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# A Performance and Risk Analysis on Brazilian Hedge Funds between 2009 and 2016

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## Abstract

This paper analyzes the fast-growing market of Brazilian hedge funds between 2009 and 2016. Since in 2017 the market had a record break of US$800 billion of assets under management, this study aims to measure, using the CAPM model, if multimarket fund managers in Brazil can produce abnormal returns and maintain a low correlation with market risk. Moreover, by using the seven-risk-factor ABS model, measure and identify factor betas that are involved in the returns of these hedge funds. Empirical evidence in this paper showed that long-short directional funds produced the largest alpha from all strategy-type funds in Brazil. Moreover, a low correlation with the market was found for strategy-free and strategy-specific funds. In the case of risk factors for the industry as a whole, only market risk factor was found to be significant. Further research aims at creating an index on the return of funds for Brazilian hedge funds in order to reduce database biases.

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# Chapter 1

# Introduction

Since the 1990s, a large growth of preference to invest in personal well-diversified portfolios has occurred not only in the US, but on several emergent markets. Such portfolios are offered by many hedge funds, which combines the expertise of a professional fund manager and the pooled funds from individual investors. Depending on the level of risk that investors are willing to take, hedge funds offer a variety of investment strategies to earn an active return. Hedge funds expect to make money whether the market is going up or down.

The Brazilian hedge fund industry, also known as the multimarkets fund industry, presented a considerable growth since the 1990s, with shareholder's equity increasing from 400 billion reais in 1996 to 3 trillion reais in 2016 [Reis Gomes and Cresto, 2010]. That is an increase of 750% in shareholder's equity in over 20 years according to the Brazilian Associaton of Financial and Capital Market Entities (ANBIMA). Such growth can be attributed to numerous improvements in the Brazilian economy, like the introduction of the "Real" currency in 1994 and the inflation and external debt control, for example. This gave the country more credibility for domestic and foreign investors, causing the aforementioned expansion [Tizziani et al., 2010]. The fund industry in Brazil is the 6th biggest in the world and it represents almost 50% of its GDP. Furthermore, together with fixed income investments, fund investments are the most sought investments by Brazilians.

Looking at the prospects of the Brazilian hedge fund industry, 2017 was its best year ever

with a net inflow of 97 billion reais (US$30 billion) partially explained by increasing investor confidence and falling interest rates. Therefore, the purpose of the study here is to analyze the returns of the Brazilian hedge funds industry from January 2009 to May 2016. Furthermore, verify if abnormal returns occurred during this period and measure their correlation with the market. Moreover, identify which performance risk factors influence such portfolio returns and how it affects its exposure.

Many different models have already been applied in order to evaluate the performance of hedge funds. Till today, the Capital Asset Pricing Model (CAPM) firstly introduced by W.Sharpe, serves for use as a performance indicator that relates risk and returns for different funds. The Three-Factor Model expands the CAPM and adds two risk variables besides the market risk factor, that is size and value risk factors [Fama and French, 1992]. These models employ a benchmark in order to identify funds with persistently above-average returns. Moreover, since they are quite dependent on the benchmark choice, such models present some flaws and are prone to biases. Examples of such biases are selection, survivorship, and instant-history bias.

In order to model hedge fund risk, a broad-based index of hedge funds must be constructed from averaging individual hedge fund firms. With this comes inherent problems that are in the hedge fund databases, affecting then the results. Selection bias, for instance, is a problem for hedge fund databases since hedge funds are not obliged to make public disclosures of their activities, causing information to be relatively costly compared to mutual funds for example. Selection bias arises then if you have an unrepresentative sample of the hedge fund market. The survivorship bias affects hedge fund databases due to the fact that it provides information only on operating funds. Funds that ceased to exist do not report information anymore, and since their performance is typically worse compared to surviving funds, it causes a misrepresentation of the data. When it comes about the instant-history bias, hedge funds tend to post their returns only after a good past performance in order to attract more investors. Such behavior causes fund returns to be biased upwards, causing then another misrepresentation concerning the database.

By using funds of hedge funds (FOF) data, that is when a fund of hedge funds invests in a fund that does not report to any database, some of these data biases are reduced. Following

the use of FOF data, a model of hedge fund returns similar to models based on arbitrage pricing theory was formulated by [Fung and Hsieh, 2004]. The model in question is what they call the seven ABS factors model, which use asset-based style factors in order to create hedge fund benchmarks and capture the common risk factors in hedge funds. In order to identify the factors, common sources of risk in hedge fund returns were extracted, that is the systematic part of the return. Then, a link between these common sources of risk and observable market prices was made. Furthermore, with the objective to eliminate the biases contained in hedge fund databases, the constructed benchmarks are based on asset returns instead of hedge fund returns. A more broad discussion on the seven-factor ABS model will follow later on.

