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Aggregate Brazilian Mutual Fund Stockholdings and Asset Returns

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Abstract

This study aims to investigate whether there is a relationship between aggregate Brazilian mutual fund positions and past, concurrent, and future stock performance. Using monthly fund portfolio data for 30.416 funds between 2006 and 2018 and market data for 84 stocks, several panel data regressions were ran to test the correlation between stock total returns and both the level and change in mutual fund aggregate long and short positions. In addition, the data was used in testing a long-short investing strategy in which stocks with high fund ownership indicators are purchased and stocks with low fund ownership indicators are sold.

Keywords

Resumo

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Este estudo objetiva investigar se existe uma relação entre posições agregadas de fundos de investimento brasileiros e o desempenho passado, presente e futuro das ações. Utilizando dados mensais das carteiras de 30.416 fundos entre 2006 e 2018 e dados de mercado de 84 ações, diversas regressões com dados em painel foram feitas para testar a correlação entre retornos totais das ações e o nível e a mudança de posições compradas e vendidas. Além disso, os dados foram utilizados para testar uma estratégia *long-short* de investimento segundo a qual as ações que ocupam posições altas nos fundos são compradas e as ações com baixas posições são vendidas.

Palavras-chave

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1.
Introduction

Globally, the mutual fund industry is highly influential with over $ 50 trillion in assets under management spread over 119 thousand funds, according to the Investment Company Institute. In Brazil, the investment fund industry has grown to 17,952 funds with over R$ 5.6 trillion in assets under management at the end of June 2019, according to ANBIMA, the Brazilian Financial and Capital Markets Association (Figure 1).

Due to the enormity of the industry and its potential influence on the financial markets and security prices, it is a subject of extensive academic debate. One area of particular interest is the relation between institutional investors and asset performance. In this paper we will use the term "fund flows" to describe the allocation and withdrawal of investment to and from investment funds. The term "fund holdings" will be used to describe the investments held by investment funds, while "fund trades", will be used to describe the investments made during the period by investment funds.

Research within the field encompasses a broad swath of topics. Warther (1995), Goetzmann and Massa (2003), Edelen and Warner (2001), and Cha and Kim (2010) discuss the relation between aggregate fund flows and market-wide returns. Ippolito (1992) and Hendricks, Patel, and Zeckhauser (1990) touch upon the relation between individual fund flows and individual fund performance. Frazzini and Lamont (2008) focuses on the relation between individual fund flows and stock performance.

An area of intense interest is the relation between individual asset returns and fund holdings and fund trades. Various papers have explored whether institutional investors employ momentum or trend-following strategies, whether fund trades create price pressures and whether institutional investors have stock picking abilities or informational advantages.

This study attempts to further understand the relation between individual asset returns and fund holdings and fund trades using data from the Brazilian investment fund industry. Similar to Chen, Jegadeesh and Wermers (2000), we explore the relation between asset returns and aggregate fund holdings and the relation between asset returns and aggregate fund trades.

This paper adds to the existing literature in a number of ways. First, Brazilian investment funds are required to report portfolio holdings on a monthly basis. Due to this higher level of transparency within the Brazilian financial markets, the analysis is able to utilize higher frequency portfolio data compared to the quarterly portfolio holdings data provided by 13F filings in the US market. Secondly, the portfolio data reported by the Brazilian investment funds includes information regarding both long and short positions, allowing us to isolate both measures on an aggregate basis. Finally, we introduce a measure of aggregate fund holdings which takes into account the level of trading liquidity of the individual assets.

The results of our analysis suggests that Brazilian institutional investors have stock-picking abilities and are correctly able to identify stocks which will underperform. Aggregate fund short holdings are positively correlated with negative future excess returns. In addition, Brazilian institutional investors appear to use trend-following strategies when implementing short positions. Utilizing fund holdings as a percentage of asset trading liquidity, we find that liquidity is also an important factor for institutional investors when considering the size of their positions.

We organize the paper as follows. Section 2 provides an overview of the existing literature on the relation between institutional ownership and asset returns. Section 3 summarizes the data and key measures utilized. Section 4 presents our quantitative analysis and results and Section 5 concludes.

2.
Literature Summary

Numerous studies have investigated the relationship between institutional ownership and asset returns. We segregate this literature by asset return intervals to simplify the discussion. In section 2.1 we discuss the relation between institutional investment allocations and past asset returns and momentum investing strategies. We summarize in section 2.2 the literature on institutional investor herding and contemporaneous price effects and the possible causes of observed price effects. In section 2.3 we review the relationship between institutional investors and future asset returns and explore the stock-picking abilities of mutual fund managers.

In addition, section 2.4 recaps the effect liquidity has on institutional investor allocations. Lastly, in section 2.5 we discuss the relation between short interest and asset returns.

2.1.
Institutional Ownership and Past Asset Returns

Momentum investing strategies, which are also known as trend-following or positive feedback trading strategies, involve buying assets that previously experienced positive returns and selling assets that previously experienced negative returns. Many studies have found evidence of momentum strategies among institutional investors.

Cai and Zheng (2004) show positive correlation between stocks with heavy institutional buying (selling) and positive (negative) returns over the previous twelve months. In addition, Nofsinger and Sias (1999) show a positive correlation between changes in institutional ownership and lag returns. Griffin, Harris and Topaloglu (2001), using daily NASDAQ data, show that there is a correlation between past stock returns and institutional trading.

Choe, Kho and Stulz (1999), studying the role of foreign investors during the 1997 economic crisis, find that both Korean and foreign institutional investors engage in trend-following behavior.

Froot, O'Connell and Seasholes (2001) find positive correlation between international net portfolio flows and lagged equity returns, suggesting that international investors display trend-following behavior.

Grinblatt, Titman and Wermers (1995) show that mutual fund managers pursue momentum strategies, buying stocks that were past winners. Grinblatt and Keloharju (2000), using data from Finland, show that foreign institutional investors pursue momentum strategies, buying past winners and selling past losers, while Finnish households and Finish institutional investors pursue a contrarian strategy, buying past losers and selling past winners for individual stocks.

Looking at individual investors and using flows into and out of mutual funds, Sirri and Tuffano (1998), show that individual investors allocate based on prior period performance information. While these flows are on an individual investor level, these individual flows may explain institutional investor trades as shown in Khan Kogan Serafeim (2012) for mutual fund inflows and in Coval and Stafford (2007) for mutual fund outflows.

2.2.
Institutional Ownership and Contemporaneous Asset Returns

Numerous studies have found a positive strong correlation between institutional investor trades and contemporaneous asset returns and explore whether this correlation is caused by institutional trade price-pressures or by herding behaviors among institutional investors. Herding, as defined by Sias (2004), occurs when a group of investors follows each other into the same assets over the same period of time. The price-pressure hypothesis, as described in Ben-Rephael, Kandel and Wohl (2011), describes how mutual fund flows create temporary price-pressure which is subsequently corrected in future periods.

Nofsinger and Sias (1999) show strong positive correlation between changes in institutional ownership and contemporaneous stock returns over the same period. Sias, Starks and Titman (2006) find evidence that the positive correlation between changes in institutional ownership and contemporaneous returns is associated with information effects (institutional investors are better informed than individuals).

Sias (2004) shows that institutional investors herd, following each other into and out of the same securities and show that despite being momentum investors the herding is more related to past institutional demand rather than past returns. Wermers (1999) finds evidence of herding in mutual fund trades and find that stocks bought by herding funds have higher contemporaneous and future returns,

suggesting that institutional investors herd on new information that is then reflected in the prices. Grinblatt, Titman and Wermers (1995) find weak evidence that mutual funds exhibit herding behavior, buying and selling the same stocks at the same time.

Lakonishok, Shleifer and Vishny (1992) find evidence only in the smallest stocks of herding behavior among institutional investors and of positive correlation between changes in institutional holdings and contemporaneous excess returns. Choe, Kho and Stulz (1999) find that both Korean and foreign institutional investors engage in herding behavior while this behavior became less apparent during the crisis of 1997.

Griffin, Harris and Topaloglu (2001) show that there is a contemporaneous relation between changes in institutional ownership and stock returns but do not find strong evidence of institutional price pressure. Ben-Rephael, Kandel and Wohl (2011) find a high positive contemporaneous correlation between mutual fund flows and market returns and show that mutual fund flows create temporary price pressures that correct in future periods, supporting the price pressure hypothesis.

Boyer and Zheng (2002) find that quarterly stock returns are positively correlated with cash flows from mutual funds and find evidence supporting pricing pressure contributing to this positive correlation as well as evidence supporting short-term momentum trading as the source of this positive correlation.

2.3.
Institutional Ownership and Future Asset Returns

There are numerous papers discussing whether institutional investors have the ability to outperform the market before and after expenses. Jensen (1968) shows that mutual funds do not outperform passive strategies, even when considering returns gross of expenses.

On the other hand, Chen, Jegadeesh and Wermers (2000) find evidence of stock picking skills for mutual fund managers, showing that stocks purchased by mutual funds outperform the stocks that they sell. Grinblatt and Titman (1989; 1993) examine the performance of individual stocks held by funds, and show that stocks held by mutual funds earn significantly positive risk-adjusted returns but argue that mutual fund investors cannot achieve these returns due to fund expenses. Wermers (2000), using quarterly US mutual fund portfolio data, shows that mutual

funds hold stocks that outperform the market by 1.3 percent per year but net returns underperform by one percent due to nonstock holdings, expenses and transaction costs.

Yan and Zhang (2007) show that the positive correlation between aggregate investment fund ownership and future returns is associated with short-term investors. Gompers and Metrick (2001) show aggregate investment fund ownership is positively correlated with future returns, but changes in aggregate ownership is not. Chen, Hong and Stein (2002) test whether breadth of ownership, the number of institutional investors with long positions in a stock (breadth), is a useful indicator for forecasting future returns. They show that stocks experiencing decline in breadth of ownership subsequently underperform stocks whose breadth has increased.

Daniel, Grinblatt, Titman, Wermers (1997) show that mutual fund managers exhibit stock selection ability but show that this performance is mainly due to the characteristics of the stocks held rather than superior fundamental analysis of each security. Gruber (1996) shows that a subgroup of sophisticated mutual fund investors allocate assets to funds that go on to earn positive risk adjusted returns but that the average mutual fund underperforms passive market indexes. Similarly, Kosowski, Timmermann, Wermers and White (2006) find evidence of persistent performance among top mutual fund managers, suggesting stock picking ability among a select group. Alexander, Cici and Gibson (2006), differentiate between liquidity-motivated trades and valuation-motivated trades and find that mutual fund investors significantly outperform their benchmarks when making trades based on valuation rather than trading to meet liquidity requirements of the open-end funds.

