Performance and Persistence of Brazilian Hedge Funds during the Financial Crisis

(Desempenho e Persistência de Hedge Funds Brasileiros Durante a Crise Financeira)

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Abstract

This paper investigates the performance and persistence of the Brazilian hedge fund market using daily data from September 2007 to February 2011, a period marked by what was characterized by many as the world's worst financial crisis since the great depression of the 1930s. Despite the financial turmoil, the results indicate the existence of a representative group of funds with abnormal returns and evidence of a joint persistence of funds with time frames of one to three months. Individual evaluations of the funds, however, indicate a reduced number of persistent funds.

***Keywords*:** multimarket funds; hedge funds; alpha calculation; performance evaluation; persistence; Brazilian funds.

JEL codes: G11.

Resumo

Este artigo investiga o desempenho e a persistência do mercado de fundos de hedge no Brasil utilizando dados diários de setembro de 2007 a fevereiro de 2011, um período marcado pelo que foi caracterizado por muitos como a pior crise financeira mundial desde a grande depressão dos anos 1930. Apesar da turbulência nos mercados globais, os resultados indicam a existência de um grupo representativo de fundos com retornos anormais e evidência de persistência conjunta de fundos com prazos de um a três meses. Avaliações individuais dos fundos, no entanto, indicam um número reduzido de fundos que apresentam persistência.

***Palavras-chave*:** fundos multimercado; fundos de hedge, cálculo de alfa; avaliação de desempenho; persistência; fundos brasileiros.

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1. Introduction

The Brazilian hedge fund industry, also known as the multimarket fund industry, has shown rapid growth in recent years. In April 2011, Brazilian multimarket funds represented approximately R$397 billion (approximately $232 billion).[1] In 2005, this value was R$176 billion.[2] This increase is due to a number factors, including internal factors related to the sector itself,[3] a decline in the real interest rate in Brazil during this period and an increase in investors' interest this category of funds. Using daily data from September 2007 to February 2011, this study investigates the performance and persistence of the Brazilian hedge fund market. The main objective is to search for evidence of solid hedge fund management in relation to market benchmarks and to test whether this relationship is consistent throughout time (that is, to test whether the past performance of a fund may be a good indicator of future performance). Finally, we seek to analyze the main determinants of performance and persistence based on management fees, performance fees and adopted strategies.

Although the fund literature is vast, the shift in focus to hedge funds is a recent phenomenon. To test whether hedge funds deliver superior performance, Liang (1999) used a series of linear multivariate models to explain the dynamics of hedge fund returns. The main conclusions were that hedge funds are capable of delivering abnormal returns with a low systematic risk, making them a superior option to mutual funds. Given the flexibility of the portfolios that hedge funds might hold, however, linear analyses tend to underestimate the tail risk, as mentioned by authors such as Fung & Hsieh (2001). In a more recent study, Aggarwal & Jorion (2010) ran a vast analysis and, after controlling for biases on databases, showed that hedge fund performance is superior only during the first years of existence and that these performance tends to reduce 42 basis points for each additional year. This variable is not included on our analysis due to our limited sample (from 2007 to 2011), although it might be considered in future studies.

Regarding how performance indicators may be related to characteristics of the funds, Ackerman *et al.* (1999) concluded that the most important aspect is the performance fee. According to the authors, an increase from 0% to 20% in the performance fee has an estimated positive impact on the Sharpe ratio in 66% of the funds, without a simultaneous increase in the risk level of those funds.

From an operational point of view, it is possible to use a wide variety of performance indicators in the analysis of performance. According to Eling (2009), these

[1]This figure includes funds classified by Anbima (Associação Brasileira das Entidades dos Mercados Financeiro e de Capitais – Brazilian Association of Financial and Capital Market Entities) as multi-strategy multimarkets, interest and currency multimarkets, specific strategy multimarkets, multi-manager multimarkets, long and short neutral multimarkets and long and short directional multimarkets

[2]Data are obtained from the Economatica fund database, with the CVM (*Comissão de Valores Mobiliários* – Securities and Exchange Commission) database as the primary source.

[3]The regulation of funds varies greatly between countries, mainly in areas such as the use of the fund manager's own capital, different types of management strategies, the minimum capital necessary for participation, etc.

measures may be classified into five groups: return, risk, higher moments, correlation and performance adjusted for risk. In this study, the Sharpe ratio (1966) and Jensen's alpha (1968), both risk-weighted performance measures, are used. According to Eling (2009), these types of performance measures are robust choices compared to other indicators and, for this reason, are applied in this study.

Regarding persistence, researchers such as Park & Staum (1998) have used the Tremont Advisory Shareholders Services (TASS) database from 1986 to 1997, the contingency tables method and Spearman's rank-order correlation coefficient and concluded that there is persistence with a period of one year. However, another work with similar specifications (Malkiel & Saha, 2005) analyzed the period from 1996 to 2003 and found that there is no persistence over time frames of one year. Furthermore, studies conducted by Brown & Goetzmann (2003) and Capocci *et al.* (2005), which used regression as the statistical method and the Jensen's alpha as the best indicator of performance, did not find persistence for annual periods either. Additionally, their results were robust given the databases used: Center for International Securities and Derivatives Markets (CISDM), Hedge Fund Research (HFR) and TASS.

Similar to the objectives of the present study, Agarwal & Naik (2000b) analyzed a time horizon of three years (1995-1998) that was subdivided into time frames of three months. During this period, the performances of 167 funds were analyzed according to their alphas and information ratios. With respect to persistence, Agarwal & Naik (2000b) used the cross-product ratio and regressions and determined that there is strong evidence that quarterly persistence exists in fund performance. Jagannathan *et al.* (2010) conclude that persistence depends positively of the performance delivered by the fund. This evidence is corroborated by the analysis of Fung & Hsieh (2011), who concluded that the fraction of funds with significant and persistence superior performance is less than 20%.

Still, Do *et al.* (2010) reported evidence of persistence only for short-run winner status and of no persistence in market timing for Australian hedge funds from 2000 to 2005. Cavé *et al.* (2011) studied performance during the crisis and found that a selected sample of fund managers were able to deliver a superior performance by predicting the markets movements, although some presented mixed or even negative market timing.