## 1.1 Theoretical Framework

[Fonseca et al., 2007] divided their study between fixed-income and equity multimarket funds from May 2001 to May 2006. By using Sharpe and Sortino ratios, the performance of such funds was evaluated in terms of risk and return. The conclusion was that, in terms of returns, equity funds proved to be better than fixed income funds. On the other, in terms of risk/return ratio, fixed income funds showed better results due to Brazil having high-interest rates.

[Coelho et al., 2009] tried to identify which factors best explain the management quality of multimarket funds in accordance with their stated strategies. Furthermore, the resulting factor model measures the exposure of each risk factor. They concluded that the factor model is a useful tool for risk management, however, the non-constancy allocation of hedge fund portfolios made the sensitivity factors to be unstable over time. The study was from 2003 to 2008 by using daily returns from 23 different funds.

[Yoshinaga et al., 2009] analyzed leveraged and non-leveraged multi-assets funds from January 2003 until March 2006 with the objective of verifying if different hedge fund strategies present different investments allocations. By using a style analysis model from [Sharpe, 1992], they predicted for each strategy type funds its sensitivity to factors such as the CDI (Interbank Deposit Certificate rate), Dolar, Ibovespa and IGPM (General Market Price Index). Although

the CDI factor prevailed for multimarket funds, the analysis was not capable to classify these funds properly.

[Jordão and De Moura, 2011] investigated the fast-growing market of Brazilian hedge funds between January 2000 and February 2009. The objective was to test if hedge funds can produce abnormal returns, gain market momentum and maintain a low correlation with market risk. By using a robust set of models like the three-factor model of [Fama and French, 1996] or the four-factor model of [Carhart, 1997] the findings were that only 5% of funds had positive and significant abnormal returns. Moreover, 35% of the funds showed no correlation with the market. The study contained information on 1673 funds.

[Malaquias and Junior, 2014] studied the performance of Brazilian multimarket funds from 2005 to 2013. They base their study on the work of [Amin and Kat, 2003], by using a continuous-time version of [Dybvig, 1983] payoff distribution pricing model. This is an alternative measure to evaluate the performance of investment funds with a frequency of returns different than normal. The main results of this study showed that, for net performance, there is no evidence of abnormal returns being generated by the funds studied. This is consistent with the efficient market hypothesis. Moreover, they found that stock funds were significant at 1% for exchange rate factors and the Ibovespa.

[Maestri and Malaquias, 2017] is another work that attempts to analyze the exposition to numerous market factors in Brazil for two types of investment funds, fixed income funds and Neutral Long & Short hedge funds from 2005 to 2014. By using a return-based style analysis with the help of a model containing 6 market factors, they found that for each fund, there is a composition difference between hedge fund portfolios and fixed income portfolio funds. That is, different market factors affect to a larger or smaller degree the different strategies implemented by such funds.

As we can see, there exists a vast literature on the analysis of Brazilian hedge funds performance. However, the findings vary due to different methodologies of study, as using different multi-factor models or choosing different benchmarks. In order to contribute to such a broad literature, this paper investigates common risk factors in Brazilian hedge funds by using Fung

ad Hsieh asset-based style (ABS) factors model. According to the authors, the model is composed by seven risk factors capturing the betas. For equity long-short multimarket funds, two equity risk factors are involved, that is market risk and the spread between small-capitalization and large capitalization stock returns. For fixed-income hedge funds, the change in 10-year U.S. Treasury yields and the change in the yield spread between 10-year T-bonds and Moody's Baa rated bonds are the two interest-rate related risk factors. Furthermore, when it comes about trend-following funds, portfolios of "lookback" options on commodity futures, currency futures and bond futures are used as risk factors.

This is an alternative way of approach compared to previous papers since it takes into account the diverse performance characteristics of hedge funds, the different styles of investments and highly leveraged positions. Moreover, empirical evidence shows that these seven risk factors capture about 80% of the return movements in the diversified hedge fund portfolios. At last, the study will focus on the post 2008 financial crisis period, from 2009 to 2016, in which the hedge fund industry in Brazil had a considerable growth.

## 1.2 Research Question

This calls into request the following research questions:

- ***"To what extent was the performance and risk exposure of portfolios returns in the Brazilian hedge fund industry from 2009 to 2016?"***
- ***"How and which risk factors influence such performance?"***

# Chapter 2

# Data and Methodology

## 2.1 Data

The database used for this study was provided by the Brazilian Association of Financial and Capital Market Institutions (ANBIMA). In order to have a considerable amount of observations, only funds with at least 48 monthly returns available were chosen resulting of having 5611 funds at our disposition. The period of interest is from January 2009 to May 2016. Furthermore, only funds with a net worth of over million reais were selected. The Brazilian hedge funds, classified as multimarket funds, can be considered representative for the industry as a whole according to ANBIMA. Moreover, the funds are divided by the type of strategy that fits their investment style.