Other studies try to explore the source of the institutional investor stock-picking abilities. Baker, Litov, Wacther and Wurgler (2010) show that stocks purchased by fund managers outperform stocks sold at the next earnings announcement and show that fund trades around earnings announcements account for a significant portion of the excess return generated by fund managers. Carhart (1997) finds that the short-term persistence of positive returns displayed by some fund managers is attributable to luck and not momentum strategies or stock picking abilities. Coval and Moskowitz (2001) show that institutional investors that strongly bias their holdings to local firms hold an informational advantage and earn abnormal returns in their geographically local investments and thus display a local

stock picking ability. Similarly, Baik, Kang and Kim (2010) show that the level and change of local institutional holdings predict future stock returns and that local institutional investors earn higher excess returns around earnings announcements than nonlocal institutional investors.

2.4.
Institutional Investors and Asset Liquidity

One of the key measures of aggregate fund holdings utilized in our study is the ratio between aggregate fund holdings and asset trading liquidity. Institutional investors take into account the relative liquidity of investments when making investment decisions. Wang (2003) argues that "given that institutions are required to stand ready to accommodate individuals' redemption and purchase orders, liquidity ranks as a top concern for their stock-picks".

Falkenstein (1996), by regressing fund ownership (as a percentage of shares outstanding) on share liquidity (as measured by trading volume over shares outstanding), shows that mutual fund demand for a security is increasing in liquidity.

Massa and Phalippou (2005) show that portfolio liquidity is actively managed and that liquidity considerations affect the portfolio construction of US equity mutual funds. Similarly, Huang (2015) shows that fund managers actively manage the liquidity characteristics of the fund portfolio in response to changing market liquidity expectations. Yan (2008) finds evidence supporting liquidity as the determining factor in why fund size erodes performance.

One argument of liquidity being an important factor is the detrimental price effect of large relative trades for less liquid instruments. Coval and Stafford (2007) shows that mutual fund flows create pricing pressures in the securities held by the mutual funds experiencing the inflows and outflows. They also show that mutual funds incur costs when forced to liquidate illiquid investments due to investor redemptions.

Chordia (1996) shows that fund managers are required to account for liquidity risk when structuring their portfolios. Besides adjusting the liquidity profile of the portfolio assets to account for investor inflows and outflows, funds can try to manage the liquidity risk of their investors by opting for closed-end fund structures,

including load fees or redemption fees, or actively filtering investors who match the liquidity profile required by the investment strategy.

Edelen (1999) concludes that the underperformance of mutual funds is not due to manager inability but rather is due to the indirect costs of liquidity-motivated trades due to the structure of open-end funds.

2.5.
Institutional Investors and Short Interest

The investment fund portfolio data set utilized in our study includes both long and short positions for each investment fund. There is extensive research between short positions, institutional investors and asset returns.

Boehmer Jones and Zhang (2008) demonstrate that short sellers are well informed and predict future stock returns and show that heavily shorted stocks significantly underperform lightly shorted stocks. In addition, they show that institutional short sales are the most informative and that the price effects are permanent, suggesting that short sellers do not manipulate the prices to achieve these returns.

Akbas, Boehmer, Erturk, Sorescu (2017) show that short interest levels predict future stock returns due to the fact that short sellers are better informed and are able to anticipate future fundamental events such as negative earnings surprises or analyst downgrades.

Desai, Ramesh, Thiagarajan, and Balachandran (2002), using NASDAQ stocks, show that firms with high short interest experience future negative abnormal returns. In addition, they demonstrate that increases in short interest are negatively correlated with future abnormal returns.

Diether, Lee, and Werner (2008) show that short sellers correctly predict future negative abnormal returns and increase price efficiency. Similarly, Saffi and Sigurdsson (2010) demonstrate the importance of short selling for price efficiency and market liquidity.

Jiao, Massa and Zhang (2016) demonstrate that opposite changes in short interest and fund holdings is associated with informed demand and predicts future returns.

Christophe, Ferri and Angel (2004) demonstrate that short sellers are informed traders and front-run analyst downgrades, and suggest that this informational edge comes from insider "tipping".

Dechow, Hutton, Meulbroek and Sloan (2001) demonstrate that short-sellers use fundamental information to take short positions in overpriced stocks.

Asquith, Pathak and Ritter (2005), using institutional ownership as a proxy for stock lending supply, show that the relationship between high short interest and abnormal lower stock returns is higher for short-sale constrained stocks.

As documented in Lamont (2012), short selling costs include interest paid for borrowing shares, increased margin requirements, and the transaction costs of implementing the trade. Short-selling risks include early recall of borrowed shares, the asymmetrical pricing risks of the security, lawsuits, regulation changes, and short squeezes.

3.
Data and Key Variables

3.1.
Data Sources and Description

We obtained the data used in our study from three principal sources:

1. **Securities and Exchange Commission of Brasil ("CVM"):** CVM is the principal regulating authority of the financial markets in Brazil and is responsible for regulating capital markets and capital market participants, including financial exchanges, publicly traded companies, investment funds and investors.

2. **B3 S.A. – Brasil, Bolsa, Balcão ("B3"):** B3 is Brazil's largest financial market infrastructure company, and the principal stock exchange in Brazil.

3. **Economatica:** a financial information provider focused on the Latin American market.

3.1.1.
IBrX 50 (Brazil 50 Index)

We limited our analysis to ordinary shares and preferential shares which were components of the IBrX-50 Index for at least 24 months during the period of analysis (January 2006 – December 2018).

The IBrX-50 Index is a total return index designed to measure average stock performance of the 50 most actively traded and most representative stocks of the Brazilian stock market. The index components are weighted by the market value of the stock's free float. We obtained IBrX-50 component data from B3. The sample of assets in our analysis includes 84 stocks, of which 49 are ordinary shares and 35 are preferential shares. The complete list of the stocks included in our analysis and associated descriptive statistics can be found in Tables 1 and 2.

In addition, we obtained IBrX-50 end of month pricing data from B3, which we used to calculate subperiod returns of the index throughout the period of analysis.

3.1.2.
Historical Market Data

For each of the 84 stocks included in our analysis, we obtained historical daily prices, daily transaction volume and quote multipliers between January 2005 and June 2019 (inclusive) from B3.

Historically in Brazil, stock prices were often listed as a price per group of shares (often 10, 100 or 1,000 shares). Using the quote multipliers, we adjusted the historical prices to calculate historical price per share for each stock at the end of each month between January 2005 and June 2019 (inclusive).

Using the daily transaction volume obtained from B3, we calculated the average daily trading volume over three month periods ("ADTV") for each stock.

From Economatica, we obtained historical shares outstanding data for each stock and historical stock split information between January 2006 and December 2018 (inclusive).

In addition, we obtained adjusted pricing data for each of the stocks in our analysis from Economatica. Using adjusted pricing data, we calculated 1-month, 2-month, 3-month, 6-month and 12-month subperiod returns for each of the stocks included in our analysis. Economatica adjusts for cash and stock dividends, stock splits, reverse splits, spinoffs, rights issues and capital reductions. More details about the adjustment factor for each type of corporate action can be found in appendix 1.

3.1.3.
Fund Portfolio Holdings

We obtained monthly portfolio holdings data for all Brazilian investment funds, between January 2006 and December 2018 (inclusive), from CVM, through CVM's Open Data Portal. Investment funds in Brazil are obligated to report their end of month portfolio holdings to the CVM on a monthly basis but can choose to postpone the public disclosure of this portfolio holding information for three

months. This monthly reporting obligation is the principal advantage of using Brazilian fund data, as many international studies are limited to quarterly data.

Our sample includes monthly portfolio holding data for 30,416 different investment funds over 156 months, of which 6,214 investment funds held a position in one of the 84 stocks for at least one period.

Using our fund portfolio database, we calculated the monthly aggregate market value of long, short and net positions of Brazilian investment funds in each of the 84 stocks included in the analysis.

3.2.
Key Measures of Aggregate Fund Holdings

The portfolio holdings data was used to find aggregate positions held by investment funds in each stock included in our analysis. Using this data, we calculated two key measures of aggregate fund holdings and aggregate fund trades, described in the following subsections.

3.2.1.
Aggregate Fund Holdings as % of Market Cap.

The first measure of aggregate fund holdings is the sum of shares of each security held by investment funds as a percentage of the market capitalization of each security. The formulas for long, short and net positions of this measure are

$$LONG_{i,t} = \frac{IO\_Long_{i,t}}{Shares_{i,t}*Mkt\_Price_{i,t}} \tag{1}$$

$$SHORT_{i,t} = \frac{IO\_Short_{i,t}}{Shares_{i,t}*Mkt\_Price_{i,t}} \tag{2}$$

$$NET_{i,t} = LONG_{i,t} - SHORT_{i,t} \tag{3}$$

where, $IO\_Long_{i,t}$ is the aggregate market value of stock i held in long positions at the end of month t by all investment funds and $IO\_Short_{i,t}$ is the aggregate market value of stock i held in short positions at the end of month t by all investment funds. $Shares_{i,t}$ is the total shares outstanding of stock i at the end of month t and

$Mkt\_Price_{i,t}$ is the unadjusted closing stock price of stock i at the end of month t. The $LONG_{i,t}$ measure is similar to the $FracHoldings_{i,t}$ variable used by Chen, Jegadees and Wermers (2000), using market values instead of number of shares.

3.2.2.
Aggregate Fund Holdings as Multiple of ADTV

Due to risks of fund withdrawals on short notice, fund managers have to take into account the expected time to liquidate a position when deciding what size investment each security should represent within their portfolio. We calculated a second measure of aggregate fund holdings, which is the ratio of the aggregate investment fund holdings in each stock in relation to the ADTV of each stock. Similar to the first measure, we calculate long, short and net positions,

$$DaysLONG_{i,t} = \frac{IO\_Long_{i,t}}{3M\_ADTV_{i,t}} \qquad (4)$$

$$DaysSHORT_{i,t} = \frac{IO\_Short_{i,t}}{3M\_ADTV_{i,t}} \qquad (5)$$

$$DaysNET_{i,t} = DaysLONG_{i,t} - DaysSHORT_{i,t} \qquad (6)$$

where, $3M\_ADTV_{i,t}$ is the ADTV for stock i for the three-month period ending at month t.

