t pay dividends to shareholders, reinvesting the stocks dividends in their portfolios. The instruction nº 359 of CVM determines that at least 95% of ETF equity should be invested in assets traded in the stock market or other assets authorized by the CVM, in the proportion they integrate the fund reference index, or invested in index futures. This way, ETF is assured to reflect its reference index variation. The remaining 5% of the fund equity can be invested in government bonds, fixed income bank investments, fixed income mutual funds, commitment transactions and derivatives (exclusively for risk management of the fund portfolio). In the Brazilian market, ETFs are one of the few investment fund kinds that can trade shares at a stock market, unlike the USA where this possibility is available to many kinds of investment funds. Funds with traded shares puzzle investors in the sense that their total share prices may represent a different value of their underlying fundamentals, i.e., their net asset values (NAVs). The difference between share prices and their NAVs is called a discount and some studies such as Berk and Stanton (2007) point out to the discount persistence. But the discount and its persistence are not very well explained by current literature and this kind of funds challenge conventional models of asset pricing. Section 3 presents a brief review of the late studies on this subject.

Theoretical Issues

A concise review of the recent developments of the academic studies on Exchange Traded Funds is provided by Charupat and Miu (2012). They identify three main literature strands: (a) ETFs pricing efficiency (how close ETFs prices are from their NAVs); (b) ETFs performance (how successfully are they achieving their objectives, measuring the difference between NAV returns and underlying index returns); (c) the effects of ETF trading on their underlying securities.

Since before ETFs popularity, a considerable amount of studies have been investigating the pricing efficiency of other kinds of investment funds, especially closed-end investment funds that have traded shares. The discrepancies between share prices and underlying NAVs are often considered an anomaly, still requiring theoretical explanation. Anderson et al., (2011) find an important asymmetry between discounts (the difference between the share price and its NAV) of equity and bond funds. They estimate a dynamic conditional correlation for prices and NAVs of both equity and bond funds, showing that the correlation is much lower for bond funds than for equity funds. They also conclude that there was a structural break after Lehman bankruptcy (late 2008) for bond funds. This result may be linked with the lack of liquidity in the markets for some categories of bonds.

Tse and Martinez (2007) analyze 24 ishares series from January 2, 2002 to December 31, 2004, mostly country index funds. Their results point that ETFs do not trade at high premium or discount because the creation and redemption of ishares through in-kind transactions keep the price closer to their net asset value (NAV). International ishares have a high correlation with US markets, resulting in limited diversification benefits. Engle and Sarkar (2006) examine US and international ETFs, finding that the pricing deviations are larger for the international than for the US ETFs. Besides being larger, they are also more persistent. Jiang et al., (2010) analyze the first Chinese ETF, the SSE 50, showing that the fund price and NAV are co-integrated, and there is unidirectional causality from price to NAV. The fund is priced closely to its NAV with occasional short excursions away, particularly during the second semester of 2007, when the Chinese market experienced substantial volatilities, reflecting sudden increased market risks as a potential opportunity for arbitrage during financial instability. Defusco et al., (2011) studied the pricing deviations of the three most liquid US ETFs. Using intraday data from 1999 to 2005, they estimate an error correction model, showing that the pricing deviations are stationary and predictable.

Ivanov (2012) tested the “disintegration hypothesis” based on REIT and two ETF’s from Dow Jones, examining if their shares disintegrate from their underlying assets (NAV) during the subprime financial crisis. Their results failed to support the disintegration hypothesis between funds shares and NAV, but they found co-integration between the REIT and its benchmark index (MSCI US REITs index) before, during and after the crisis. It’s also documented that the tracking error increases during the financial crisis.

Qadan and Yagil (2012) use the co-integration tests and the error correction model (ECM) to test the long-run relationship between domestic Exchange Traded Funds and the returns of their underlying indexes. They find that the discrepancies augmented considerably during the subprime crisis, what could lead to arbitrage opportunities. Co-integration isn’t found in several banking and real estate ETF’s, but is very common among other kinds of ETF’s. Albuquerque and Maluf (2011) investigate the arbitrage possibility due to the discounts originated by the difference between the share price and fundamental price of one Brazilian ETF (ishare Ibovespa), with high
frequency data of 2009 and 2010 (26400 observations). Their conclusions pointed out that, although both series were strongly co-integrated in the long-run, ETF shares are more volatile than their benchmarks, what could open the possibility of arbitrage. They also analyze a strategy to take an advantage of the discounts, which seems to lead to real gain a priori, but fails when transactions costs are considered, turning out that the net returns could not beat a buy-and-hold strategy.