In the Brazilian market, the multimarket funds are classified according to the asset allocation and strategy they follow, in which they main ones are:

1. Asset Allocation

    - Balanced Fund: Look for long-term return through the purchase of several classes of assets, including shares of funds. These funds have a pre-determined allocation strategy and should specify the mix of investments in the various asset classes. They do not allow leverage.

- Protected Fund: Look for long-term return through the purchase of several classes of assets, including shares of funds. These funds have an asset allocation strategy without being committed to a pre-determined mix of assets. Moreover, the initial investment made by the investor is promised to be returned. They allow leverage.

2. By Strategy

- Long and Short Directional: Funds that carry out asset and derivatives linked to the variable income market, setting up long and short positions.
- Macro: Funds that carry out operations in several asset classes (fixed income, variable income, foreign exchange, etc.), defining investment strategies based on medium and long-term macroeconomic scenarios.
- Trading: Funds that carry out operations in several classes of assets, exploiting opportunities for gains from short-term movements in asset prices.
- Long and Short Neutro: Funds that carry out asset and derivative transactions linked to the variable income market, placing long and short positions, in order to keep the net financial exposure limited to 5%.
- Interest Rates and Currency: Funds seeking long-term return through investments in fixed income assets, assuming strategies that imply interest risk, price index risk and foreign currency risk. Strategies that imply variable income exposure (stocks, etc.) are excluded.
- Free: Funds that do not necessarily have a commitment to focus on any specific strategy.
- Specific Strategy: Funds that adopt an investment strategy that involves specific risks, such as commodities, index futures.

Table 2.1 presents the descriptive statistics for each classification of fund. As we can see, the highest average return for the period of interest is for the Macro strategy funds, with 1.06%. Protected funds showed the lowest average return of 0.58%. Moreover, all fund strategy and asset allocation types presented positive mean returns. Trading funds have the highest standard

deviation due to high volatility from their short-term investment strategies. This can reinforced with the fact that trading funds hold the highest return for a monthly period of 12.36%. Specific strategy funds on the other hand had the lowest return, with -10.34%.

Table 2.1: Descriptive statistics for each strategy-type fund (2009-2016)

| Fund Type | Observations | Mean Return | Std.Deviation | Min | Max |
|---|---|---|---|---|---|
| Balanced | 89 | 0.90% | 0.0090 | -1.55% | 3.08% |
| Protected | 89 | 0.58% | 0.0104 | -1.73% | 3.37% |
| Directional | 85 | 0.88% | 0.0046 | -1.04% | 1.91% |
| Macro | 85 | 1.06% | 0.0090 | -0.42% | 4.28% |
| Trading | 85 | 0.90% | 0.0180 | -3.65% | 12.36% |
| Neutro | 85 | 0.96% | 0.0048 | -0.24% | 2.80% |
| I.R/Currency | 85 | 0.81% | 0.0044 | -1.74% | 1.73% |
| Free | 85 | 0.91% | 0.0081 | -1.14% | 3.45% |
| Specific Strategy | 85 | 0.84% | 0.0138 | -10.34% | 2.65% |

With the objective of representing returns for the industry as a whole, equal and values weighted indexes were created based on the return and on the number of firms acting for each hedge fund segment. The descriptive statistics for each index can be seen on Table 2.2. Value weight in this case has a higher average return of 0.94% compared to the average return of 0.84% for equal weight. Moreover, standard deviation is higher for value weight. We can however say that the descriptive statistics for both indices are pretty similar overall.

Table 2.2: Descriptive statistics for equal and value weighted indices (2009-2016

| Index | Observations | Mean Return | Std.Deviation | Min | Max |
|---|---|---|---|---|---|
| Value Weight | 89 | 0.94% | 0.0071 | -0.84% | 3.28% |
| Equal Weight | 89 | 0.84% | 0.0047 | -0.93% | 2.07% |

For benchmark returns of the Brazilian stock market, the Ibovespa index was used as a proxy for market risk. Its historical data was monthly collected from Yahoo Finance. The risk-free rate was defined as the CDI rate (Interbank Deposit Certificates) and taken from the central bank of Brazil. Moreover, for small-capitalization and large-capitalization of stock returns the indexes SMLL and MLCX from BM&F Bovespa were chosen respectively. The change in yield from Brazil's 10-year bond was taken from Bloomberg, and the change in the yield spread between Brazil's 10-year bond and Moody's Baa bonds was calculated with the help of the Federal Reserve Bank of St.Louis (FRED) economic data. Finally, with respect to "lookback straddles" rate of returns, we used the ones directly constructed by Fung and Hsieh in which

they use the major futures and options contracts worldwide. Till the date of this paper, they update these values monthly.

The descriptive statistics for all seven factors can be seen on Table 2.3.