3.2.3.
Aggregate Fund Trades

While aggregate fund holdings can provide insight into the stock-selection abilities and process of fund managers, the change in aggregate fund holdings is useful to understand changes in investment fund manager sentiment for each security. We refer to this change in aggregate fund holdings as aggregate fund trades. Assuming managers have stock selection ability, we would expect securities with positive aggregate fund trades (aggregate fund holdings increases) between periods to have higher future returns than securities with negative aggregate fund trades (aggregate fund holdings decreases) between periods. Aggregate fund trades

of stock *i* during month *t* is measured for long, short and net positions for each of the two measures as follows:

Aggregate Fund Trades as Percentage of Market Capitalization

$$\Delta LONG_{i,t} = LONG_{i,t} - LONG_{i,t-1} \tag{7}$$

$$\Delta SHORT_{i,t} = SHORT_{i,t} - SHORT_{i,t-1} \tag{8}$$

$$\Delta NET_{i,t} = NET_{i,t} - NET_{i,t-1} \tag{9}$$

Aggregate Fund Trades as Multiple of ADTV

$$\Delta DaysLONG_{i,t} = DaysLONG_{i,t} - DaysLONG_{i,t-1} \tag{10}$$

$$\Delta DaysSHORT_{i,t} = DaysSHORT_{i,t} - DaysSHORT_{i,t-1} \tag{11}$$

$$\Delta DaysNET_{i,t} = DaysNET_{i,t} - DaysNET_{i,t-1} \tag{12}$$

4.
Methodology and Empirical Results

4.1.
Regression Analysis Models and Results

In the following sections we describe the regression models utilized in our analysis. For each of the regressions we used random effects panel data regression analysis. We ran Hausman tests to determine whether random effects or fixed effects models were appropriate.

4.1.1.
Excess Returns as a Function of Fund Holdings

To test whether there exists a correlation between aggregate fund holdings or trades and security returns we ran the following random effect model regression analysis on monthly panel data:

$$R_{i,t-1 \rightarrow t} - R_{IBrX50,t-1 \rightarrow t} = \alpha + \beta X_{i,t} + \varepsilon_i + \mu_{i,t} \tag{13}$$

where $R_{i,t-1 \rightarrow t}$ is the total return for security i during the period $t-1 \rightarrow t$, and where $R_{IBrX50,t-1 \rightarrow t}$ is the total return for the IBrX-50 Index during the period $t-1 \rightarrow t$. Thus, the left-hand side of the equation is the excess return of security i during the 1 month period ending at time t.

$X_{i,t}$ is the placeholder for the following independent variables: $LONG_{i,t}$, $SHORT_{i,t}$, $NET_{i,t}$, $DaysLONG_{i,t}$, $DaysSHORT_{i,t}$, $DaysNET_{i,t}$, $\Delta LONG_{i,t}$, $\Delta SHORT_{i,t}$, $\Delta NET_{i,t}$, $\Delta DaysLONG_{i,t}$, $\Delta DaysSHORT_{i,t}$, and $\Delta DaysNET_{i,t}$.

In addition to running the regression analysis for excess returns during the contemporaneous period ($t-1 \rightarrow t$), we repeated the regression for each of the independent variables using prior and post 1-month, 2-month, 3-month, 6-month and 12-month excess returns.

As previously explained, fund portfolio data is reported to CVM on a monthly basis. The data is reported within 10 days of the end of each month but the publication of this data in the public CVM database can be delayed until 90 days after the end of the holding period. For example, portfolio data for the end of the

month of January must be sent to CVM by the 10th day of February but is required to be publicly disclosed only by the beginning of May. To test if aggregate fund portfolio data has informational value once publicly available, we also ran tests for the 1-month, 2-month, 3-month, 6-month and 12-month periods starting 4 months after the aggregate funds portfolio holdings date.

The results of these regressions are found in Table 3. Panel A shows the results of the regressions in which the excess return is a function of the aggregate fund stockholding level. Looking at the aggregate fund holdings as a percentage of market cap, one can see that the regressions using the $SHORT$ variable result in estimators with the highest statistical significance. Further analyzing these results, we find that past negative excess returns are correlated with elevated short positions for the $SHORT$ variable, suggesting that institutional managers use trend-following or momentum strategies when implementing short positions.

Elevated short positions ($SHORT$) are also associated with negative excess returns in future periods, suggesting that investment fund managers who utilize short positions have stock-picking abilities or informational advantages.

In addition, elevated short positions ($SHORT$) are also associated with negative excess returns in the current period. Looking at the aggregate fund holdings as a multiple of ADTV we see that elevated long and net positions are associated with positive excess returns in the current period ($DaysLONG$ and $DaysNET$). These results does not provide evidence of temporary price pressure since it is the level of fund holdings rather than fund trades.

The 1-month, 2-month, 3-month, and 6-month excess returns for periods beginning in month 4 (when the fund holding information is publicly available) are statistically correlated with aggregate fund position levels as a percentage of market cap ($SHORT$) and as a multiple of ADTV ($DaysSHORT$). These regressions suggest that elevated aggregate short positions are associated with negative future excess returns and that this information continues to be "useful" once publicly available.

Panel B of Table 3 shows the results of the regressions in which excess return is a function of the aggregate fund trades. An increase in aggregate long holdings as multiple of ADTV ($\Delta DaysLONG$) is associated with negative past excess returns. This seems to suggest that the fund managers do not employ trend-

following strategies when implementing long positions and that they build positions in stocks whose assets have recently experienced negative returns.

4.1.2.
Excess Returns as a Function of Fund Long and Fund Short Holdings

To further test the relation between excess stock returns and aggregate fund holdings, we ran the following regression using: (1) the aggregate fund long variables and (2) the aggregate fund short variables.

$$R_{i,t-1\to t} - R_{IBrX50,t-1\to t} = \alpha + \beta_1 X_{i,t} + \beta_2 Y_{i,t} + \varepsilon_i + \mu_{i,t} \qquad (14)$$

$$R_{i,t-1\to t} - R_{IBrX50,t-1\to t} = \alpha + \beta_1 \Delta X_{i,t} + \beta_2 \Delta Y_{i,t} + \varepsilon_i + \mu_{i,t} \qquad (15)$$

where $X_{i,t}$ is the placeholder for the following independent variables: $LONG_{i,t}$ and $DaysLONG_{i,t}$. $Y_{i,t}$ is the placeholder for the following independent variables: $SHORT_{i,t}$ and $DaysSHORT_{i,t}$. $\Delta X_{i,t}$ is the placeholder for the following independent variables: $\Delta LONG_{i,t}$ and $\Delta DaysLONG_{i,t}$. $\Delta Y_{i,t}$ is the placeholder for the following independent variables: $\Delta SHORT_{i,t}$ and $\Delta DaysSHORT_{i,t}$.

Similar to the previous series of regressions, the excess return periods include past, current, and future excess returns.

The results of the regressions utilizing aggregate fund holding variables (formula 14 above) are found in Panel A of Table 4. Panel A1 shows the regression results using $LONG$ and $SHORT$ for past, concurrent, and future returns. Aggregate fund short holdings as a percentage of market cap ($SHORT$) are statistically correlated with past, concurrent and future negative excess returns. In Panel A2 one can see that the level of aggregate fund short holdings as a multiple of ADTV ($DaysSHORT$) is statistically correlated with future negative excess returns. These results seem to suggest that institutional investor short sellers have stock picking ability and correctly identify stocks which will underperform. In addition, the same holds true in periods starting in month four when all fund portfolio data is publically available. This suggests that one may be able to use publically available fund data to identify which stocks will underperform.

The results of the regressions utilizing aggregate fund trades variables (formula 15 above) are found in Panel B of Table 4. Panel B1 shows the regression results using $\Delta LONG$ and $\Delta SHORT$ for past, concurrent and future returns. While the results of the regression are not statistically significant, an increase in short positions (positive aggregate fund trades) as a percentage of market capitalization is associated with negative future excess returns. Panel B2 shows similar results for the regression using $\Delta DaysLONG$ and $\Delta DaysShort$. An increase in short positions as a multiple of ADTV is associated with negative future excess returns. In addition, negative past excess returns are associated with increases in long positions as a multiple of ADTV ($\Delta DaysLONG$).

Overall, the results of the regressions displayed in Table 4, utilizing aggregate fund long and short positions, suggest that fund managers who implement short positions have stock picking abilities for identifying which assets will underperform.

4.2.
Backtesting: Returns from Theoretical Long-Short Portfolio

For every month in our sample period, we split the stocks into three portfolios ranked by the aggregate fund variable (holdings and trades). The 1st (3rd) tercile portfolio composed of stocks with the lowest (highest) aggregate fund long positions. We then calculated the mean equal-weighted annualized excess returns of the 1st tercile portfolio, the 3rd tercile portfolio and a long-short portfolio (3rd tercile minus 1st tercile) for the future 1-month, 2-month, 3-month, 6-month and 12-month holding periods.

In addition, we calculated the equal-weighted mean annualized excess returns of the 1st tercile portfolio, the 3rd tercile portfolio and a long-short portfolio (3rd tercile minus 1st tercile) for the future holding periods starting at 4 months after the aggregate funds portfolio holdings date. We repeated this process for each of the fund aggregate position variables. The results are found in the following sections.

4.2.1.
Backtest: Fund Variables as % of Market Cap.

Table 5 contains the results for the $LONG$, $SHORT$, and NET variables (aggregate fund holdings as percentage of market cap). As can be seen in Panel B, using aggregate fund short holdings ($SHORT$) in the long-short strategy results in statistically significant positive returns. This statistically significant positive return is present in both the future 6-month and 12-month periods as well as the future 3-month, 6-month and 12-month periods starting in month 4. The results (Panel A) of using aggregate fund long holdings ($LONG$) show similar results with reduced statistical and economic significance. The results (Panel C) of using aggregate fund net holdings (NET) are counter to what would be expected but are not statistically significant. This suggests that information is lost when netting out the long and short positions.

Figure 2 shows the accumulated returns starting in January 2006 resulting from the long-short strategy with monthly rebalancing for the $LONG$, $SHORT$, and NET variables. Using 1-month holding periods and monthly rebalancing, the results of implementing the long-short strategy are economically significant when utilizing aggregate fund short holdings as a percentage of market cap ($SHORT$). The long-short strategy using the $SHORT$ variable results in positive 90.5% returns at the end of the 13-year period. On the other hand, the $LONG$ variable resulting in a meager positive 1.2% accumulated return at the end of the 13-year period, while the NET variable results in a negative 13.2% return.