Hughen and Matthew (2009) compare the price transmission dynamics between closed-end country funds and Exchange Traded Funds using a sample of funds that invest in foreign securities. With a sample period of March 31, 2000 to March 31, 2001, a vector auto-regression model (VAR) is estimated. The analysis shows that ETFs returns are more closely related to their portfolio returns than CEFs are. Innovations in NAV explain 78 % of the 5-day ahead forecast error variance for ETF share prices but only 54 % of the forecast error variance for CEFs. Levy and Lieberman (2013) studied the efficiency of country’s ETFs as tracking instruments that are designed to follow foreign indexes, with daily and intraday data. As long as the US and the country market are synchronized, country’s ETF prices adjust to their realized NAVs, i.e., as long as foreign markets are open and NAV is actively traded, foreign markets govern the returns of country ETFs in the US. But when foreign markets are closed, the S&P500 index accounts for the largest part of country’s ETFs returns.

The second strand of ETF academic literature, according to Charapat and Miu (2012), refers to performance evaluation, based mainly on tracking errors. In this case, tracking errors may be defined as the difference between ETF NAV return and the corresponding underlying index return.

According to Agapova (2011), differences between conventional mutual funds and ETFs performance are not significant. The study used monthly data from 2000 to 2004 on uneven panel, showing that both kinds of funds did not statistically outperform or underperform their benchmarks. The study also found that mutual funds and ETFs are substitutes, but not perfect substitutes.

Drenovalk et al. (2012) analyze 31 European Sovereign ETFs based on four Tracking Error models. The models were estimated by OLS and Co-integration approaches. In a general matter, funds underperform their benchmarks, especially during the euro zone debt crisis. Returns of active funds vary substantially and are higher than the US Treasury Bond ETFs. The effects of volatility and duration of the underlying indexes, as well as equity size affected the fund performance. Blitz et al., (2012) study European index funds and Exchange Traded Funds in the period from January 2003 to December 2008. Their results show that most funds underperform their benchmarks, but there are considerable differences in performance between funds. Also, the expense ratios are an important determinant of relative fund performance, although there is other important factor that could explain this underperformance: the dividend yield.

Shin and Soydemir (2010) tested the performance of ETF using Jensen model. Besides, they tested the dependence of discounts on their historical price movements by employing a serial correlation test and ran the test by observing how each market reacts to discrepancy. Their findings point out that there are significant tracking errors between ETF performance and their benchmark. They also find that Asian ETFs appear to be noisier and more prone to momentum trading, meaning that active management would be more appropriate for Asian markets than for the US markets.

The pricing and performance of leveraged ETFs were also analyzed by Charapat and Miu (2011), who found that while the pricing deviations are on average small, large premium or discounts are prone to occur. Compared to traditional ETFs, the premiums of leveraged ETFs have larger volatility. With respect to tracking errors, leveraged ETFs present good performance over holding periods of up to a week. Jarrow (2010) showed that a risk increase on leveraged ETFs will not earn proportional return. 

Blitz and Huij (2012) evaluate the performance of several global emerging markets (GEM) equity Exchange Traded Funds with a sample period from 2003 to 2010. GEM funds exhibit higher levels of tracking errors than ETFs from developed markets. Specially, ETFs that rely on statistical replication techniques are prone to high levels of tracking error, and particularly during the periods of high return dispersion. The GEM ETFs underperformance in relation to their benchmark is similar to that of developed markets ETFs and can be explained mainly by expense ratios and the impact of withholding taxes on dividends.

The third strand of ETFs literature, according to Charapat and Miu (2012), refers to the effect of ETF introduction on the underlying securities. Because composite securities such as ETF are diversified, they present no firm-specific risk and liquidity traders face lower expected losses to insiders by trading in composite securities, rather than in individual securities that make up the composites. In contrast, it is argued that the introduction of a basket security like that opens another avenue for arbitrage.