Table 2.3: Descriptive statistics for the asset-based (ABS) factors (2009-2016)

| Factors | Observations | Mean Return | Std.Deviation | Min | Max |
|---|---|---|---|---|---|
| Ibovespa ($R_M$) | 89 | 0.47% | 0.0613 | -11.86% | 16.97% |
| CDI ($R_f$) | 89 | 0.83% | 0.0016 | 0.48% | 1.18% |
| SMLL-MLCX | 89 | 0.18% | 0.0423 | -8.47% | 20.28% |
| $\Delta Yield10Y$ | 89 | 0.07% | 0.0470 | -12.14% | 10.32% |
| CredSpr | 89 | -0.16% | 0.0840 | -26.31% | 21.35% |
| BondOpt | 89 | -3.20% | 0.1587 | -26.63% | 50.50% |
| CurrencyOpt | 89 | -3.95% | 0.1794 | -27.94% | 69.10% |
| CommodityOpt | 89 | -1.37% | 0.1539 | -24.65% | 42.87% |

From Table 2.3, the average return of the Ibovespa from January 2009 to May 2016 was 0.47%, which is half when compared to the average return of the value weight index and 0.37% less when compared to the equal weight index, for the same period. Moreover, this is lower than the average return of the CDI, with 0.83% reinforcing the fact shown by [Fonseca et al., 2007] that fixed income funds showed better results due to Brazil having high interest rates. Furthermore, the portfolios of "lookback straddles" showed poor return performance over the period studied. In the case of bonds, the average monthly return was of -3.20%, for currencies and commodities the average monthly return was -3.95% and -1.37% respectively.

Since time series regression and correlation analysis will be undertaken in this paper, such factors and the returns for each strategy-type multimarket fund needs to follow a stationary process. Therefore, augmented Dickey-Fuller tests were performed. The null hypothesis is that the variable contains a unit root, and the alternative one is that the variable is generated by a stationary process. All tests for each strategy-type fund return rejected the null hypothesis. The case was the same for all the seven factors, except for the CDI and for the 10Y Brazilian bond yield. In order to fix this, first differences were taken for both variables. The first difference was found to be significant at 95% confidence, therefore the null hypothesis can be rejected and the data for CDI and 10Y Brazilian bond yield are now stationary.

## 2.2 Methodology

To answer the first research question, that is "To what extent was the performance and risk exposure of portfolios returns in the Brazilian hedge fund industry from 2009 to 2016?", [Sharpe, 1964] CAPM will be used. The CAPM can predict an asset excess return by the correlation it has with market excess return and is still widely used in the calculation of abnormal returns and risk. It is described by the following mathematical expression:

$$R_i - R_f = \alpha_i + \beta_i(R_M - R_f) + u_i$$

where $R_i$ is the portfolio return of the hedge fund strategy-type $i$; $R_f$ is CDI return; $\alpha_i$ is the average abnormal return; $\beta_i$ is the market beta coefficient, $R_M$ is the Ibovespa return; and $u_i$ is the random error. The model can be used as a signal of ability for the fund managers in Brazil to obtain abnormal returns which is represented by a significant and positive $\alpha_i$. These abnormal returns are not explained by the market systematic risk $\beta_i$. Based on this, a first hypothesis and its alternative are developed:

1. $H_0$: $\alpha_i = 0$ and $\beta_i = 0$

2. $H_a$: $\alpha_i \neq 0$ or $\beta_i \neq 0$

With respect to the second research question "How and which risk factors influence such performance?", Fung and Hsieh's seven ABS factors model is used here. According to the authors, it can explain up to 80 percent of monthly return variations for diversified hedge fund portfolios as proxied by indices of hedge funds. The model is similar to an APT (Arbitrage Pricing Theory) model, in which factor betas are permitted to vary over time. The model is defined by the following expression:

$$R_i = \alpha_i + \beta_{i,1}R_M + \beta_{i,2}(SMLL - MLCX) + \beta_{i,3}\Delta Yield10Y + \beta_{i,4}CredSpr + \beta_{i,5}BondOpt + \beta_{i,6}CurrencyOpt + \beta_{i,7}CommodityOpt + u_i$$

where $\beta_{i,2}$ is the coefficient related to the SMLL-MLCX factor which is the spread between returns on large-capitalization stocks and returns on small-capitalization stocks; $\beta_{i,3}$ is the coefficient related to $\Delta Yield10Y$ which is the change in 10-year Brazilian bond yields; $\beta_{i,4}$ is the coefficient related to CredSpr which is the change in the yield spread between 10-year Brazilian bonds and Moody's Baa bonds; $\beta_{i,5}$ is the coefficient related to BondOpt which is the return on portfolios of lookback straddles on bonds; $\beta_{i,6}$ is the coefficient related to CurrencyOpt which is the return on portfolios of lookback straddles on currencies; $\beta_{i,7}$ is the coefficient related to CommodityOpt which is the return on portfolios of lookback straddles on commodities. The model can be used to expain a large portion of the risk in diversified portfolios of Brazilian hedge funds. Based on this, a second hypothesis and its alternative are developed:

1. $H_0$: All $\beta_{i,1-7} = 0$
2. $H_a$: At least one $\beta_{i,1-7} \neq 0$

# Chapter 3

# Results

## 3.1 CAPM and Abnormal Returns

Before analyzing the CAPM models for each strategy hedge fund type and for the industry as a whole, heteroskedasticity and autocorrelation tests need to take place. This is essential for consistent estimators and the possibility to make statistical inferences using OLS (Ordinary Least Squares). Furthermore, when making use of stock returns in emerging markets like Brazil, it is essential that we control for heteroskedasticity and autocorrelation.
Therefore, two tests will be used here in order to control for these problems. On one hand, [Breusch, 1978] test is used to assess for the presence of serial correlation and that if present, wrong conclusions would be drawn from the regression results. To correct for the lack of zero autocorrelation, a [Newey and West, 1987] estimator is used as a more general estimator for the covariance matrix. On the other hand, [Breusch and Pagan, 1979] test accounts for heteroskedasticity in a linear regression model, which is when the variance of the errors is dependent on the values of the independent variables. If this is the case, [White, 1980] proposed an estimate known as the least squares robust estimation, that makes estimators consistent and efficient.

After taking heteroskedasticity and autocorrelation into account for the CAPM models, the distributions of Jensen's alpha for abnormal returns and the beta coefficients accounting for

systematic market risk can be computed for each type and asset allocation of hedge fund. This can be seen seen in Table 3.1 and Table 3.2. Moreover, the same will be done with equal and value weight in order to have the large picture of the industry as a whole, which is presented on Table 3.3.

Table 3.1: Alphas and betas coefficients for each type of hedge fund from 2009 to 2016

| **Coefficient** | **Balanced** | **Protected** | **Directional** | **StrategySp.** | **I.R-Currency** |
|---|---|---|---|---|---|
| $\alpha$ | .0011* | -.0021** | .0110*** | .0007 | -.0000 |
| | (1.94) | (-2.54) | (10.44) | (0.57) | (-0.09) |
| $\beta$ | .1125*** | .1200*** | -.1200*** | .0562** | .0074 |
| | (10.26) | (9.04) | (-6.78) | (2.62) | (0.97) |
| N | 89 | 89 | 85 | 85 | 85 |

$^{*}\ p < 0.1\ ^{**}\ p < 0.5\ ^{***}\ p < 0.01$

Table 3.2: Alphas and betas coefficients for each type of hedge fund from 2009 to 2016

| **Coefficient** | **Free** | **Macro** | **Neutro** | **Trading** |
|---|---|---|---|---|
| $\alpha$ | .0011* | .0023** | 0.0017*** | .0008 |
| | (1.87) | (2.40) | (2.65) | (0.42) |
| $\beta$ | .0271** | -.0106 | .0120 | .0082 |
| | (2.13) | (-0.66) | (1.52) | (0.30) |
| N | 84 | 85 | 84 | 84 |

$^{*}\ p < 0.1\ ^{**}\ p < 0.5\ ^{***}\ p < 0.01$

In Table 3.1, three out of the five type of hedge funds alpha's abnormal return turned out to be significant. For Long and Short Directional funds alpha was significant at a 1% significance level, with a value of 1.10%. This represents a considerable high abnormal monthly return when comparing to the other types of hedge funds. Moreover, directional funds are considered to be the glamorous funds with the objective to "beat the market", explaining then why it is

the type of hedge fund with the highest abnormal return. Normally, directional funds do not hedge, at least not fully, and managers maintain a certain level of exposure to the market with the goal of realizing higher than expected returns. However in this case, there is a negative systematic market risk $\beta$ of 0.1200, which is significant at a 1% significance level.

Comparing Table 3.1 with Table 3.2, macro, balanced and free funds hold alphas of 0.23%, 0.11% and 0.11%, respectively. Market risk factor, however, is only significant for balanced and free funds, with coefficients of 0.1125 and 0.0271, respectively. In the case of balanced funds the coefficient was significant at a 1% significance level and for free funds, at 5% significance level. A significant alpha was the case for neutro multimarket funds with 0.17%. Curiously, the hedge fund type with a negative monthly abnormal return was protected funds with -0.21%. Since protected funds promise to return at least some portion of the initial investment to investors, the negative and significant at a 5% significance level abnormal return is a surprise here.

For strategy-specific funds, only $\beta$ was significant at 5% level with a coefficient of 0.0562. In the case of interest-rate-currency and trading funds, the regression alpha's and beta's turned out to be non-significant.