Table 6 contains the results for the $\Delta LONG$, $\Delta SHORT$, and ΔNET variables (aggregate fund trades as percentage of market cap). Panel A of Table 6 shows the results of using aggregate fund long trades ($\Delta LONG$) in the long-short strategy. The mean annualized positive return from the long short strategy with holding periods of 1-month is 12.98% and is statistically significant at the 0.001 probability level. The results (Panel B and Panel C) of using the change in the aggregate fund short position ($\Delta SHORT$) and the change in the aggregate fund net position (ΔNET) show similar results with positive returns but with reduced statistical and economic significance.

Figure 3 shows the accumulated returns using the $\Delta LONG$, $\Delta SHORT$, and ΔNET variables with monthly rebalancing. The accumulated returns of the long-

short portfolio strategy for each of the variables is positive with the $\Delta LONG$ variable resulting in a positive 340.7% accumulated return at the end of the 13 year period.

4.4.2.
Backtest: Fund Variables as Mutilple of ADTV

Table 7 contains the results using aggregate fund holdings as multiple of ADTV variables ($DaysLONG$, $DaysSHORT$, and $DaysNET$). The results are found in Panels A, B and C, respectively. Once again, a long-short portfolio results in economically significant returns in all periods for $DaysLONG$ and $DaysNET$. Using $DaysSHORT$ results in positive returns except for when the information becomes publically available. The average holding period returns for the long-short strategy for the 1-month, 2-month, 3-month and 6-month holding periods starting in month 4 are all negative.

The primary source of the positive returns for the long-short portfolio are the stocks purchased rather than the stocks sold short. The stocks purchased are the 3rd tercile stocks for the $DaysLONG$ and $DaysNET$ variables and the 1st tercile stocks for the $DaysSHORT$ variable. The annualized excess returns range between 1.759% and 3.647% for the 3rd tercile stocks (ranked by $DaysLONG$) and are statistically significant at the 0.001 probability level for the 6-month and 12-month holding periods starting at month 0. In addition, the annualized excess returns are 2.195% (significance at 0.05 probability level) for the 6-month period starting at month 4 and 1.759% (significance at the 0.01 probability level) for the 12-month period starting at month 4. Similar results are found using the 3rd tercile stocks for the $DaysNET$ variable and the 1st tercile stocks for the $DaysSHORT$ variable. These results suggest that economically and statistically significant positive excess returns are obtainable utilizing the $DaysLONG$, $DaysSHORT$ and $DaysNET$ variables in a long-short strategy.

Figure 4 shows the accumulated returns using the $DaysLONG$, $DaysSHORT$, and $DaysNET$ variables with monthly rebalancing from January 2006 to December 2018. The long-short portfolio strategy for the $DaysSHORT$ variable results in a positive 109.6% accumulated return at the end of the 2018 while the $DaysNET$ and $DaysLONG$ variables result in positive 20.4% and negative 2.2% accumulated returns, respectively.

Table 8 contains the results using aggregate fund trades as multiple of ADTV variables ($\Delta DaysLONG$, $\Delta DaysSHORT$, and $\Delta DaysNET$). Panel C shows the results of using aggregate net fund trades as a multiple of ADTV ($\Delta DaysNET$). The average return from the long-short portfolio is negative for the 1-month, 2-month and 3-month holding periods starting at month zero (with no statistical significance) but is positive for the 2-month, 3-month, and 12-month holding periods starting at month 4 (with statistical significance at the 0.05 probability level).

Figure 5 shows the accumulated returns using the $\Delta DaysLONG$, $\Delta DaysSHORT$, and $\Delta DaysNET$ variables with monthly rebalancing. The accumulated returns of the long-short portfolio strategy for the $\Delta DaysSHORT$ variable returned the highest accumulated returns at the end of 13 years with a positive 17.3% accumulated return while the $\Delta DaysNET$ and $\Delta DaysLONG$ variables resulting in a negative accumulated returns at the end of the 13 year period.

5.
Conclusion

This study aimed to investigate the relationship between aggregate Brazilian investment fund holdings and trades and asset performance for 84 different components of the IBrX50 index.

Utilizing publicly available fund portfolio data from 2006 to 2018, we compiled aggregate fund holdings and trades for each stock. Our fund holdings data included long, short and net positions compared to market capitalization, free float and trading liquidity. We then analyzed the relation between the aggregate fund holdings and trades and the excess returns realized by each stock in past, future and contemporaneous holding periods.

The results of our analysis suggest that information can be gleamed from the holdings and trades of Brazilian investment funds, especially when considering short positions. Aggregate short holdings of Brazilian investment funds are correlated with future negative excess returns, which suggests that Brazilian investment fund managers have stock-picking abilities and are capable of identifying underperforming assets. In addition, our analysis suggests that liquidity is an important factor for institutional investors when considering the size of their positions.

Future studies could explore segmenting portfolio data based on fund characteristics such as investment style, past investment performance, and size. In addition, differentiating trades of funds with positive flows versus the trades of funds with negative flows, one may isolate the relationship between asset returns and valuation-motivated trades. Finally, utilizing realized return in excess of expected returns (based on fundamental characteristics) rather than return in excess of the IBrX 50 index may provide more robust results.

6.
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7.
Appendix

Appendix 1: Adjustment Factor for Adjusted Stock Prices
Source: Economatica

The formulas below show the calculation of the adjustment factor for each type of corporate action. Stock prices prior to the corporate action (from the beginning of the series to the day before the corporate action) are multiplied by this factor so that they are comparable to the stock prices after the corporate action.

- Cash Dividends: $\quad F = 1 - \left(\dfrac{D}{Pu}\right)$
- Stock Dividends: $\quad F = \dfrac{1}{(1+b)}$
- Stock Splits: $\quad F = \dfrac{1}{d}$
- Capital Reduction: $\quad F = \dfrac{1}{(1-r)}$
- Reversed Splits: $\quad F = g$
- Rights Issues: $F = \dfrac{(Pu+s*S)}{((1+s)*Pu)}$
- Spinoff: $\quad F = 1 - \left(\dfrac{c}{100}\right)$

Where:

- F = adjustment factor
- Pu = original price at last date WITH right
- D = dividend value
- b = number of new shares received for each share held
- d = number of new shares replacing each old share
- r = number of shares cancelled for each share held
- g = number of old shares being replaced by each new share
- S = subscription price
- s = number of new shares offered for each share held
- c = percent of the market value represented by the spunoff unit

Table 1: Summary Statistics by Stock

#	Stock	Number of Months	Market Cap (Stock Class) Mean (R$ millions)	ADTV (Last 3 Months) Mean (R$ millions)	Mean Fund Holdings as % of Mkt Cap			Mean Fund Holdings / ADTV		
					LONG	SHORT	NET	DaysLong	DaysSHORT	DaysNET
1	ABEV3	59	R$ 290.655,1	R$ 243,1	1,1%	0,3%	0,8%	13,98	3,86	10,15
2	ALLL3	36	R$ 6.450,3	R$ 28,7	8,6%	1,0%	7,6%	18,07	2,24	15,89
3	AMBV4	90	R$ 58.850,4	R$ 69,1	2,0%	0,5%	1,5%	16,78	4,59	12,14
4	ARCZ6	46	R$ 4.946,5	R$ 23,0	4,4%	1,9%	2,6%	9,68	6,84	2,75
5	BBAS3	154	R$ 69.682,2	R$ 160,6	5,8%	0,3%	5,5%	28,12	1,64	26,43
6	BBDC3	57	R$ 80.115,8	R$ 45,1	0,9%	0,3%	0,6%	15,73	4,51	11,31
7	BBDC4	154	R$ 64.664,3	R$ 223,9	6,2%	0,8%	5,4%	18,82	2,50	16,32
8	BBSE3	55	R$ 57.962,2	R$ 123,7	2,5%	0,2%	2,4%	12,00	0,87	11,14
9	BISA3	34	R$ 2.397,7	R$ 19,4	9,1%	2,0%	7,1%	11,32	2,13	9,26
10	BRAP4	146	R$ 6.335,3	R$ 39,4	20,9%	0,6%	20,3%	30,68	0,89	29,80
11	BRFS3	106	R$ 35.311,6	R$ 111,7	12,2%	0,6%	11,6%	42,10	2,11	40,00
12	BRKM5	124	R$ 7.084,8	R$ 34,8	10,2%	1,1%	9,2%	20,82	2,06	18,81
13	BRML3	87	R$ 8.979,7	R$ 60,4	12,2%	1,2%	11,0%	18,18	1,86	16,37
14	BRTO4	29	R$ 4.014,5	R$ 18,2	13,4%	0,5%	12,9%	30,16	1,02	29,14
15	BRTP4	29	R$ 4.645,5	R$ 15,9	6,3%	1,5%	4,8%	22,03	5,68	16,35
16	BTOW3	45	R$ 5.619,8	R$ 37,6	9,0%	0,9%	8,1%	13,76	1,40	12,38
17	BVMF3	113	R$ 25.026,7	R$ 160,0	7,0%	1,1%	5,9%	11,25	1,70	9,57
18	CCRO3	152	R$ 22.360,7	R$ 58,2	2,9%	0,4%	2,5%	12,62	1,93	10,73
19	CESP6	48	R$ 5.312,4	R$ 39,9	16,5%	0,3%	16,1%	25,54	0,73	25,00
20	CIEL3	101	R$ 50.202,4	R$ 127,4	2,3%	0,2%	2,0%	9,54	0,85	8,72
21	CMIG4	154	R$ 9.947,6	R$ 60,5	11,2%	2,1%	9,1%	18,39	4,22	14,11
22	CPFE3	52	R$ 18.808,0	R$ 25,4	12,6%	0,4%	12,2%	96,00	3,01	93,02
23	CPLE6	55	R$ 3.624,7	R$ 21,0	15,2%	2,4%	12,8%	26,35	4,21	22,26
24	CRUZ3	41	R$ 29.518,9	R$ 23,1	1,0%	0,4%	0,5%	12,97	6,15	6,80
25	CSAN3	143	R$ 11.610,0	R$ 37,6	5,4%	0,5%	4,9%	17,12	1,78	15,37
26	CSNA3	152	R$ 20.932,2	R$ 76,0	4,8%	0,8%	4,0%	13,52	1,94	11,61
27	CTIP3	53	R$ 8.488,9	R$ 55,9	20,0%	1,7%	18,3%	31,39	2,54	28,86
28	CYRE3	112	R$ 6.603,4	R$ 49,7	8,0%	1,9%	6,1%	10,66	2,68	8,07
29	ELET3	92	R$ 22.340,1	R$ 35,3	4,1%	0,2%	3,9%	25,03	1,23	23,81
30	ELET6	61	R$ 5.750,4	R$ 27,7	22,2%	3,3%	18,8%	40,90	7,22	33,88