It is noteworthy that, according to Eling (2009), there are no clear guidelines in the literature for the length of the period necessary to measure persistence. From one perspective, larger samples would certainly provide better data. However, the hedge fund manager market is dynamic, which means that very large samples are not appropriate for measuring the quality of managers because they frequently change funds. In this study, we did not encounter this second problem because the availability of data is limited and we do not cover a sufficiently long time frame.

Harri & Brorsen (2004) and Henn & Meier (2004) found that the choice of time frame leads to significant differences in the levels of persistence because there is a smoothness in the returns for shorter periods. According to Henn & Meier (2004),

this effect is due both to the presence of non-liquid assets in the portfolios of many funds and to the administered return. That is, many managers try to maximize the smoothness of the return time series. Another hypothesis, which is defended by Barès *et al.* (2003) and Jagannathan *et al.* (2010), is the effect known in the literature as the "hot hand", which assumes that assets under fund management that yield excellent returns in one period will do so in the following period.

In emerging markets, such as Brazil, the opportunities for short-selling and operations involving derivatives are limited and of poor liquidity. Hence, assessing the performance and persistence of hedge funds is even more vital in these environments, as mentioned by Eling & Faust (2010). Studies focusing specifically on the Brazilian fund market, however, are still relatively scarce.

Focusing on the ability of market timing, Leusin & Brito (2008) applied the parametric and non-parametric methods developed by Henriksson & Merton (1981) to conclude that 34.57% of the analyzed funds delivered a positive alpha but that only 1.65% were significantly positive at a 95% confidence level. Using a different approach, Castro & Minardi (2009) investigated whether active portfolio managers of Brazilian stock mutual funds displayed superior selection ability from 1996 to 2006. Their main conclusion was that only 4.8% of the active funds presented a significantly positive alpha for net returns. This result was corroborated by Gomes & Cresto (2010), who recently studied the performance of long-short multimarket funds in Brazil by estimating the CAPM model with market timing via General Method of Moments (GMM). Their results indicated that 25% of the funds in the sample delivered a significant Jensen's alpha, in most cases because the market-timing coefficient was negative, thus reducing the returns. Xavier (2008) analyzed the persistence of performance for 44 multimarket funds with equity and leverage and found evidence of persistence in the Sharpe ratio for windows of one and two years.

In summary, with the improvement in the quality of databases in recent years, we have observed an increasing number of works using quantitative finance techniques to evaluate hedge funds (Eling & Faust, 2010). However, the results obtained in the literature to date are contradictory. This inconsistency is, in part, due to the use of different time frames, the application of different statistical methods and the use of different databases.

This article draws on the existing literature by analyzing a representative emerging market in light of the recent financial turmoil of 2008 and 2009. We explore, through daily observations, a unique data set of Brazilian hedge funds. It is worth noting that due to Brazilian regulations, the data are audited by independent auditing companies and reported daily to the Brazilian Securities Commission (CVM – *Comissão de Valores Mobiliários*). The presence of daily observations and the guarantee of audited data are, without a doubt, a significant contribution to the literature.

We begin our study by first analyzing performance through the accumulated return, the Sharpe ratio (1966) and Jensen's alpha (1968). The latter is analyzed

with three linear models using alternative factors. Second, we evaluate persistence using the contingency tables method, Spearman's rank correlation coefficient and a simple parametric regression. Finally, we examine the relationship between the characteristics of the funds (i.e., management fees, performance fees and management strategy) and performance and persistence. In addition, we study the influence of persistence on performance or, rather, whether more persistent funds tend to perform better or worse than those funds that are less persistent.

This paper is divided into four sections, including this introduction. The next section presents the pricing models, the performance indicators and the statistical methods used in the performance study. The third part describes the data used in the study and presents the results. In the final section, the conclusions of this work are presented, along with the limitations and possible extensions.

2. Methodology

2.1 Performance Indicators

The first performance indicator used was the net return on management and performance fees. Because we use daily data (for working days), the *average monthly cumulative return* of a fund i for a period of T working days is calculated by the following equation:

$$R_i^{ac} = (\prod_{t=1}^{T}(1 + R_{it}))^{22/T} - 1$$

where R_{it} denotes the daily return of the fund. The Sharpe ratio was selected as one of the methods to evaluate performance because of its appeal and because it provides performance rankings that are identical to those of most modern indices, such as the Modigliani index. The Sharpe ratio represents the risk premium given one additional unit of total risk for the fund, see Eling (2009). It can be calculated using the following formula:

$$S_i = \frac{E(R_{it} - R_f}{\sigma_i}$$

where S_i is the Sharpe ratio of fund i during that period, R_f is the return of the risk-free asset during that period and σ_i is the standard error of the returns of the fund i during that period.

The use of the Sharpe ratio is problematic in the case of multimarket funds because that category involves significant investments in the derivatives market, making the return structure non-linear and leading to a lack of normality across the returns. However, the Sharpe ratio is still widely applied in the literature and is used by many fund managers.

Additionally, Jensen's alpha (1968) was also used to evaluate performance. It is the intercept of the regressions performed by the pricing models; it represents

the capacity of a manager to obtain abnormal returns that are not inherent to the risk exposure factors of the model.

The simplest and most well-known model is the CAPM, which was first developed by Sharpe (1964). The CAPM is based on the following assumptions: i) no investor is large enough to change market prices; ii) all investors possess the same expectations and the same investment time horizon; iii) all parties use the Markovitz optimization process based on the risk-return criterion; iv) all investors have access to the same universe of investments (limited to assets negotiated in the market); vi) all investors can apply or borrow at the same rate; and vi) there are no transaction or information costs.

Mathematically, the equilibrium ratio of the model can be defined as follows:

$$R_{it} - R_f = \alpha_i + \beta_i(R_{mt} - R_f)$$

where R_f is the risk-free asset return rate and β_i is the beta coefficient, which measures the correlation of the portfolio return, R_{it}, to the overall market return denoted by R_{mt}. This model can be estimated econometrically using the index model represented by the following equation for the return series for asset i:

$$R_{it} - R_f = \alpha_i + \beta_i(R_{mt} - R_f) + \epsilon_{it} \quad (1)$$

where ϵ_{it} is the noise estimation. Although many of the hypotheses described above are difficult to verify empirically and testing with real data is impossible, the model is still widely applied in practice, especially as a guideline for investment decisions.