Table 3.3: Alphas and betas coefficients for equal and value weight indexes of Brazilian hedge funds from 2009 to 2016

| **Coefficient** | **Value Weight** | **Equal Weight** |
|---|---|---|
| $\alpha$ | .0011** | .0003 |
| | (2.26) | (0.71) |
| $\beta$ | .0257** | .0315*** |
| | (2.56) | (4.35) |
| N | 89 | 89 |

$^{*}\ p < 0.1$ $^{**}\ p < 0.5$ $^{***}\ p < 0.01$

In order to study the Brazilian hedge fund industry as a whole and not only divided by sub-category, value and equal weight returns were included as well in CAPM regressions, and the results are presented in Table 3.3. Alpha's abnormal monthly return was only significant at 5% significance level for value weight, with a value of 0.11%. Moreover, for the market risk factor

$\beta$, value weight had a coefficient of 0.0257 which was significant at 5% significance level. In the case of equal weight, the $\beta$ for market risk was at a similar coefficient value of 0.0315 and significant at a 1% significance level. These small beta coefficients show that Brazilian hedge funds are quite efficient with respect to mitigate market risk on their returns. However, this could also be explained by the fact that many of these funds are heavily invested in government bonds, taking advantage of the high interest rates in Brazil and thus returns are lightly correlated to market risk.

Following such results, the null hypothesis can be rejected at 5% significance level, since for value weight, $\alpha$ and $\beta$ were different than 0, and for equal weight $\beta$ was statistically different than 0.

## 3.2 Seven ABS Factor Model

In this section, three tables will be presented with the seven ABS factors model results. That is the coefficients for each factor beta with their significance and their t-values. In order to study the effect of the seven factors in the Brazilian hedge funds industry, the model was regressed for each strategy and asset allocation type. Moreover, equal and value weight indices representing the industry were also regressed using the seven factors ABS model.

Table 3.4 presents the coefficients results and its t-statistics values for balanced, protected, directional, strategy-specific and interest-rate/currency hedge funds. For all strategy-types of multimarket funds, the intercept was significant at a 1% significance level with balanced funds having the highest value of 0.85%. When it comes about the market risk, that is the Ibovespa factor, balanced, protected and strategy-specific funds had significant coefficients. Protected funds had an exposure of 0.1160 to market risk, whereas balanced funds had 0.0910. Both coefficients were significant at 1% significance level. In the case of strategy-specific funds, the factor beta accounting for risk exposure was at 0.0722.

The spread effect between small-cap and large-cap stock returns in the Brazilian market (SMLL-MLCX) was found to only be significant at a 10% level for directional funds. This is in ac-

Table 3.4: Exposure of the different strategy-types of Brazilian hedge funds to the ABS Risk Factors from 2009 to 2016

| **Coefficient** | **Balanced** | **Protected** | **Directional** | **StrategySp.** | **I.R-Currency** |
|---|---|---|---|---|---|
| $\alpha$ | .0085*** | .0052*** | .0084*** | .0083*** | .0082*** |
| | (15.84) | (6.36) | (14.63) | (5.56) | (15.40) |
| Ibovespa | .0910*** | .1160*** | .0035 | .0722** | .0042 |
| | (8.62) | (7.98) | (0.30) | (2.13) | (0.40) |
| SMLL-MLCX | .0153 | .0250 | .0270* | -.0270 | .0115 |
| | (1.21) | (0.63) | (1.84) | (-0.63) | (0.83) |
| $\Delta d.Yield10Y$ | -.0060*** | .0007 | -.0003 | .0020 | -.0016 |
| | (-5.93) | (1.25) | (-0.35) | (0.66) | (-1.63) |
| CrediSpr | -.0060 | -.0240** | -.0035 | .0063 | .0043 |
| | (-0.91) | (-2.39) | (-0.46) | (0.30) | (0.65) |
| BdOpt | -.0003 | -.0061 | -.0003 | .0115 | .0031 |
| | (-0.06) | (-0.96) | (-0.07) | (0.92) | (0.81) |
| FXOpt | .0050 | .0074 | -.0045 | -.0110 | -.0005 |
| | (1.22) | (1.35) | (-0.89) | (-1.08) | (-0.14) |
| ComOpt | -.0080** | -.0009 | .0009 | -.0040 | -.0060* |
| | (-2.17) | (-0.17) | (0.21) | (-0.36) | (-1.85) |
| N | 88 | 88 | 84 | 84 | 84 |

$^{*}\ p < 0.1$ $^{**}\ p < 0.5$ $^{***}\ p < 0.01$

cordance with [Fung and Hsieh, 2004], in which they state that the spread is found in equity long-short hedge funds. For this case, the coefficient had a value of 0.0270. The difference in change for 10-year Brazilian bond yields ($\Delta d.Yield10Y$) was only significant only for balanced funds at 1%. Its coefficient was a negative one at -0.0060. Since most of balanced funds in Brazil invest heavily in government bonds due to high interest rates in Brazil, the significant coefficient for the change in yield for 10-year Brazilian bonds makes sense.

Furthermore, for the credit spread variable, defined as the change in the difference between Moody's Baa yield and the Brazilian 10-year yield, only protected funds had a significant coefficient of -0.0240 at 5% significance level. When credit spreads widen, 10-year Brazilian bonds are favored over corporate bonds. This is typically the case when economic conditions are expected to deteriorate. Therefore, if the credit spread increases, protected funds will have the obligation to chose safer investments like the 10-year bond in order to protect the initial investment made by investors. This will decrease their returns, since the rate of return for safe debt obligations is lower when compared to riskier equity instruments, explaining then the negative coefficient.