Table 1: Summary Statistics by Stock (continued)

#	Stock	Number of Months	Market Cap (Stock Class) Mean (R$ millions)	ADTV (Last 3 Months) Mean (R$ millions)	Mean Fund Holdings as % of Mkt Cap			Mean Fund Holdings / ADTV		
					LONG	SHORT	NET	DaysLong	DaysSHORT	DaysNET
31	ELPL4	26	R$ 2.703,7	R$ 26,6	8,9%	4,3%	4,6%	6,33	3,12	3,32
32	ELPL6	36	R$ 3.246,5	R$ 25,3	15,9%	1,2%	14,7%	20,39	1,55	18,90
33	EMBR3	117	R$ 13.209,4	R$ 40,4	3,1%	0,6%	2,5%	11,16	2,94	8,30
34	EQTL3	38	R$ 11.009,3	R$ 62,3	29,2%	0,7%	28,5%	51,64	1,26	50,42
35	ESTC3	59	R$ 6.554,6	R$ 65,3	7,7%	1,2%	6,6%	8,06	1,49	6,61
36	FIBR3	106	R$ 17.797,8	R$ 59,2	2,5%	0,3%	2,1%	7,79	1,06	6,74
37	GFSA3	84	R$ 2.726,5	R$ 42,7	17,7%	3,2%	14,5%	9,74	1,89	7,90
38	GGBR4	156	R$ 16.797,8	R$ 107,9	7,1%	1,1%	6,0%	12,03	1,91	10,13
39	GOAU4	118	R$ 5.675,8	R$ 44,3	20,8%	1,3%	19,5%	36,95	1,05	35,93
40	GOLL4	86	R$ 2.740,0	R$ 27,5	8,7%	1,8%	6,9%	7,85	2,08	5,83
41	HGTX3	46	R$ 5.168,2	R$ 45,8	8,6%	1,8%	6,8%	9,82	2,19	7,75
42	HYPE3	95	R$ 13.330,6	R$ 59,3	7,0%	0,9%	6,1%	15,74	1,91	13,86
43	ITAU4	38	R$ 44.494,6	R$ 104,1	3,5%	1,0%	2,5%	16,07	4,69	11,20
44	ITSA4	156	R$ 32.554,8	R$ 114,6	12,7%	0,6%	12,1%	39,65	1,69	37,97
45	ITUB4	107	R$ 94.255,8	R$ 373,0	5,3%	1,0%	4,3%	13,88	2,66	11,22
46	JBSS3	127	R$ 22.331,4	R$ 56,3	2,3%	0,3%	2,1%	11,95	1,40	10,56
47	KLBN4	40	R$ 4.562,2	R$ 16,6	5,3%	1,9%	3,4%	14,69	6,15	8,56
48	KROT3	57	R$ 20.535,9	R$ 140,3	5,6%	0,9%	4,6%	8,28	1,47	6,80
49	LAME4	153	R$ 9.777,4	R$ 39,9	7,5%	1,7%	5,8%	18,30	4,43	13,89
50	LREN3	137	R$ 10.241,5	R$ 60,6	10,3%	1,4%	8,9%	15,81	1,98	13,82
51	MMXM3	54	R$ 3.984,1	R$ 38,8	8,4%	1,3%	7,2%	8,53	1,20	7,39
52	MRFG3	28	R$ 3.814,1	R$ 29,8	6,2%	1,7%	4,5%	9,22	2,36	7,04
53	MRVE3	106	R$ 5.174,7	R$ 42,5	5,8%	2,5%	3,3%	7,02	3,25	3,81
54	MULT3	37	R$ 10.804,0	R$ 45,6	4,8%	0,6%	4,2%	11,15	1,48	9,67
55	NATU3	140	R$ 14.145,7	R$ 37,4	2,5%	0,8%	1,7%	9,65	3,10	6,60
56	NETC4	57	R$ 4.532,3	R$ 35,9	11,1%	0,6%	10,5%	14,59	0,84	13,74
57	OGXP3	48	R$ 35.998,5	R$ 252,5	4,6%	1,4%	3,2%	4,88	0,78	4,15
58	OIBR4	40	R$ 5.729,2	R$ 47,2	4,0%	1,5%	2,5%	4,14	1,75	2,61
59	PCAR4	121	R$ 9.975,8	R$ 52,3	8,3%	1,1%	7,2%	18,67	2,37	16,35
60	PDGR3	60	R$ 5.151,4	R$ 79,7	21,9%	3,7%	18,2%	13,88	2,25	11,75

Table 1: Summary Statistics by Stock (continued)

#	Stock	Number of Months	Market Cap (Stock Class) Mean (R$ millions)	ADTV (Last 3 Months) Mean (R$ millions)	Mean Fund Holdings as % of Mkt Cap			Mean Fund Holdings / ADTV		
					LONG	SHORT	NET	DaysLong	DaysSHORT	DaysNET
61	PETR3	154	R$ 149.197,2	R$ 160,0	5,9%	0,3%	5,6%	73,52	2,67	71,06
62	PETR4	154	R$ 100.855,0	R$ 639,2	7,4%	0,6%	6,8%	13,36	1,06	12,31
63	PRGA3	38	R$ 6.635,2	R$ 28,2	14,1%	0,5%	13,6%	34,09	1,12	32,97
64	QUAL3	51	R$ 6.050,4	R$ 53,0	10,7%	0,4%	10,3%	11,40	0,48	10,93
65	RADL3	39	R$ 21.326,4	R$ 78,9	8,5%	0,8%	7,7%	23,22	2,19	21,08
66	RDCD3	48	R$ 18.446,3	R$ 68,4	4,3%	0,6%	3,7%	12,22	1,73	10,52
67	RENT3	65	R$ 9.150,1	R$ 52,0	6,6%	1,2%	5,4%	12,13	2,28	9,88
68	RSID3	68	R$ 2.258,2	R$ 28,3	12,6%	2,3%	10,3%	9,19	1,56	7,69
69	SBSP3	73	R$ 14.398,4	R$ 31,4	2,0%	0,8%	1,2%	10,13	4,75	5,33
70	SDIA4	44	R$ 3.110,5	R$ 22,3	6,1%	2,3%	3,9%	8,31	4,39	3,87
71	SUZB5	61	R$ 8.617,1	R$ 58,0	10,8%	0,8%	10,0%	16,38	1,29	15,10
72	TAMM4	58	R$ 3.468,1	R$ 28,7	7,6%	0,9%	6,7%	9,54	1,18	8,42
73	TCSL4	65	R$ 8.635,9	R$ 21,1	3,8%	0,8%	3,0%	15,03	3,52	11,57
74	TIMP3	65	R$ 24.153,8	R$ 44,1	0,7%	0,1%	0,7%	4,25	0,54	3,75
75	TNLP3	31	R$ 7.719,6	R$ 30,4	6,4%	0,4%	6,0%	18,82	1,17	17,72
76	TNLP4	75	R$ 8.007,4	R$ 44,4	7,5%	1,7%	5,9%	14,47	2,81	11,73
77	UGPA3	67	R$ 33.751,4	R$ 85,9	5,7%	0,5%	5,2%	23,71	2,10	21,62
78	USIM5	154	R$ 6.625,0	R$ 98,1	16,5%	2,7%	13,7%	11,23	1,78	9,46
79	VALE3	152	R$ 126.289,8	R$ 213,3	6,3%	0,4%	5,9%	54,34	2,39	51,90
80	VALE5	135	R$ 62.602,5	R$ 530,4	10,7%	1,1%	9,6%	13,39	1,23	12,17
81	VCPA4	43	R$ 3.754,0	R$ 16,5	8,9%	1,3%	7,6%	19,57	3,21	16,23
82	VIVO4	58	R$ 10.196,2	R$ 26,0	4,7%	0,7%	3,9%	18,22	2,76	15,49
83	VIVT4	83	R$ 43.724,1	R$ 72,4	1,5%	0,4%	1,1%	8,82	2,40	6,44
84	WEGE3	25	R$ 28.884,6	R$ 37,5	1,3%	0,4%	0,9%	10,11	3,14	6,93

Table 2: Summary Statistics by Year

Year	Number of Data Points	Market Cap (Stock Class) Mean (R$ millions)	ADTV (Last 3 Months) Mean (R$ millions)	Mean Fund Position as % of Mkt Cap			Fund Position / ADTV 3 Months		
				LONG	SHORT	NET	DaysLONG	DaysSHORT	DaysNET
2006	434	R$ 18.493	R$ 38	6,7%	1,0%	5,7%	27,8	3,6	24,3
2007	502	R$ 22.506	R$ 63	8,6%	1,7%	6,9%	25,4	4,5	20,7
2008	537	R$ 22.638	R$ 82	12,0%	0,6%	11,4%	28,1	1,4	26,8
2009	528	R$ 23.027	R$ 75	8,3%	0,7%	7,6%	22,0	1,4	20,5
2010	518	R$ 30.340	R$ 98	7,0%	0,8%	6,2%	19,6	1,9	17,7
2011	537	R$ 28.853	R$ 96	7,3%	1,3%	5,9%	19,0	2,6	16,5
2012	563	R$ 27.925	R$ 98	7,9%	1,2%	6,7%	16,7	1,9	14,8
2013	561	R$ 27.157	R$ 102	9,6%	1,9%	7,7%	16,6	3,0	13,7
2014	545	R$ 32.924	R$ 108	8,1%	1,2%	6,9%	17,1	2,6	14,6
2015	555	R$ 31.360	R$ 106	6,8%	1,0%	5,8%	13,5	2,1	11,4
2016	553	R$ 33.338	R$ 113	7,0%	0,8%	6,2%	16,7	1,9	14,9
2017	534	R$ 41.103	R$ 127	7,3%	0,8%	6,6%	16,5	1,7	14,8
2018	492	R$ 48.157	R$ 181	9,6%	0,8%	8,8%	16,9	1,7	15,2

Table 3: Regression Results: Excess Returns as Function of Fund Holdings Variables