One critique of the CAPM specification is that the market index in the majority of Brazilian studies is represented by the *Ibovespa* (the main stock market Brazilian index). Some may claim that the *Ibovespa* is not representative of the hedge fund industry, given that hedge funds allow short positions and investments in other assets not listed on the market. Therefore, in an attempt to provide more consistency to our conclusions, we opted to use a specific hedge fund index reported by Anbima, *Associação Brasileira das Entidades dos Mercados Financeiro e de Capitais* (Brazilian Association of Financial and Capital Market Entities), and the *IHFA* (Anbima Hedge Fund Index) market index, which will be explained below, as representative of the market portfolio for hedge funds. The following equation thus applies:

$$R_{it} - R_f = \alpha_i + \beta_i(R_{IHFA,t} - R_f) + \epsilon_{it} \quad (2)$$

where $R_{IHFA,t}$ is the daily return of the IHFA. The inclusion of an index in pricing models is widely used in the literature, as in Agarwal & Naik (2000a).

Researchers such as Fung & Hsieh (1997) and Brown *et al.* (1999) stress the importance including factors specific to hedge funds, such as characteristic indices (Brown *et al.*, 1999). In the Brazilian case, the expression "Brazil kit" is common in the multimarket fund market; it consists of taking positions bought on the

market along with the risk-free interest rates and then sold in American dollars. To represent differences in styles, we propose the following style-factor model that includes the return of the public title indices IRF-M and IMA-B[4] and any variations in the exchange rate:

$$R_{it} - R_f = \alpha_i + \beta_{1,i}(R_{IHFA,t} - R_f) + \beta_{2,i}(R_{IRF-M,t} - R_f) + \beta_{3,i}(R_{IMA-B,t} - R_f) + \beta_{2,i}(R_{E,t} - R_f) + \epsilon_{it} \quad (3)$$

where $R_{IRF-M,t}$, $R_{IMA-B,t}$ and $R_{E,t}$ represent, respectively, the daily return of investments in the IRF-M and IMA-B indices and the Brazilian Real/U.S. dollar exchange rate, R$/U.S.$.

In specifications (2) and (3), the coefficient α_i represents the abnormal returns that fund i obtains, that is, the returns obtained by a risk factor that are not explained by the respective model. In other words, the coefficient α_i indicates the individual ability of the managers of each fund.

Estimation Methods

The estimations of models (1), (2) and (3) were performed by ordinary least squares (OLS) and adjusted by the covariance matrix of Newey & West (1987), which corrects the problems of heteroscedasticity and the autocorrelation of errors.

Although OLS is a generally robust estimation method, according to Fusai & Roncoroni (2008), the OLS estimates are extremely sensitive to outliers in the sample. Therefore, to check the robustness of the estimations, the least trimmed squares (LTS), a methodology that corrects for the possible presence of outliers in the sample, was also applied. Moreover, other studies of Brazilian funds have found inconsistent information and typing errors in the databases, a problem that is addressed by the LTS.

The intent of applying the LTS is to estimate the parameters of models (1), (2) and (3) while excluding the extreme high or low values (that is, a Winsorized estimation). Following Fusai & Roncoroni (2008), this methodology truncates values larger or smaller than the values of the upper or lower γ quantiles to the γ quantile values.

In mathematical terms, we want to find the values of the arguments that minimize the following loss function:

$$[\alpha_i, \beta_i] = \overset{argmin}{\alpha_i \beta_i} \sum_{t=1}^{T} \rho(r_{i,t} - \alpha_i - \beta_i r_{m,t})$$

[4]More information on the methodology used to construct these indices can be found on the Anbima website at `http://www.anbima.com.br`.

The symmetric loss function, ρ, is defined as follows:

$$\rho(\gamma) = \begin{cases} q_{\gamma}^2, \gamma < q_{\gamma} \\ \gamma^2, q_{\gamma} \leq \gamma \leq q_{1-\gamma}, \\ q_{1-\gamma}^2, \lambda > q_{1-\gamma} \end{cases}$$

where q_{gamma} and $q_{1-\gamma}$ are the values of the relevant quantiles. One downside of this methodology is that the value of γ must be chosen ex-ante. Because we do not want to exclude a large amount of data, we adopt = 0.05, a usual level applied in economics and statistics.

Persistence Indicators

To measure persistence, we used the Spearman's correlation coefficient, contingency table methods (i.e., the cross-product ratio and chi-square test) for two periods and the parametric method based on the regression of present values with past values.

The Spearman's rank-order correlation coefficient is calculated for all prior and subsequent periods. For example, if we are analyzing a time frame of 66 working days (3 months), the coefficient captures the relationship between the performance ranking of the funds in the 66 days prior (in relation to some performance indicator) and the 66 days after a given date. This technique is used repeatedly to analyze the entire period. Unlike a linear correlation, Spearman's correlation seeks only a monotonic relationship among the rankings in different periods. Persistence is observed when this coefficient is positive and significant. This method is important because it allows us to identify the intensity and direction of the relation and because it is non-parametric. That is, this method does not require the assumption of a certain probability distribution. Because there are no ties in the classifications, the Spearman's rank-order correlation coefficient (SPR) between period X and period Y is given by

$$\rho(X_i, Y_i) = 1 \frac{6 \sum_i (R(X_i) - R(Y_i))^2}{n(n^2 - 1)}$$

where $R(X_i)$ is the position of fund i in list X (for the prior period), $R(Y_i)$ is the position of fund i in list Y (for subsequent period) and n is the number of funds. According to Eling (2009), the significance of this coefficient can be tested by Fisher's T statistic, which follows Student's-t distribution with $n - 2$ degrees of freedom:

$$T_{SPR} = \sqrt{n-2}(\frac{SPR}{\sqrt{1 - SPR}})$$

Contingency table methods are based on defining winners and losers. A fund is a winner (W) or a loser (L) in relation to the median of the funds for a performance-specific measure. Because the approach assumes two periods, the funds that are

above the median in the two periods under analysis are considered WW (winners), while those that are consistently below the median are considered LL (losers). The funds that change their comparative performance over time are either WL (a declining relative performance over time) or LW (an improving relative performance over time). Similar to Spearman's rank-order correlation coefficient, this method has the advantage of being non-parametric.