Two of the three ABS factors, return of a portfolio of lookback straddles on bond futures (BdOpt) and on currency futures (FXOpt), turned out to be non-significant for the five strategy-type hedge funds in Table 3.4. However, the return of lookback straddles on commodity futures (ComOpt) was significant for balanced and interest-rate/currency hedge funds at a 5% and 10% significance level, respectively. In the case of balanced funds, the coefficient was negative at -0.0080. For interest-rate/currency hedge funds, the coefficient was negative as well, at -0.0060.

Table 3.5 is a continuation of Table 3.4, presenting the coefficients results and its t-statistics values for free, macro, neutro and trading hedge funds. Similarly to Table 3.4, all intercepts are significant at a 1% significance level for all specified strategy-types funds. In this case, macro funds had a even larger intercept compared to balanced funds, with a value of 1.08%. Only free-strategy funds had a significant coefficient at 5% level of 0.0410 for market risk. The SMLL-MLCX factor coefficients turned out non-significant for free, macro, neutro and trading funds. Furthermore, the difference in change for 10-year Brazilian bond yields was only significant for

Table 3.5: Exposure of the different strategy-types of Brazilian hedge funds to the ABS Risk Factors from 2009 to 2016

| **Coefficient** | **Free** | **Macro** | **Neutro** | **Trading** |
|---|---|---|---|---|
| $\alpha$ | .0093*** | .0108*** | .0096*** | .0080*** |
| | (13.48) | (10.36) | (13.82) | (4.16) |
| Ibovespa | .0410** | -.0174 | -.0010 | -.0463 |
| | (2.21) | (-0.78) | (-0.09) | (-1.05) |
| SMLL-MLCX | -.0871 | .0083 | .0100 | .0124 |
| | (-0.39) | (0.29) | (0.70) | (0.22) |
| $\Delta d.Yield10Y$ | 0.0012 | -.0019 | -.0100** | -.0300 |
| | (0.73) | (-0.93) | (-2.02) | (-0.77) |
| CrediSpr | -.0192 | -.0260* | .0009 | -.0300 |
| | (-1.61) | (-1.87) | (0.14) | (-1.08) |
| BdOpt | .0078 | -.0026 | -.0008 | -.0254 |
| | (1.16) | (-0.32) | (-0.21) | (-1.57) |
| FXOpt | .0015 | .0040 | -.0061** | -.0031 |
| | (0.27) | (0.52) | (-1.99) | (-0.23) |
| ComOpt | -.0046 | .0040 | .0014 | -.0180 |
| | (-0.80) | (-0.57) | (0.44) | (-1.32) |
| N | 88 | 88 | 84 | 84 |

$^{*}\ p < 0.1$ $^{**}\ p < 0.5$ $^{***}\ p < 0.01$

neutro-strategy funds at 1%. Similarly to balanced funds, its coefficient was negative, and at -0.100.

Credit spread factor was significant only for macro funds at a 10% significance level. Its coefficient was negative with a value of -0.0260. This negative coefficient can be linked to the negative coefficient of protected funds for the same reason, since a wider credit spread implies safer investments for macro funds, consequently implying lower returns. Again, like in Table 3.4, two out of three ABS factors turned out to be non-significant for all different strategy-types of Brazilian hedge funds in question. These factors were BdOpt and ComOpt. Factor FXOpt turned out significant at a 5% significance level for neutro-strategy funds, with a coefficient of -0.0061.

Table 3.6 presents the coefficient results and its respectively t-statistic values for each of the seven risk factor ABS model for equal and value weight indices. For equal weight index, only one risk factor, market risk, was significant at 5% significance level. Its coefficient was at 0.0191. Moreover, the intercept was significant at 1% significance level, with a value of 0.0081. Furthermore, the case was the same for value weight index, only market risk was significant from all the seven risk factors. The equal weight coefficient, on the other hand, had a higher value of 0.0335, and was significant at a 5% significance level as well. Comparing these results to the CAPM results, market risk factor beta was not that different. In the CAPM, like for the seven factor ABS risk factor model, market risk was significant at 5% significance level. Moreover, its coefficients for both value and equal weight were similar.

These results contradicts the findings of [Fung and Hsieh, 2004]. For the Brazilian hedge fund market, the seven hedge fund risk factors seem that it cannot explain a significant part of the systematic risk of a typical hedge fund portfolio. Even though six out of seven risk factors were non-significant in our results, the null hypothesis is rejected, since market risk was significant for both equal and value weight indexes.