Although the three main strands were discussed above, there are other ETF features which have been studied, like returns predictability and volatility. Yang et al., (2010) examined daily return predictability for eighteen international stock indices of ETFs employing several non-linear models like the feed-forward artificial neural network, the functional coefficient model and the nonparametric kernel regression model. Their sample period begins in 1996 for developed countries and in 2000 for emerging countries and their results show that 3 funds of emerging countries and 3 funds of developed countries show predictability in returns.

Gutierrez et al. (2009) found that there is a volatility spillover from the US ETFs to Asian ETFs and their returns are granger-caused by the US ETFs. Also, their overnight volatility is higher than daytime volatility, due to information and sentiment that arise from the US market due to schedule differences. In the same sense, Krause and Tse (2012) found bi-directional volatility spillovers between Canada and US ETFs and that US ETFs returns lead the returns of Canadian ETFs.
Data and Method

Brazilian ETFs are this paper’s object of study. The data analyzed consist of three time-series: ETFs share return (d_price), ETFs net asset value variation (d_NAV) and the return of Ibovespa Index (d_ibov), used as proxy. Both share return and NAV variation series represent an average from all Brazilian ETFs, weighted by their own NAV. Since Brazilian ETFs do not pay dividends, ETF return refers to share prices variation.

The fund data were obtained from Associação Brasileira das Entidades dos Mercados Financeiro e de Capitais (ANBIMA), a non-profit institution of self-regulation of Brazilian investment funds. Ibovespa data were obtained from BM&FBOVESPA, the largest Brazilian stock market. The sample period was chosen according to ETF data availability and it range from 02/08/2004 to 29/03/2012, with daily observations.

Firstly, some basic analysis will be done, such as descriptive statistics and time-series graphics interpretation. Also, Ordinary Least Squares (OLS) regressions will be performed to verify the influence of NAV, discount and Ibovespa on share return.

Since the objective of this work is to analyze the dynamics of share return, NAV variation and the market, the comprehension of the correlation between share return and NAV variation, as well as correlation of share return and the market proxy, is fundamental. These relationships will be studied by the Dynamic Conditional Correlation (DCC) model.

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 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) proposes the use of Dynamic Conditional Correlation (DCC), previously developed by (Engle & Sheppard, 2001; Tse & Tsui, 2002) as a way to estimate the conditional correlation between two variables. To enable the estimation of 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. Thus, the estimation of univariate volatility can be understood by Equations (1), (2) and (3):

\[ r_{i,t} = \mu_i + \sum \theta_i \varepsilon_{i,t-m} + \sum \theta_i \varepsilon_{i,t-n} + \varepsilon_{i,t}, \]

\[ \varepsilon_{i,t} = h_{i,t}^{1/2} \varepsilon_{i,t}, \]

\[ h_{i,t} = \alpha_i + \sum \alpha_i \varepsilon_{i,t-p}^2 + \sum \beta_i h_{i,t-\tau} \]

Where \( r_{i,t} \) is a log-return of an asset \( i \) in period \( t \); \( h_{i,t} \) is a conditional variance of the asset \( i \) in period \( t \); \( \mu_i, \phi_i, \theta_i, \alpha_i \) and \( \beta_i \) are parameters; \( \varepsilon_{i,t} \) is an 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 DCC, i.e. the correlation in each period, replacing the traditional static index. DCC model, according to Tsay (2010) can be represented by Equation (4).

\[ H_t = J_t R_t J_t \]

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

Francz and Zakoiian (2010) emphasize that Equation (4) is reminiscent of GARCH model (1,1), in which \( \theta_1 \) is similar to parameter \( \alpha_i \), and \( \theta_2 \) is similar to parameter \( \beta_i \). Todorov and Bidarkota (2012) argue that the conditional correlation between two variables is summarized as the conditional covariance between the standardized disturbances \( \varepsilon_t \).

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 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.

However, the original DCC model is estimated under the assumption of multivariate normality (maximum likelihood) or a mixture of elliptical distributions (almost maximum likelihood). The use of a copula function considers the marginal distributions and the dependence structure both separately and simultaneously (Hsu et al., 2008). Thus, 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. Therefore, the combined distribution of asset returns can be specified with complete flexibility, being more realistic.