We can consider two test statistics using this approach. The first is the cross-product ratio (CPR), which is the ratio of persistent funds to non-persistent fund:

$$CPR = \frac{WW \times LL}{WL \times LW}$$

Under the null hypothesis that there is no persistence, this coefficient should be close to one. That is, the number of funds that persist in the winner or loser categories is similar to the number of funds that do not persist. The significance of this coefficient can be tested by a chi-square test. The chi square test statistic compares the expected and the observed distributions of WW, WL, LW and LL; it follows a χ^2 distribution with one degree of freedom (Eling, 2009). In other words,

$$\chi^4 = \frac{(WW - D_1)^2}{D_1} + \frac{(WL - D_2)^2}{D_2} + \frac{(LW - D_3)^2}{D_3} + \frac{(LL - D_4)^2}{D_4} \quad (4)$$

where the variables D_1, D_2, D_3 and D_4 are defined by $D_1 = (WW + WL)(WW + LW)/n$, $D_2 = (WW + WL)(WL + LL)/n$, $D_3 = (LW + LL)(WW + LW)/n$, and $D_4 = (LW + LL)(WL + LL)/n$, with n indicating the total number of funds.

However, neither of these two methods captures the fund-to-fund performance; that is, we only obtain a vision of persistence specific to the funds of the sample. One possible use of the χ^2 statistic is in fund-to-fund analysis. For this purpose, it is sufficient to use the percentage of times that the fund was above or below the median (i.e., was classed as W or L, respectively) and to construct sequences for each fund with respect to WW, WL, LW and LL. The measure of individual persistence is then calculated using (4), with n indicating the total number of periods.

Another measure of individual persistence for each fund is obtained by the parametric regression method. This measure consists of the regression of the performance indicator during period t to that of period $t - 1$, that is,

$$I_{it} = \alpha + bI_{i,t-1} + \epsilon_{it} \quad (5)$$

In this regression, a positive and significant angular coefficient ($b > 0$) provides evidence of persistence. The significance of this coefficient may be tested

through Student's-t test in which the null hypothesis indicates the lack of persistence. Because this is a parametric method, we know that many of the hypotheses in the regression, such as normal errors and lack of correlation over time, may not be verified in practice, as has been empirically demonstrated in the mutual fund literature (Eling, 2008). In addition, the smoothness of the returns of multimarket funds over time indicates that detecting persistence using these methods, particularly using correlation, may in fact be due to the presence of serial autocorrelation. Taking this fact into account, we estimate (5) with a Newey & West (1987) correction, which provides robust estimators for serial correlation and heteroscedasticity.

3. Data Description

In this paper, we use the Anbima database. The period of analysis is from September 28th, 2007 to February 28th, 2011, with 859 daily observations. Obviously, this time frame places certain limitations on definitive conclusions due to the limited period involved; however, there are two relevant factors that justify this choice. First, the IHFA, which is one of the benchmarks used, only began to be calculated in June 2007. Furthermore, we use higher-frequency data consisting of daily observations for each fund, as compared to the majority of studies in the literature that use monthly, quarterly or annual returns. This characteristic is particularly important in periods of high volatility and financial stress, as was observed from the mid of 2008 to last quarter of 2008, and in cases of rapid recovery rallies, starting in the last quarter of 2008 to the end of 2009.

A total of 161 funds were chosen. They consisted of funds that were present in the IHFA at some point and possessed a complete sample for the study period. Despite the relatively small number of funds compared to American studies, which use thousands of funds, this sample is representative because it contains funds from the main institutions in the Brazilian market and funds that, according to the selection criteria of Anbima,[5] possess *de facto* hedge fund characteristics. These choices are based on two concerns. First, because the analysis period covers the financial crisis, the funds that emerged after the end of the crisis or left the market before the onset of the crisis may render the results less consistent. Second because one of the objectives is to compile a ranking that evaluates the funds, they should still be active so that the results can be applied by investors (Andaku & Pinto, 2003).

The exclusion of funds that are no longer active generates bias in the survival rate. Malkiel & Saha (2005) find evidence that if non-operative funds are discarded, the level of persistence increases. However, Eling (2009) concludes that approaches with survival biases do not systematically lead to higher or lower levels of persistence. Therefore, we believe that the existence of this problem in the analysis does not invalidate the results; rather, it provides the results with greater applicability from the perspective of investors.

[5]These criteria will be explored below.

In the Brazilian market, there is no consensus regarding which risk-free rates should be used. This study uses the daily rate based on the Interbank Certificate of Deposit (*ICD*) because the funds in question use this rate to calculate their performance fees. In turn, two indicators are used for the market: returns from the Ibovespa index, and the IHFA.

The IHFA is calculated daily by Anbima as follows. All of the multimarket funds that fit all the Anbima's criteria for more than one year are classified as hedge funds. Then a theoretical portfolio is calculated at the beginning of each quarter where the weight as a percentage of each of the funds corresponds to its net worth divided by the total net worth of all the funds present in the index. The number of points that each fund has in the IHFA is determined by the weight multiplied by the index of the day prior to the rebalancing, which is performed quarterly. Therefore, the index is the sum of the products of the theoretical quotas of each fund (i.e., the index points) and the values of the quotas.[6] The data on the ICD rates and on the Ibovespa were obtained from the Thomson/Reuters Datastream database. The IHFA data were obtained from Anbima.

Table 1 presents the descriptive statistics of the funds, grouped by strategy, together with the benchmarks used. We observed that the return on the funds was greater than the returns from the Ibovespa and the ICD during the period in question. As expected, the hypothesis of normality for the returns is rejected in all cases. It is worth noting that during the period analyzed, there was a strong fall in the markets due to the peak of the worldwide financial crisis in September 2008, and there was a strong recovery phase beginning in the last quarter of 2008. Therefore, the data consist of bearish and bullish phases.

[6]For details on the methodology for selecting IHFA funds, see `http://www.andima.com.br/ihfa/ihfa_cartilha.asp`.