Panel A: Aggregate Fund Holdings

Excess Return Holding Period	n	Aggregate Fund Holdings as % of Market Cap. LONG	SHORT	NET	n	Aggregate Fund Holdings as Multiple of ADTV DaysLONG	DaysSHORT	DaysNET
(T-13 -> T-1) -12 Month	156	-0,118 (*)	-2,089 (***)	-0,055 ( )	156	0,004 ( )	-0,007 ( )	0,004 ( )
(T-7 -> T-1) -6 Month	156	-0,070 ( )	-1,377 (***)	-0,029 ( )	156	0,002 ( )	-0,008 ( )	0,002 ( )
(T-4 -> T-1) -3 Month	156	0,013 ( )	-0,567 (***)	0,030 ( )	156	0,003 (**)	0,006 ( )	0,003 (**)
(T-3 -> T-1) -2 Month	156	0,021 ( )	-0,439 (***)	0,035 ( )	156	0,002 (**)	0,003 ( )	0,002 (**)
(T-2 -> T-1) -1 Month	156	0,019 ( )	-0,177 (*)	0,025 ( )	156	0,002 (***)	0,005 ( )	0,002 (***)
(T-1 -> T) Current	156	0,011 ( )	-0,237 (**)	0,018 ( )	156	0,002 (***)	0,007 (*)	0,002 (**)
(T -> T+1) +1 Month	156	-0,001 ( )	-0,191 (*)	0,005 ( )	156	0,000 ( )	-0,004 ( )	0,000 ( )
(T -> T+2) +2 Month	156	-0,007 ( )	-0,449 (***)	0,006 ( )	156	0,000 ( )	-0,012 (*)	0,000 ( )
(T -> T+3) +3 Month	156	-0,002 ( )	-0,649 (***)	0,018 ( )	156	0,000 ( )	-0,017 (**)	0,000 ( )
(T -> T+6) +6 Month	156	0,009 ( )	-1,120 (***)	0,043 ( )	156	0,000 ( )	-0,045 (***)	0,001 ( )
(T -> T+12) +12 Month	150	0,020 ( )	-0,887 (**)	0,047 ( )	150	-0,003 ( )	-0,062 (***)	-0,002 ( )
(T+4 -> T+5) +1 Month	156	0,006 ( )	-0,212 (**)	0,012 ( )	156	0,001 ( )	-0,009 (**)	0,001 ( )
(T+4 -> T+6) +2 Month	156	0,005 ( )	-0,241 (*)	0,012 ( )	156	0,000 ( )	-0,014 (**)	0,001 ( )
(T+4 -> T+7) +3 Month	155	0,008 ( )	-0,371 (**)	0,019 ( )	155	0,000 ( )	-0,022 (***)	0,001 ( )
(T+4 -> T+10) +6 Month	152	-0,001 ( )	-0,495 (*)	0,014 ( )	152	-0,001 ( )	-0,038 (***)	0,000 ( )
(T+4 -> T+16) +12 Month	146	-0,032 ( )	0,125 ( )	-0,037 ( )	146	-0,006 (**)	-0,029 (*)	-0,005 (*)

Panel B: Aggregate Fund Trades (Between T-1 and T)

Excess Return Holding Period	n	Aggregate Fund Trades as % of Market Cap. ΔLONG	ΔSHORT	ΔNET	n	Aggregate Fund Holdings as Multiple of ADTV ΔDaysLONG	ΔDaysSHORT	ΔDaysNET
(T-13 -> T-1) -12 Month	155	-0,028 ( )	0,198 ( )	-0,033 ( )	155	-0,005 ( )	0,001 ( )	-0,005 ( )
(T-7 -> T-1) -6 Month	155	-0,080 ( )	-0,183 ( )	-0,073 ( )	155	-0,007 (**)	-0,015 ( )	-0,006 (**)
(T-4 -> T-1) -3 Month	155	-0,042 ( )	0,112 ( )	-0,045 ( )	155	-0,005 (**)	-0,007 ( )	-0,004 (**)
(T-3 -> T-1) -2 Month	155	-0,028 ( )	-0,074 ( )	-0,025 ( )	155	-0,003 (**)	-0,011 ( )	-0,003 (*)
(T-2 -> T-1) -1 Month	155	0,015 ( )	0,019 ( )	0,014 ( )	155	0,000 ( )	-0,004 ( )	0,000 ( )
(T-1 -> T) Current	155	0,019 ( )	-0,060 ( )	0,021 ( )	155	0,005 (***)	0,017 (***)	0,004 (***)
(T -> T+1) +1 Month	155	0,009 ( )	-0,007 ( )	0,009 ( )	155	0,000 ( )	0,000 ( )	0,000 ( )
(T -> T+2) +2 Month	155	-0,009 ( )	-0,163 ( )	-0,004 ( )	155	-0,001 ( )	-0,004 ( )	-0,001 ( )
(T -> T+3) +3 Month	155	-0,007 ( )	-0,141 ( )	-0,002 ( )	155	-0,002 ( )	-0,004 ( )	-0,002 ( )
(T -> T+6) +6 Month	155	0,011 ( )	-0,330 ( )	0,021 ( )	155	0,000 ( )	-0,015 ( )	0,001 ( )
(T -> T+12) +12 Month	149	0,022 ( )	-0,174 ( )	0,027 ( )	149	0,002 ( )	-0,018 ( )	0,003 ( )
(T+4 -> T+5) +1 Month	155	0,024 ( )	-0,113 ( )	0,027 ( )	155	0,001 ( )	-0,006 ( )	0,001 ( )
(T+4 -> T+6) +2 Month	155	0,022 ( )	-0,023 ( )	0,022 ( )	155	0,001 ( )	-0,005 ( )	0,002 ( )
(T+4 -> T+7) +3 Month	154	0,007 ( )	-0,134 ( )	0,011 ( )	154	0,001 ( )	-0,010 ( )	0,002 ( )
(T+4 -> T+10) +6 Month	151	0,038 ( )	-0,252 ( )	0,045 ( )	151	0,003 ( )	-0,015 ( )	0,004 ( )
(T+4 -> T+16) +12 Month	145	0,060 ( )	0,495 ( )	0,044 ( )	145	0,005 ( )	-0,001 ( )	0,005 ( )

Significance: * 0.05 probability level, ** 0.01 probability level, *** 0.001 probability level

Table 4: Regression Results: Excess Returns as Function of Fund Long and Short Holdings (and Trades)

Panel A: Aggregate Fund Holdings

Excess Return Holding Period	(A1) Aggregate Fund Holdings as % of Mkt. Cap			(A2) Aggregate Fund Holdings as Multiple of ADTV		
	Months	LONG	SHORT	Months	DaysLONG	DaysSHORT
(T-13 -> T-1) -12 Month	156	-0,078 ( )	-2,041 (***)	156	0,004 ( )	-0,008 ( )
(T-7 -> T-1) -6 Month	156	-0,041 ( )	-1,349 (***)	156	0,002 ( )	-0,008 ( )
(T-4 -> T-1) -3 Month	156	0,027 ( )	-0,589 (***)	156	0,003 (**)	0,005 ( )
(T-3 -> T-1) -2 Month	156	0,033 ( )	-0,469 (***)	156	0,002 (**)	0,002 ( )
(T-2 -> T-1) -1 Month	156	0,025 ( )	-0,205 (**)	156	0,002 (***)	0,005 ( )
(T-1 -> T) Current	156	0,019 ( )	-0,259 (***)	156	0,002 (***)	0,007 (*)
(T -> T+1) +1 Month	156	0,005 ( )	-0,198 (**)	156	0,000 ( )	-0,004 ( )
(T -> T+2) +2 Month	156	0,005 ( )	-0,454 (***)	156	0,000 ( )	-0,012 (*)
(T -> T+3) +3 Month	156	0,014 ( )	-0,660 (***)	156	0,000 ( )	-0,017 (**)
(T -> T+6) +6 Month	156	0,031 ( )	-1,142 (***)	156	0,000 ( )	-0,045 (***)
(T -> T+12) +12 Month	150	0,037 ( )	-0,915 (**)	150	-0,003 ( )	-0,061 (***)
(T+4 -> T+5) +1 Month	156	0,011 ( )	-0,223 (**)	156	0,001 ( )	-0,009 (**)
(T+4 -> T+6) +2 Month	156	0,010 ( )	-0,250 (*)	156	0,001 ( )	-0,014 (**)
(T+4 -> T+7) +3 Month	155	0,016 ( )	-0,383 (**)	155	0,001 ( )	-0,022 (***)
(T+4 -> T+10) +6 Month	152	0,008 ( )	-0,501 (*)	152	-0,001 ( )	-0,038 (***)
(T+4 -> T+16) +12 Month	146	-0,035 ( )	0,143 ( )	146	-0,006 (**)	-0,027 (*)

Panel B: Aggregate Fund Trades (Between T-1 and T)

Excess Return Holding Period	(B1) Aggregate Fund Trades as % of Mkt. Cap			(B2) Aggregate Fund Trades as Multiple of ADTV		
	Months	ΔLONG	ΔSHORT	Months	ΔDaysLONG	ΔDaysSHORT
(T-13 -> T-1) -12 Month	155	-0,029 ( )	0,204 ( )	155	-0,005 ( )	0,002 ( )
(T-7 -> T-1) -6 Month	155	-0,079 ( )	-0,166 ( )	155	-0,007 (**)	-0,013 ( )
(T-4 -> T-1) -3 Month	155	-0,043 ( )	0,121 ( )	155	-0,005 (**)	-0,005 ( )
(T-3 -> T-1) -2 Month	155	-0,028 ( )	-0,068 ( )	155	-0,003 (*)	-0,010 ( )
(T-2 -> T-1) -1 Month	155	0,015 ( )	0,015 ( )	155	0,000 ( )	-0,004 ( )
(T-1 -> T) Current	155	0,020 ( )	-0,064 ( )	155	0,005 (***)	0,016 (***)
(T -> T+1) +1 Month	155	0,009 ( )	-0,009 ( )	155	0,000 ( )	0,000 ( )
(T -> T+2) +2 Month	155	-0,008 ( )	-0,161 ( )	155	-0,001 ( )	-0,004 ( )
(T -> T+3) +3 Month	155	-0,006 ( )	-0,140 ( )	155	-0,002 ( )	-0,003 ( )
(T -> T+6) +6 Month	155	0,013 ( )	-0,333 ( )	155	0,000 ( )	-0,015 ( )
(T -> T+12) +12 Month	149	0,023 ( )	-0,179 ( )	149	0,002 ( )	-0,018 ( )
(T+4 -> T+5) +1 Month	155	0,025 ( )	-0,118 ( )	155	0,001 ( )	-0,006 ( )
(T+4 -> T+6) +2 Month	155	0,022 ( )	-0,028 ( )	155	0,001 ( )	-0,005 ( )
(T+4 -> T+7) +3 Month	154	0,007 ( )	-0,136 ( )	154	0,002 ( )	-0,011 ( )
(T+4 -> T+10) +6 Month	151	0,039 ( )	-0,261 ( )	151	0,004 ( )	-0,016 ( )
(T+4 -> T+16) +12 Month	145	0,057 ( )	0,483 ( )	145	0,005 ( )	-0,002 ( )

Significance: * 0.05 probability level, ** 0.01 probability level, *** 0.001 probability level

Table 5: Backtest: Fund Holdings as % of Market Cap.