In this paper, we estimate the Dynamic Conditional Correlation (DCC) between ETF’s share return and net asset value, besides DCC between ETF’s share and the market proxy. The estimated model used a copula function to calculate DCC model based on the univariate volatility estimated by ARMA (1,1) GARCH with multivariate t-distribution. Section 5 presents the results and discussion.

Results and Discussion

To initiate the analysis, we present summary statistics of return series on Table 1.
The descriptive statistics presented in Table 1 show that the mean return of the share and Ibovespa are positive, but the variation of NAV is negative, that means that in the analyzed period, the market proxy and the share prices increased, but NAV decreased. Minimum and Maximum points are similar to the three series, but the market proxy exhibits lower amplitude. Regarding the standard deviation, Price and Ibovespa returns are similar, but NAV variation is higher than them. As could be expected, Ibovespa skewness is negative, that means that, for this series, extreme negative returns may be larger than positive.

Initiating the analysis of the Dynamic Conditional Correlation, as Equation 4, Table 2 presents the results of the model that estimates the dynamic correlation between share return and market return.

Assuming multivariate t distribution, all coefficients are significant, at 5% significance level. Concerning the univariate estimated volatility, Beta Coefficients are considerably higher than Alfa Coefficients, that means that previous volatility is the main influence to explain present volatility. In both cases, almost 90% of the volatility is explained by the previous volatility. Regarding DCC parameters, the sum of $\theta_1$ + $\theta_2$ would be 1 if all the Conditional Correlation between share and market return was explained by the model, as theorized by Equation (4). Both parameters were significant and their sum is high, evidencing DCC persistency. The Conditional Correlation can be clarified by the graphic on Figure 1.

Figure 1 shows that the conditional correlation between these two variables is very high, reaching values higher than 0.96 during some periods, but also that DCC varies during the sample period. It is perceivable that in the beginning of the series, DCC was low and there was not an identifiable pattern, maybe because that was the beginning of ETFs fund history in Brazil, constituting a primitive period of their development. After some point of around 500 observations (August, 2006), the correlation reaches a stability landing.
Differently of what was verified in Table 2, not all coefficients were significant in the estimation of the Asymmetric DCC-Copula model to the variables share return and NAV variation. ARMA (1,1) coefficients are not significant for the variable Share return, that means that this variation cannot be predicted by the model. Regarding to GARCH parameters Alpha and Beta, the results point in the same direction as previous estimation, in the sense that the major part of NAV and share return volatility depend on their previous volatility.

DCC parameters $\theta_1$ and $\theta_2$ present a sum near 1 again, confirming a good model adjustment. Probably, this good fit is due to the flexibility of the copula function, that doesn’t depend on a specific kind of distribution, as verified by Hsu, Tse and Wang (2008). However, $\theta_1$ is higher than the previous estimation and $\theta_2$, smaller, that indicates that the Dynamic Conditional Correlation between Share Return and NAV variation presents a larger constant coefficient. This can be verified by Figure 2 which presents the graphic of Dynamic Conditional Correlation between share return and NAV variation.

Figure 2 shows out that during the beginning of the series, there was not a pattern of correlation, as was verified in Figure 1 for DCC of share return and market return. Next, DCC stabilizes near 1, even after the subprime crises, showing that there is a very close relationship between share return and NAV variation. The two series share the same variation for most of the sample period. This constancy is a result of a larger $\theta_1$ coefficient.

However, as the series approximates to its end, the correlation seems to lose its pattern, coincidently with a volatility increase in the univariate volatilities, due to the

| Parameter | Estimate | Std. Error | $t$ value | Pr(>|t|) |
|-----------|----------|------------|-----------|----------|
| Ma        | 0.1222   | 0.0308     | 3.9664    | 0.0001   |
| Ar (1)    | -0.1725  | 0.2036     | -0.8473   | 0.3968   |
| Ma (1)    | 0.1882   | 0.2018     | 0.9327    | 0.3510   |
| Omega     | 0.0605   | 0.0183     | 3.3131    | 0.0009   |
| Alpha (1) | 0.0822   | 0.0192     | 4.2727    | 0.0000   |
| Beta (1)  | 0.8980   | 0.0162     | 55.5507   | 0.0000   |
| Shape     | 9.8403   | 2.1483     | 4.5805    | 0.0000   |