Table 3.6: Exposure of equal and value weight indexes of Brazilian hedge funds to the ABS Risk Factors from 2009 to 2016

| **Coefficient** | **Equal Weight** | **Value Weight** |
|---|---|---|
| $\alpha$ | .0081*** | .0092*** |
| | (17.26) | (15.36) |
| Ibovespa | .0191** | .0335** |
| | (2.05) | (2.37) |
| SMLL-MLCX | .0030 | -.00073 |
| | (0.26) | (-0.04) |
| $\Delta d.Yield10Y$ | -.0015 | .0012 |
| | (-1.66) | (0.98) |
| CrediSpr | -.0090 | -.0090 |
| | (-1.51) | (-0.96) |
| BdOpt | -.0032 | .0060 |
| | (-0.83) | (1.02) |
| FXOpt | -.0015 | -.0007 |
| | (-0.47) | (-0.16) |
| ComOpt | -.0025 | -.0033 |
| | (-0.78) | (-0.66) |
| N | 88 | 88 |

$^{*}\ p < 0.1$ $^{**}\ p < 0.5$ $^{***}\ p < 0.01$

# Chapter 4

# Conclusion

This paper analyzed the performance of the Brazilian hedge fund industry for the post-financial crisis period from 2009 to 2016. This is an important period of study for such market, since after a significant increase in equity shareholder's value throughout this period, the hedge fund industry in Brazil turned out to be the 6th biggest in the world with over US$ 800 billion of assets under management. Moreover, a scarce previous literature for the period mentioned above motivated the performance analysis. Furthermore, this paper was the first one to make use of the seven-risk-factor ABS model in the Brazilian hedge fund industry, in which the authors captured over 80% monthly variations for hedge fund returns in the US.

The returns for each specified strategy-type multimarket funds was available in the ANBIMA database. By making the use of the Sharpe's CAPM model, abnormal returns ($\alpha$) and systematic risk ($\beta$) proxied by the Ibovespa could be captured. This was interesting to analyze for the Brazilian market, since after such development in the Brazilian hedge fund industry throughout 2009 to 2016, the ability of managers to obtain returns not explained by the market risk could be studied in depth. Moreover, the efficiency of the fund with regard to mitigating market risk. When it comes about the seven-risk-factor ABS model, factors such as lookback straddle futures on currency, bonds and commodities, or such as the credit spead and the change in the 10-year Brazilian bond yield provided a vital link between hedge fund risks and conventional asset class risks. Due to good results of the model in the US, the model was also applied in the

Brazilian market in order to capture the factor beta coefficients for each of the risk factors.

When analyzing the results of the ability of managers to obtain alpha's, long-short directional funds showed abnormal returns of 1.08%, which was significant at 1% significance level. This represents good investment opportunities in this strategy-type of fund in Brazil. Moreover, balanced, strategy-free, macro and strategy-neutro funds also showed significant positive returns unexplained by market risk, but at a lower degree when compared to long-short directional funds. The constructed value weight index also showed a positive Jensen's alpha of 0.11% for the period studied, whereas the equal weight index had a non-significant alpha.
The efficiency of Brazilian funds in mitigating market risk presented good results for strategy-free and strategy-specific funds, with coefficients of 0.0271 and 0.0562, respectively. This can signal as well the ability of providing investors with efficient diversified portfolios.

## 4.1 Limitations

Unfortunately, the database provided by ANBIMA may probably suffer from different types of biases. In fact, contrary of HFRI (Hedge Fund Research Index) for instance, which is classified as funds of hedge funds data, the ANBIMA database only gives returns for each strategy-type of operating hedge funds in Brazil, which increases the likelihood of survivorship bias. Moreover, there is the problem of lack of transparency. Hedge funds in Brazil have the option of not disclosing their activities, and so, bad returns that can make the quality of a certain fund dubious may not be included in the data. This leads to selection bias and instant-history bias, which causes an unrepresentative sample of the Brazilian hedge funds. Hence, the ANBIMA hedge fund data is prone to selection, survivorship and instant history bias, which can affect the results of the seven factor ABS risk factor model.

This problem with ANBIMA's database raises concern in the research, since it needs to be internally valid. That is, its statistical inferences about causal effects must be valid for the population and settings studied. The estimator of the causal effects should be unbiased and consistent and the hypotheses tests should have the desired significance level and confidence

intervals. Furthermore, another threat to internal validity is omitted variable bias. This occurs when variables that are not included in the regression affect both the dependent and independent variable. It can be the case in the research, since the Brazilian market may have other explanatory variables besides the ones specified for the US market, that explain returns for hedge funds.

## 4.2 Future Work

Future work on the subject could lead to different results if a more representative Brazilian hedge fund index could be created. Instead of creating equal and value weight index based on individual strategy-types hedge funds and then combining it to have a picture of the whole industry, an index where it captures the returns of funds of hedge funds would lead to fewer data biases. Consequently, a more accurate measure on the breadth of the Brazilian hedge fund industry performance trends across all strategies. Furthermore, the index would be rebalanced on an annual basis.

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