Panel A: Aggregate Fund Long Holdings as % of Market Cap. (LONG)

Holding Period	LONG Mean Value by Tercile			Mean Return: 1st Tercile (Sell)			Mean Return: 3st Tercile (Buy)			3rd Tercile minus 1st Tercile		
	1st	3rd	Δ	Period	Annualized		Period	Annualized		Period	Annualized	
(T -> T+1) *+1 Month*	2.67%	15.42%	-12.75%	0.088%	1.062%	( )	0.175%	2.116%	( )	0.087%	1.044%	( )
(T -> T+2) *+2 Month*	2.67%	15.42%	-12.75%	0.309%	1.869%	( )	0.284%	1.718%	( )	-0.025%	-0.148%	( )
(T -> T+3) *+3 Month*	2.67%	15.42%	-12.74%	0.223%	0.893%	( )	0.324%	1.303%	( )	0.102%	0.407%	( )
(T -> T+6) *+6 Month*	2.67%	15.43%	-12.76%	-0.004%	-0.008%	( )	0.555%	1.113%	( )	0.559%	1.121%	( )
(T -> T+12) *+12 Month*	2.68%	15.24%	-12.56%	0.430%	0.430%	( )	1.070%	1.070%	( )	0.640%	0.640%	( )
(T+4 -> T+5) *+1 Month*	2.67%	15.43%	-12.75%	-0.155%	-1.842%	( )	0.026%	0.311%	( )	0.181%	2.190%	( )
(T+4 -> T+6) *+2 Month*	2.67%	15.43%	-12.76%	-0.193%	-1.151%	( )	-0.010%	-0.060%	( )	0.183%	1.101%	( )
(T+4 -> T+7) *+3 Month*	2.67%	15.40%	-12.73%	-0.141%	-0.562%	( )	-0.069%	-0.277%	( )	0.072%	0.287%	( )
(T+4 -> T+10) *+6 Month*	2.68%	15.30%	-12.63%	0.229%	0.459%	( )	-0.120%	-0.240%	( )	-0.350%	-0.698%	( )
(T+4 -> T+16) *+12 Month*	2.67%	15.15%	-12.49%	0.167%	0.167%	( )	0.291%	0.291%	( )	0.123%	0.123%	( )

Panel B: Aggregate Fund Short Holdings as % of Market Cap. (SHORT)

Holding Period	SHORT Mean Value by Tercile			Mean Return: 1st Tercile (Buy)			Mean Return: 3st Tercile (Sell)			1st Tercile minus 3rd Tercile		
	1st	3rd	Δ	Period	Annualized		Period	Annualized		Period	Annualized	
(T -> T+1) *+1 Month*	0.25%	2.24%	-1.99%	0.358%	4.386%	( )	-0.198%	-2.350%	( )	0.556%	6.884%	( )
(T -> T+2) *+2 Month*	0.25%	2.24%	-2.00%	0.550%	3.347%	( )	-0.148%	-0.884%	( )	0.698%	4.263%	( )
(T -> T+3) *+3 Month*	0.25%	2.25%	-2.00%	0.898%	3.640%	(**)	-0.374%	-1.486%	( )	1.271%	5.183%	( )
(T -> T+6) *+6 Month*	0.25%	2.25%	-2.00%	1.337%	2.691%	(**)	-0.918%	-1.828%	( )	2.255%	4.561%	(*)
(T -> T+12) *+12 Month*	0.25%	2.28%	-2.02%	2.392%	2.392%	(***)	-1.793%	-1.793%	( )	4.185%	4.185%	(*)
(T+4 -> T+5) *+1 Month*	0.25%	2.25%	-2.00%	0.058%	0.700%	( )	-0.267%	-3.160%	( )	0.325%	3.975%	( )
(T+4 -> T+6) *+2 Month*	0.25%	2.25%	-2.00%	0.201%	1.209%	( )	-0.380%	-2.257%	( )	0.580%	3.533%	( )
(T+4 -> T+7) *+3 Month*	0.25%	2.25%	-2.00%	0.572%	2.306%	( )	-0.736%	-2.913%	( )	1.308%	5.336%	(*)
(T+4 -> T+10) *+6 Month*	0.25%	2.27%	-2.02%	1.311%	2.639%	(**)	-0.971%	-1.933%	( )	2.282%	4.617%	(*)
(T+4 -> T+16) *+12 Month*	0.25%	2.30%	-2.05%	2.476%	2.476%	(***)	-2.377%	-2.377%	( )	4.853%	4.853%	(**)

Panel C: Aggregate Fund Net Holdings as % of Market Cap. (NET)

Holding Period	NET Mean Value by Tercile			Mean Return: 1st Tercile (Sell)			Mean Return: 3st Tercile (Buy)			3rd Tercile minus 1st Tercile		
	1st	3rd	Δ	Period	Annualized		Period	Annualized		Period	Annualized	
(T -> T+1) *+1 Month*	1.84%	14.14%	-12.30%	0.203%	2.469%	( )	0.185%	2.241%	( )	-0.019%	-0.223%	( )
(T -> T+2) *+2 Month*	1.84%	14.14%	-12.30%	0.462%	2.806%	( )	0.257%	1.550%	( )	-0.206%	-1.227%	( )
(T -> T+3) *+3 Month*	1.84%	14.13%	-12.29%	0.528%	2.129%	( )	0.353%	1.418%	( )	-0.175%	-0.700%	( )
(T -> T+6) *+6 Month*	1.84%	14.14%	-12.31%	0.637%	1.279%	( )	0.577%	1.158%	( )	-0.060%	-0.120%	( )
(T -> T+12) *+12 Month*	1.82%	13.95%	-12.12%	1.280%	1.280%	( )	1.025%	1.025%	( )	-0.255%	-0.255%	( )
(T+4 -> T+5) *+1 Month*	1.84%	14.14%	-12.30%	-0.004%	-0.045%	( )	-0.084%	-1.008%	( )	-0.081%	-0.963%	( )
(T+4 -> T+6) *+2 Month*	1.84%	14.14%	-12.31%	0.013%	0.081%	( )	-0.147%	-0.878%	( )	-0.160%	-0.958%	( )
(T+4 -> T+7) *+3 Month*	1.83%	14.11%	-12.28%	0.010%	0.041%	( )	-0.142%	-0.565%	( )	-0.152%	-0.606%	( )
(T+4 -> T+10) *+6 Month*	1.83%	14.01%	-12.18%	0.319%	0.639%	( )	-0.200%	-0.399%	( )	-0.519%	-1.035%	( )
(T+4 -> T+16) *+12 Month*	1.80%	13.85%	-12.05%	0.583%	0.583%	( )	0.365%	0.365%	( )	-0.219%	-0.219%	( )

Significance:
* 0.05 probability level
** 0.01 probability level
*** 0.001 probability level

Table 6: Backtest: Fund Trades as % of Market Cap.

Panel A: Aggregate Fund Long Trades as % of Market Cap. (ΔLONG)

Holding Period	ΔLONG Mean Value by Tercile			Mean Return: 1st Tercile (Sell)			Mean Return: 3st Tercile (Buy)			3rd Tercile minus 1st Tercile		
	1st	3rd	Δ	Period	Annualized		Period	Annualized		Period	Annualized	
(T -> T+1) +1 Month	-1.26%	1.39%	-2.65%	-0.430%	-5.038%	( )	0.592%	7.345%	(*)	1.022%	12.981%	(***)
(T -> T+2) +2 Month	-1.26%	1.39%	-2.65%	-0.260%	-1.548%	( )	0.663%	4.047%	( )	0.923%	5.667%	(*)
(T -> T+3) +3 Month	-1.26%	1.39%	-2.65%	-0.407%	-1.620%	( )	0.831%	3.366%	( )	1.238%	5.047%	(*)
(T -> T+6) +6 Month	-1.26%	1.39%	-2.65%	-0.293%	-0.585%	( )	1.723%	3.476%	(*)	2.016%	4.073%	(*)
(T -> T+12) +12 Month	-1.27%	1.41%	-2.68%	0.050%	0.050%	( )	2.371%	2.371%	(*)	2.321%	2.321%	(*)
(T+4 -> T+5) +1 Month	-1.26%	1.39%	-2.65%	-0.188%	-2.233%	( )	0.343%	4.195%	( )	0.531%	6.562%	( )
(T+4 -> T+6) +2 Month	-1.26%	1.39%	-2.65%	-0.002%	-0.011%	( )	0.548%	3.331%	( )	0.550%	3.343%	( )
(T+4 -> T+7) +3 Month	-1.26%	1.39%	-2.66%	0.088%	0.352%	( )	0.599%	2.417%	( )	0.511%	2.060%	( )
(T+4 -> T+10) +6 Month	-1.27%	1.40%	-2.67%	0.218%	0.436%	( )	0.970%	1.950%	( )	0.753%	1.511%	( )
(T+4 -> T+16) +12 Month	-1.31%	1.40%	-2.71%	-0.173%	-0.173%	( )	0.936%	0.936%	( )	1.109%	1.109%	( )

Panel B: Aggregate Fund Short Trades as % of Market Cap. (ΔSHORT)

Holding Period	ΔSHORT Mean Value by Tercile			Mean Return: 1st Tercile (Buy)			Mean Return: 3st Tercile (Sell)			1st Tercile minus 3rd Tercile		
	1st	3rd	Δ	Period	Annualized		Period	Annualized		Period	Annualized	
(T -> T+1) +1 Month	-0.35%	0.45%	-0.80%	0.195%	2.365%	( )	-0.116%	-1.385%	( )	0.311%	3.798%	( )
(T -> T+2) +2 Month	-0.35%	0.45%	-0.80%	0.575%	3.501%	( )	-0.130%	-0.775%	( )	0.705%	4.303%	( )
(T -> T+3) +3 Month	-0.35%	0.45%	-0.80%	0.322%	1.293%	( )	-0.047%	-0.188%	( )	0.369%	1.483%	( )
(T -> T+6) +6 Month	-0.35%	0.45%	-0.80%	0.595%	1.193%	( )	-0.113%	-0.226%	( )	0.708%	1.420%	( )
(T -> T+12) +12 Month	-0.36%	0.46%	-0.81%	1.085%	1.085%	( )	-0.008%	-0.008%	( )	1.094%	1.094%	( )
(T+4 -> T+5) +1 Month	-0.35%	0.45%	-0.80%	-0.049%	-0.581%	( )	0.006%	0.072%	( )	-0.055%	-0.652%	( )
(T+4 -> T+6) +2 Month	-0.35%	0.45%	-0.80%	0.053%	0.319%	( )	-0.119%	-0.709%	( )	0.172%	1.034%	( )
(T+4 -> T+7) +3 Month	-0.35%	0.45%	-0.80%	0.063%	0.251%	( )	-0.378%	-1.502%	( )	0.440%	1.774%	( )
(T+4 -> T+10) +6 Month	-0.36%	0.45%	-0.81%	0.584%	1.172%	( )	-0.694%	-1.384%	( )	1.279%	2.573%	( )
(T+4 -> T+16) +12 Month	-0.36%	0.46%	-0.82%	0.758%	0.758%	( )	-1.025%	-1.025%	( )	1.783%	1.783%	( )