Table 1
The descriptive statistics for the IHFA member hedge funds and market benchmarks

		Returns[a]				
	Number of funds	Mean(%)[a] Deviation (%)[a]	Standard	Asymmetry (Excess)	Kurtosis (%)	Jarque-Bera
Ibovespa		0.41033	1.065.858	0.33970	614.832	$<$0.0001
ICD		0.91050	0.01849	0.17948	-0.89757	$<$0.0001
IHFA		133.900	0.82441	-0.58813	1.248.549	$<$0.0001
IRF-M		143.520	0.74855	-151.707	2.396.678	$<$0.0001
IMA-B		165.157	131.782	-0.51902	918.306	$<$0.0001
DS		-0.42649	554.265	0.64190	1.296.359	$<$0.0001
Multi-strategy Multimarkets	80	129.062	109.464	-0.06877	5.833.054	0%
Macro Multimarkets	39	108.235	226.703	-0.98506	3.548.580	0%
Long/Short – Neutral	22	131.293	102.403	0.07031	687.237	0%
Long/Short – Directional	9	128.204	175.934	-0.46362	1.219.108	0%
Interest and Currency Multimarkets	4	122.919	0.16977	-110.707	4.343.059	0%
Specific Strategy Multimarkets	4	118.009	123.494	-479.653	12.873.765	0%
Multi-manager Multimarkets	3	135.299	0.94570	-0.45493	1.855.076	0%
All Funds	161	123.963	138.387	-0.44425	4.382.377	0%

[a] Monthly Values.

Note: The sample includes 859 daily observations from September 28th, 2007 to February 28th, 2011. The mean uses the same weight for every fund and the standard deviation, the asymmetry and the kurtosis statistics uses the mean of all funds. The Jarque-Bera tested normality individually for each fund and the percentage represents the fraction of funds that present evidence of normal returns. For the factors, the value $<$0.0001 is the p-value of the Jarque-Bera test.

In Figure 1, we observe the accumulated returns for the Ibovespa, the ICD and the IHFA hedge fund index. It is interesting to note that volatility is much lower in the IHFA than in the Ibovespa. It is also evident that the IHFA returns closely follow the ICD returns, probably due to the hedge funds being strongly positioned in fixed income instruments to lowering volatility and take advantage of high local interest rates.

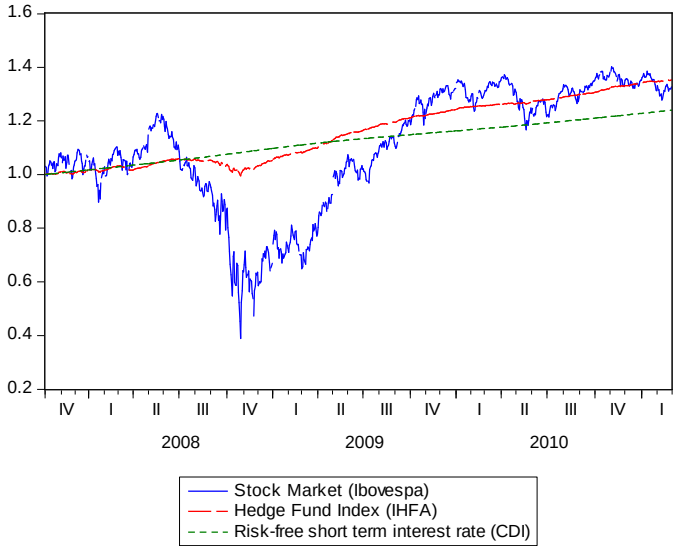

Figure 1
The accumulated returns of the Brazilian stock market (Ibovespa), the hedge fund index (IHFA) and accumulated short term risk-free, (*ICD*)

4. Results

Table 2 presents the estimations of the performance indicators from the methodology section. The results show that a high percentage of funds with positive and statistically significant alphas. These alphas are mainly for the CAPM model, followed closely by the Style model and the CAPM-IHFA. In the initial analysis, the performance indicators for this group of funds present better results than others in the Brazilian literature. As Leusin & Brito (2008) concluded, only 1.65% of funds delivered a higher performance in terms of selection. Additionally, Gomes & Cresto (2010) found that only 25% of funds had a positive and significant alpha. Therefore, the results of greater than 40% generated by our analysis are certainly grounds for discussion. At first glance, these results may seem strange, but the sample used in this study is a restricted subsample of the Brazilian multimarket funds. They were selected by Anbima as the actual hedge funds for their

positions and strategies. Hence, the possible outcomes of the analysis were biased toward better results from the beginning. Another possible explanation is that we used a period of significant financial stress in which the use of government bonds indexed to high interest rates avoided heavy losses by the Brazilian hedge funds (see Figure 1).

Moreover, this table indicates that for all the models, there is an increase both in the mean and percentage of significant alphas if we use the LTS estimate instead of the OLS. This result is interesting because it states that, excluding the outliers, more selection ability can be inferred from the data.

In Table 3, we evaluate the exposure of the funds to risk factors in the three models. We conclude that the funds exhibit a significant but not elevated exposure to *Ibovespa*, which is a result also reported by Gomes & Cresto (2010). This finding suggests that the funds in the sample do adopt strategies that depend on, but are not heavily influenced by, stock market movements. In terms of the IHFA, the extent to which the funds are exposed to the market portfolio is higher, indicating that most of the funds have their systematic risk associated with the same factors. This difference is clear when comparing the mean betas of the two models because the IHFA's beta is noticeably higher. In relation to the other risk factors, the majority of the funds do not demonstrate exposure to public titles and currency exchange. For those that present exposure to these factors, a greater number of the funds are exposed to public titles than to currency exchange, and the positive exposures are generally greater than the negative exposures to these factors. These results show that the factors in question systematically capture the risk exposure of the funds. Moreover, the amount by which the IHFA's betas are higher than those of the *Ibovespa* suggests that the returns of the hedge funds are not highly sensitive to the market return.