| Parameter | Estimate | Std. Error | $t$ value | Pr(>|t|) |
|-----------|----------|------------|-----------|----------|
| Ma        | 0.0483   | 0.0382     | 1.2631    | 0.2066   |
| Ar (1)    | 0.8160   | 0.0402     | 20.2758   | 0.0000   |
| Ma (1)    | -0.8435  | 0.0274     | -30.7982  | 0.0000   |
| Omega     | 0.1050   | 0.0341     | 3.0789    | 0.0021   |
| Alpha (1) | 0.0941   | 0.0175     | 5.3889    | 0.0000   |
| Beta (1)  | 0.8765   | 0.0230     | 38.1271   | 0.0000   |
| Shape     | 6.4586   | 0.9624     | 6.7107    | 0.0000   |

| Parameter | Estimate | Std. Error | $t$ value | Pr(>|t|) |
|-----------|----------|------------|-----------|----------|
| DCC (\theta_1) | 0.1137 | 0.0617 | 1.8425 | 0.0654 |
| DCC (\theta_2) | 0.8852 | 0.0629 | 14.0766 | 0.0000 |
| m-Shape    | 4.0246   | 0.4296    | 9.3691    | 0.0000   |

<table>
<thead>
<tr>
<th>Information Criteria</th>
<th>Estimate</th>
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<tr>
<td>Akaike</td>
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<td>4.5669</td>
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Euro zone debt crisis. Again, it is possible to verify differences between the two crises. In this case, the Euro zone debt crisis has made the share return/NAV variation correlation to fall down to a lower standard than the share return/market return correlation. One possible explanation is that both the share and market return are very susceptible to speculation, but as NAV is a form of passive investment, is not so affected by speculation.

DCC between share and market return presented an important feature regarding the crisis signaling. This can lead to an explanation pointing that ETF share traders sensed the upcoming crisis. Another interesting feature is that the conditional correlation between share return and NAV is higher than the correlation between share return and market.

**Figure 2. Dynamic Conditional Correlation between Share Return and NAV variation**

**Conclusions**

The objective of this paper was to analyze the dynamics of share return and NAV variation of Brazilian ETFs and how they behave in relation to the Brazilian Exchange Market. The Dynamic Conditional Correlation (ENGLE, 2002) was used to verify the correlation between Share and Market return, besides the correlation between NAV variation and Market return.

Our results point that the correlation between Share and Market returns was higher than the correlation between NAV variation and Market return, indicating that the investor who buys ETF share is more exposed to Market risk than the risk of ETF fund portfolio. Notwithstanding that ETF portfolio seeks to mimic the market index, their shares may work at a different dynamics than its portfolio. Also, they are allowed to operate derivatives, what contributes to detach NAV variation of a spot market index.

Another important issue regarding the crisis periods is that DCC between Share and Market return showed that before the crisis, there was a correlation drop, indicating that ETF market suffered some kind of effect that could be a crisis forecast. But during the Euro zone debt crisis, the correlation drop happened concomitantly with the volatility increment, i.e., with the crisis. That can be because of different natures of the crises, since the former was a financial crisis and the latter, an economic crisis.

Regarding the correlation between share return and NAV variation, it was smaller than the previous DCC. Some similar characteristics remain, like the lack of a correlation pattern in the series beginning and the correlation drop during the Euro zone debt crisis, although these drops were higher than in the first case. But there was no correlation drop during the subprime crises, that may indicate that during the financial crisis the investors traded ETF shares by their NAV value, leaving aside speculation. When not in a financial crisis period, ETF’s returns are more linked with the overall market, but during financial crisis periods, investors seek to trade ETF shares by their NAV value. During the economic crisis, however, the opposite effect seems to occur: the correlation between Share and Market return remains higher than 0.95, but the correlation between Share return and NAV variation drops to very low standards.
References


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**Dinaminė koreliacija tarp Brazilijos BPF akcijų grąžos, GTV ir rinkos pakažto**

Santrauka

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