Table 2
The Sharpe's mean and Jensen's Alpha mean and percentage of positive and significant (Monthly Values) performance indicators

	Number of funds	Sharpe	Mean Alpha CAPM (%)	Mean Alpha CAPM (%) robust	Mean Alpha IHFA(%)	Mean Alpha IHFA(%) robust	Mean Alpha Style(%)	Mean Alpha Style(%)	Robust
Multi-strategy Multimarkets	80	0.5890	0.2661	0.2617	0.1359	0.1828	0.1158	0.1770	
				65%	76%	43%	63%	49%	61%
Macro Multimarkets	39	0.4463	0.2788	0.4438	-0.0198	0.2741	-0.03359	0.2999	
				56%	64%	31%	41%	31%	59%
Long/Short – Neutral	22	0.4694	0.2938	0.2985	0.2367	0.2607	0.25129	0.2716	
				64%	76%	50%	67%	50%	67%
Long/Short – Directional	9	0.2934	0.3270	0.3088	0.1797	0.1863	0.20000	0.2130	
				22%	33%	11%	22%	11%	22%
Interest and Currency Multimarkets	4	18.931	0.2159	0.2179	0.2020	0.2126	0.18000	0.2034	
				100%	100%	100%	100%	100%	100%
Specific Strategy Multimarkets	4	0.2738	0.1831	0.2692	-0.0016	0.1669	0.01985	0.1910	
				25%	50%	25%	75%	25%	50%
Multi-manager Multimarkets	3	0.6299	-0.4690	0.3313	-0.7163	0.1700	-0.68438	0.2133	
				67%	100%	0%	100%	0%	100%
All Funds	161	0.5469	0.2576	0.3104	0.0958	0.2131	0.08633	0.2206	
				60%	71%	39%	58%	43%	60%

Note: The sample includes 859 daily observations from September 28th, 2007 to February 28th, 2011 for 161 funds. Each column represents one specification and estimation method. The title "CAPM" indicates the CAPM with Ibovespa and the title "IHFA" for the CAPM index model using IHFA as the market benchmark.When the estimation method is OLS there is no indication and when it is LTS the column title receives the term "robust". The mean uses the same weight for each fund. The percentages bellow the means indicate the fraction of funds with positive and significant alpha in the period analyzed.

Table 3
The mean and percentage of positive and significant estimated betas

Panel A: CAPM and IHFA

	Number of funds	Beta CAPM	Beta CAPM robust	Beta IHFA	Beta IHFA robust
Multi-strategy Multimarkets	80	0.0155	0.0160	0.3337	0.2792
		76%	77%	85%	92%
Macro Multimarkets	39	0.0704	0.0388	10.755	0.6042
		79%	85%	82%	87%
Long/Short – Neutral	22	0.0039	0.0007	0.1966	0.1288
		32%	38%	64%	62%
Long/Short – Directional	9	0.0271	0.0185	0.6622	0.4291
		33%	44%	78%	78%
Interest and Currency Multimarkets	4	0.0027	0.0009	0.0496	0.0166
		50%	50%	75%	75%
Specific Strategy Multimarkets	4	0.0437	0.0247	0.6593	0.3661
		50%	50%	50%	50%
Multi-manager Multimarkets	3	0.0544	0.0303	0.8877	0.5700
		67%	100%	67%	100%
All Funds	161	0.0290	0.0196	0.5244	0.3443
		67.0%	70.9%	80.0%	84.8%

Note: The sample includes 859 daily observations from September 28th, 2007 to February 28th, 2011 for 161 funds. Each column represents one specification and estimation method. The CAPM using Ibovespa is identified by CAPM and the model using IHFA by IHFA. When the estimation method is OLS there is no indication and when it is LTS the column title receives the term "robust". The mean uses the same weight for each fund. The percentages bellow the means indicate the fraction of funds with positive and significant beta in the period analyzed.

The evaluation of persistence is presented in Table 4. Various interesting factors can be observed. First, the mean accumulated returns and the Sharpe's ratio in the joint tests (panel A) demonstrated generally better performance persistence than did the Jensen's alphas. Second, in the joint persistence analysis, timeframes of three months generally exhibited greater persistence than those of one month for Spearman's correlation and χ^2 tests, a result not as strongly observed for the CPR.

Examining the individual tests in panels B and C, we found that the persistence index is far lower than the joint persistence tests of the funds. We also found that the parametric tests (panel B) present much higher evidence of persistence than indicated by the non-parametric tests (panel C). Finally, individual persistence declines considerably if we increase the time horizon from three months to six months.

Panel B: Style Model

	Number of funds	Beta IHFA	Beta IHFA robust	Beta IMA-B	Beta IMA-B robust
Multi-strategy Multimarkets	80	0.445	0.261	-0.017	0.021
		84%	85%	23%	29%
Macro Multimarkets	39	1.081	0.657	0.081	0.080
		74%	79%	44%	44%
Long/Short - Neutral	22	0.225	0.155	-0.004	-0.001
		64%	62%	9%	10%
Long/Short - Directional	9	0.796	0.532	-0.046	-0.077
		78%	78%	0%	0%
Interest and Currency Multimarkets	4	0.015	-0.001	-0.012	0.005
		0%	0%	0%	25%
Specific Strategy Multimarkets	4	0.658	0.417	-0.027	-0.035
		50%	50%	0%	25%
Multi-manager Multimarkets	3	0.878	0.676	0.062	-0.002
		67%	100%	0%	33%
All Funds	161	0.5888	0.3602	0.0082	0.0242
		75%	77%	23%	28%

	Beta IRF-M	Beta robust	Beta DS	Beta robust
Multi-strategy Multimarkets	0.110	0.002	0.000	0.000
	32%	22%	4%	5%
Macro Multimarkets	-0.081	-0.206	0.012	0.010
	18%	15%	23%	23%
Long/Short – Neutral	-0.057	-0.047	0.000	0.002
	9%	10%	5%	5%
Long/Short – Directional	-0.243	-0.034	-0.002	0.007
	11%	0%	11%	22%
Interest and Currency Multimarkets	0.107	0.033	0.000	0.000
	75%	75%	0%	0%
Specific Strategy Multimarkets	-0.048	-0.061	-0.013	-0.001
	0%	0%	25%	25%
Multi-manager Multimarkets	-0.193	-0.190	-0.011	0.008
	0%	0%	0%	67%
All funds	0.0110	-0.0614	0.0022	0.0033
	24%	18%	9%	12%

Note: The sample includes 859 daily observations from September 28th, 2007 to February 28th, 2011 for 161 funds. Each column represents one specification and estimation method. The CAPM using Ibovespa is identified by CAPM and the model using IHFA by IHFA. When the estimation method is OLS there is no indication and when it is LTS the column title receives the term "robust". The mean uses the same weight for each fund. The percentages bellow the means indicate the fraction of funds with positive and significant beta in the period analyzed.

We conclude that while there is evidence of joint persistence, only a select group of individual funds is persistent, especially if we consider a 3-month time horizon. Such results highlight the importance of diversification from an investor's perspective, not only in terms of risk but also with respect to performance persistence.

Table 4
The performance persistence indicators

	Number of funds	Return	Sharpe	CAPM Alpha	IHFA Alpha	Style Alpha	Return	Sharpe	CAPM Alpha	IHFA Alpha	Style Alpha
		1 month					3 months				
A. Joint Tests											
Spearman's Correlation Coefficient		67.57%	86.49%	59.46%	62.16%	40.54%	81.82%	90.91%	81.82%	81.82%	54.55%
CPR		59.46%	54.05%	35.14%	51.35%	37.84%	45.45%	45.45%	27.27%	54.55%	45.45%
X^2		54.05%	56.76%	32.43%	37.84%	35.14%	63.64%	81.82%	63.64%	63.64%	45.45%
B. Individual Tests – Regression											
Multi-strategy Multimarkets	80	36.25%	35.00%	38.75%	40.00%	28.75%	15.00%	12.50%	13.75%	27.50%	26.25%
Macro Multimarkets	39	41.03%	66.67%	56.41%	53.85%	48.72%	15.38%	10.26%	12.82%	48.72%	41.03%
Long/Short - Neutral	22	22.73%	40.91%	31.82%	0.00%	4.55%	31.82%	22.73%	22.73%	31.82%	36.36%
Long/Short - Directional	9	88.89%	66.67%	66.67%	44.44%	44.44%	0.00%	33.33%	22.22%	11.11%	0.00%
Interest and Currency Multimarkets	4	50.00%	25.00%	25.00%	50.00%	75.00%	50.00%	0.00%	25.00%	75.00%	25.00%
Specific Strategy Multimarkets	4	25.00%	25.00%	25.00%	50.00%	0.00%	50.00%	50.00%	25.00%	25.00%	25.00%
Multi-manager Multimarkets	3	0.00%	100.00%	66.67%	100.00%	66.67%	0.00%	0.00%	0.00%	100.00%	0.00%
All Funds	161	37.89%	45.96%	43.48%	39.75%	32.30%	18.01%	14.91%	15.53%	34.78%	29.19%
C. Individual Tests – X^2		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Multi-strategy Multimarkets	80	8.75%	6.25%	10.00%	6.25%	11.25%	6.25%	18.75%	3.75%	8.75%	7.50%
Macro Multimarkets	39	2.56%	2.56%	7.69%	12.82%	12.82%	2.56%	0.00%	5.13%	28.21%	2.56%
Long/Short – Neutral	22	4.55%	9.09%	27.27%	4.55%	4.55%	9.09%	13.64%	4.55%	0.00%	0.00%
Long/Short – Directional	9	22.22%	0.00%	22.22%	0.00%	22.22%	44.44%	11.11%	55.56%	11.11%	0.00%
Interest and Currency Multimarkets	4	25.00%	25.00%	0.00%	25.00%	25.00%	50.00%	0.00%	0.00%	25.00%	25.00%
Specific Strategy Multimarkets	4	25.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	25.00%	0.00%	0.00%
Multi-manager Multimarkets	3	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	33.33%	0.00%	0.00%	0.00%
All Funds	161	8.07%	5.59%	11.80%	7.45%	11.18%	8.70%	12.42%	7.45%	12.42%	4.97%

Note: The joint tests indicate the percentage of the time frames analyzed in which the ranking (based on the respective indicator) proved to be persistent. The individual tests evaluate the percentage of funds that showed an indication of persistence during the time frame analyzed. In both cases, we adopted a significance level of 5%. The alpha results are derived from the OLS results.

After separately analyzing performance and persistence, we turned our attention to the relationship between the two. After running various regression specifications among the performance indicators and test statistics for individual persistence, the results indicate a weak relationship between performance and persistence; furthermore, when the relationship is statistically significant, it is not always positive. This result is the same for OLS and LTS. According to these results, we could not confirm that performance and persistence are related. To save space, we do not report the results.[7]

Additionally, we evaluated whether the funds' characteristics can serve as explanatory variables for the performance and returns. Table 5 presents the results for the performance indicators. The most interesting result is the relationship between performance and management fees, which has positive and statistically significant coefficients for the mean-accumulated returns and TLS alpha estimates. In our evaluation, this relationship may indicate that higher alphas or mean-accumulated returns allow fund managers to charge higher management fees, although we cannot in principle discard the opposite causality. The strategy analysis appears to be of little relevance. In relation to the determinants of persistence, a similar analysis was conducted using the parametric coefficients of equation (5) as dependent variables. Again, no significant results were found, and to save space, we do not report the results[8] (that the characteristics of a fund are not related to its persistence).

[7]Results are available upon request to the authors.
[8]Results are available upon request to the authors.

Table 5
The relationship among performance and fund characteristics

	Dependent Variable							
	Returns	Sharpe	Alpha Ibovespa	Alpha IHFA	Alpha Style	Alpha Ibovespa robust	Alpha IHFA robust	Alpha Style robust
Constant	0.328682	0.591784**	-0.000674	-0.000808	-0.000813	-0.025373	-0.025463	-0.025512
	(0.738241)	(0.255379)	(0.003341)	(0.003402)	(0.003513)	(0.017442)	(0.017458)	(0.017491)
Management fee	69.759920***	-8.566.139	0.037107	0.039043	0.041376	1.262490**	1.263811**	1.266859**
	-2.163.193	-7.483.094	(0.097912)	(0.099682)	(0.10293)	(0.511079)	(0.51155)	(0.512528)
Performance fee	-2.015.439	-0.659108	-0.001607	-0.001554	-0.001598	0.004824	0.004868	0.004875
	-1.644.623	(0.568922)	(0.007444)	(0.007579)	(0.007825)	(0.038856)	(0.038892)	(0.038966)
Multi-strategy Multimarketsa	0.267900	0.276631	0.001397	0.001444	0.001443	-0.000469	-0.000450	-0.000465
	(0.503427)	(0.17415)	(0.002279)	(0.00232)	(0.002395)	(0.011894)	(0.011905)	(0.011928)
Macro Multimarketsa	-0.212739	0.150398	0.000458	0.000408	0.000376	0.000665	0.000644	0.000645
	(0.52537)	(0.18174)	(0.002378)	(0.002421)	(0.0025)	(0.012412)	(0.012424)	(0.012448)
Long/Short – Neutrala	0.017310	0.182383	0.000430	0.000489	0.000465	-0.013532	-0.013505	-0.013535
	(0.562328)	(0.194525)	(0.002545)	(0.002591)	(0.002676)	(0.013286)	(0.013298)	(0.013323)
Interest and Currency	0.667035	1.511324***	0.000755	0.000854	0.000836	0.012987	0.013054	0.013069
and Multimarketsa	(0.882253)	(0.305196)	(0.003993)	(0.004066)	(0.004198)	(0.020844)	(0.020863)	(0.020903)
Specific Strategy Multimarketsa	0.216818	-0.058790	0.000526	0.000537	0.000526	0.005751	0.005766	0.005779
	(0.859249)	(0.297238)	(0.003889)	(0.00396)	(0.004089)	(0.020301)	(0.020319)	(0.020358)
Multi-manager Multimarketsa	0.130364	0.268799	0.000056	0.000038	0.000024	0.003839	0.003828	0.003844
	(0.956031)	(0.330718)	(0.004327)	(0.004405)	(0.004549)	(0.022587)	(0.022608)	(0.022651)
R^2	0.085895	0.202710	0.006891	0.007287	0.007160	0.054738	0.054628	0.054673
Observations	161	161	161	161	161	161	161	161

*,**,*** represent significances of 10%, 5% and 1%, respectively.
[a] Dummy variables (1 if it belongs to the category, 0 otherwise). The benchmark group is the Long/Short directional funds.
Note: The sample includes 859 daily observations from September 28th, 2007 to February 28th, 2011 for 161 funds. Each column represents a different performance indicator regressed to fund characteristics. The estimation method is OLS with robust (Newey-West) standard errors. Values in parenthesis indicate standard deviations, the asterisks *,** and *** indicates statistical significance at 10%, 5% and 1%, respectively.

Finally, to determine whether the estimation methods, OLS and TLS, provided results that were consistent with each other, we assessed the number of estimations with the same sign, the same significance or both. The results are presented in Table 6. The estimations deliver fairly similar results, except for the sensitivity to the exchange rate. This exception is probably a consequence of a small number of funds that depend on this variable; thus, any changes in it represent a high percentage of funds with divergent OLS and TLS results.

		Sign	Significance	Sign and Significance
CAPM	Alpha	93.17%	80.12%	77.64%
	Beta	93.79%	90.68%	85.09%
IHFA	Alpha	80.75%	75.78%	62.73%
	Beta	96.27%	92.55%	89.44%
STYLE	Alpha	79.50%	70.19%	60.87%
	Beta IHFA	93.79%	91.93%	86.34%
	Beta IMA-B	96.27%	82.61%	79.50%
	Beta IRF - M	83.23%	85.09%	73.91%
	Beta DS	88.20%	20.50%	11.80%

Note: The sample includes 859 daily observations from September 28th, 2007 to February 28th, 2011 for 161 funds. Each percentage indicates the fraction of funds with the same estimated sign, significance or both when the OLS and LTS estimations are compared.

5. Conclusion

The Brazilian hedge fund market represents an extremely dynamic industry segment within the Brazilian fund industry. This study sought to evaluate this market from the perspective of performance and persistence. To this end, we used daily data and analyzed a select group of funds classified as *de facto* hedge funds by the Brazilian financial association Anbima (Brazilian Association of Financial and Capital Market Entities).

Given the financial turmoil contained in our dataset time span (a period characterized by many as the world's worst financial crisis since the great depression of the 1930s), this analysis served in some ways as a stress test. In theory, we should expect hedge funds to provide hedging in periods such as this.

In fact, through a robust but not exhaustive analysis of the performance and persistence indicators, we demonstrated that a fair number of funds present indicators of abnormal returns and persistence at a combined level. However, a fewer number of funds exhibit performance persistence at the individual level, and such persistence decreases with an increasing time horizon. Our results can be compared and contrasted with those of other studies of the Brazilian industry's multimarket funds, with a note of caution that we are using a different data frequency, different time horizons and different funds (because we include only de facto hedge funds in our analysis). In particular, we found that more than 39% of the funds analyzed presented a significant and positive alpha for all of the specifications and estimation methods. These results are significantly higher than those of other studies focused on Brazilian funds. Moreover, we determined that the majority of funds are influenced by market movements and are not dependent on the factor used. The

major difference between the models is the extent to which the funds are impacted by market movements. That is, the mean beta is close to 0.02 when measured by the Ibovespa; when the IHFA is used, however, it is greater than 0.34. This finding corroborates the research of Gomes & Cresto (2010). Combining these results, our analysis shows that the funds analyzed are de facto hedge funds because they offer higher performance with a low systematic risk to the stock index movements.

Finally, charging management fees appears to be closely related to the performance of funds, but other characteristics are apparently not relevant as drivers of performance and persistence. This result matches the findings of Chen & Liang (2007), who determined that the performance of market-timing hedge funds in the U.S. market is relatively stronger under bear and volatile market conditions.

Inevitably, this study presents limitations that should be addressed in future studies. One possibility is to estimate alternative factor models through other techniques that do not assume a static Jensen's alpha and market beta, such as the Kalman Filter technique. In addition, new factor models that include the influence of factors external to the Brazilian economy, such as factor models based on arbitrage pricing theory (APT), may be estimated and presented. Finally, using out-of-sample exercises, the economic value of these results can be evaluated by comparing the performance of fund portfolios selected on the basis of performance and persistence indicators.

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