Panel C: Aggregate Fund Net Trades as % of Market Cap. (ΔNET)

Holding Period	ΔNET Mean Value by Tercile			Mean Return: 1st Tercile (Sell)			Mean Return: 3st Tercile (Buy)			3rd Tercile minus 1st Tercile		
	1st	3rd	Δ	Period	Annualized		Period	Annualized		Period	Annualized	
(T -> T+1) +1 Month	-1.34%	1.40%	-2.74%	-0.500%	-5.837%	( )	0.226%	2.742%	( )	0.726%	9.064%	(*)
(T -> T+2) +2 Month	-1.34%	1.40%	-2.74%	-0.467%	-2.769%	( )	0.330%	1.994%	( )	0.797%	4.875%	( )
(T -> T+3) +3 Month	-1.34%	1.40%	-2.74%	-0.343%	-1.364%	( )	0.384%	1.543%	( )	0.726%	2.937%	( )
(T -> T+6) +6 Month	-1.34%	1.40%	-2.74%	-0.453%	-0.904%	( )	1.366%	2.750%	(*)	1.819%	3.670%	(*)
(T -> T+12) +12 Month	-1.36%	1.41%	-2.77%	-0.365%	-0.365%	( )	1.959%	1.959%	( )	2.324%	2.324%	( )
(T+4 -> T+5) +1 Month	-1.34%	1.40%	-2.74%	-0.320%	-3.768%	( )	0.396%	4.853%	( )	0.715%	8.929%	(*)
(T+4 -> T+6) +2 Month	-1.34%	1.40%	-2.74%	-0.264%	-1.571%	( )	0.544%	3.311%	( )	0.808%	4.947%	( )
(T+4 -> T+7) +3 Month	-1.35%	1.40%	-2.75%	-0.231%	-0.921%	( )	0.644%	2.600%	( )	0.875%	3.545%	( )
(T+4 -> T+10) +6 Month	-1.35%	1.40%	-2.75%	-0.436%	-0.871%	( )	1.221%	2.457%	( )	1.657%	3.342%	( )
(T+4 -> T+16) +12 Month	-1.39%	1.40%	-2.80%	-0.653%	-0.653%	( )	1.297%	1.297%	( )	1.951%	1.951%	( )

Significance:
* 0.05 probability level
** 0.01 probability level
*** 0.001 probability level

Table 7: Backtest: Fund Holdings as Multiple of ADTV

Panel A: Aggregate Fund Long Holdings as Multiple of ADTV (DaysLONG)

Holding Period	DaysLONG Mean Value by Tercile			Mean Return: 1st Tercile (Sell)			Mean Return: 3st Tercile (Buy)			3rd Tercile minus 1st Tercile		
	1st	3rd	Δ	Period	Annualized		Period	Annualized		Period	Annualized	
(T -> T+1) *+1 Month*	7.30	37.88	-30.59	0.165%	1.998%	( )	0.299%	3.647%	( )	0.134%	1.619%	( )
(T -> T+2) *+2 Month*	7.30	37.89	-30.60	0.346%	2.097%	( )	0.447%	2.711%	( )	0.100%	0.604%	( )
(T -> T+3) *+3 Month*	7.30	37.90	-30.60	0.247%	0.990%	( )	0.746%	3.019%	(*)	0.500%	2.014%	( )
(T -> T+6) *+6 Month*	7.31	37.95	-30.64	0.079%	0.158%	( )	1.432%	2.884%	(***)	1.353%	2.724%	( )
(T -> T+12) *+12 Month*	7.31	38.46	-31.15	-0.913%	-0.913%	( )	2.417%	2.417%	(***)	3.330%	3.330%	(*)
(T+4 -> T+5) *+1 Month*	7.31	37.95	-30.64	-0.215%	-2.551%	( )	0.146%	1.762%	( )	0.361%	4.416%	( )
(T+4 -> T+6) *+2 Month*	7.31	37.95	-30.64	-0.131%	-0.785%	( )	0.332%	2.006%	( )	0.463%	2.810%	( )
(T+4 -> T+7) *+3 Month*	7.31	38.06	-30.75	-0.125%	-0.500%	( )	0.505%	2.034%	( )	0.630%	2.544%	( )
(T+4 -> T+10) *+6 Month*	7.31	38.29	-30.97	-0.404%	-0.805%	( )	1.092%	2.195%	(*)	1.495%	3.013%	( )
(T+4 -> T+16) *+12 Month*	7.30	38.91	-31.61	-0.804%	-0.804%	( )	1.759%	1.759%	(**)	2.563%	2.563%	( )

Panel B: Aggregate Fund Short Holdings as Multiple of ADTV (DaysSHORT)

Holding Period	DaysSHORT Mean Value by Tercile			Mean Return: 1st Tercile (Buy)			Mean Return: 3st Tercile (Sell)			1st Tercile minus 3rd Tercile		
	1st	3rd	Δ	Period	Annualized		Period	Annualized		Period	Annualized	
(T -> T+1) *+1 Month*	0.69	4.51	-3.82	-0.136%	4.982%	( )	-0.136%	-1.615%	( )	0.542%	6.696%	( )
(T -> T+2) *+2 Month*	0.70	4.51	-3.82	0.834%	5.109%	(*)	-0.010%	-0.059%	( )	0.844%	5.171%	(*)
(T -> T+3) *+3 Month*	0.70	4.51	-3.82	0.994%	4.036%	(*)	0.064%	0.256%	( )	0.930%	3.772%	( )
(T -> T+6) *+6 Month*	0.70	4.52	-3.82	1.251%	2.518%	( )	0.011%	0.022%	( )	1.241%	2.496%	( )
(T -> T+12) *+12 Month*	0.71	4.57	-3.86	1.997%	1.997%	(*)	0.065%	0.065%	( )	1.932%	1.932%	( )
(T+4 -> T+5) *+1 Month*	0.70	4.52	-3.82	-0.234%	-2.775%	( )	-0.007%	-0.082%	( )	-0.227%	-2.695%	( )
(T+4 -> T+6) *+2 Month*	0.70	4.52	-3.82	-0.083%	-0.499%	( )	0.173%	1.044%	( )	-0.257%	-1.530%	( )
(T+4 -> T+7) *+3 Month*	0.70	4.53	-3.83	0.071%	0.283%	( )	0.303%	1.219%	( )	-0.233%	-0.927%	( )
(T+4 -> T+10) *+6 Month*	0.71	4.56	-3.85	0.286%	0.572%	( )	0.444%	0.890%	( )	-0.158%	-0.317%	( )
(T+4 -> T+16) *+12 Month*	0.72	4.62	-3.90	1.428%	1.428%	( )	-0.274%	-0.274%	( )	1.702%	1.702%	( )

Panel C: Aggregate Fund Net Holdings as Multiple of ADTV (DaysNET)

Holding Period	DaysNET Mean Value by Tercile			Mean Return: 1st Tercile (Sell)			Mean Return: 3st Tercile (Buy)			3rd Tercile minus 1st Tercile		
	1st	3rd	Δ	Period	Annualized		Period	Annualized		Period	Annualized	
(T -> T+1) *+1 Month*	4.79	35.90	-31.10	0.169%	2.046%	( )	0.423%	5.195%	(*)	0.254%	3.091%	( )
(T -> T+2) *+2 Month*	4.79	35.90	-31.11	0.389%	2.359%	( )	0.622%	3.789%	(*)	0.232%	1.402%	( )
(T -> T+3) *+3 Month*	4.80	35.91	-31.12	0.309%	1.242%	( )	0.894%	3.624%	(**)	0.585%	2.360%	( )
(T -> T+6) *+6 Month*	4.80	35.96	-31.16	0.009%	0.018%	( )	1.375%	2.768%	(**)	1.366%	2.750%	( )
(T -> T+12) *+12 Month*	4.78	36.44	-31.66	-0.317%	-0.317%	( )	2.152%	2.152%	(***)	2.469%	2.469%	( )
(T+4 -> T+5) *+1 Month*	4.80	35.96	-31.16	-0.190%	-2.253%	( )	0.152%	1.833%	( )	0.341%	4.172%	( )
(T+4 -> T+6) *+2 Month*	4.80	35.96	-31.16	-0.194%	-1.158%	( )	0.263%	1.586%	( )	0.457%	2.771%	( )
(T+4 -> T+7) *+3 Month*	4.80	36.06	-31.27	-0.295%	-1.175%	( )	0.424%	1.708%	( )	0.720%	2.909%	( )
(T+4 -> T+10) *+6 Month*	4.79	36.28	-31.48	-0.409%	-0.817%	( )	0.915%	1.839%	( )	1.325%	2.667%	( )
(T+4 -> T+16) *+12 Month*	4.75	36.88	-32.13	-0.349%	-0.349%	( )	1.690%	1.690%	(**)	2.038%	2.038%	( )

Significance:
* 0.05 probability level
** 0.01 probability level
*** 0.001 probability level

Table 8: Backtest: Fund Trades as Multiple of ADTV

Panel A: Aggregate Fund Long Trades as Multiple of ADTV (ΔDaysLONG)

Holding Period	ΔDaysLONG Mean Value by Tercile			Mean Return: 1st Tercile (Sell)			Mean Return: 3st Tercile (Buy)			3rd Tercile minus 1st Tercile		
	1st	3rd	Δ	Period	Annualized	( )	Period	Annualized	( )	Period	Annualized	( )
(T -> T+1) *+1 Month*	-4.44	4.35	-8.79	0.068%	0.818%	( )	-0.012%	-0.147%	( )	-0.080%	-0.958%	( )
(T -> T+2) *+2 Month*	-4.44	4.35	-8.79	0.418%	2.536%	( )	0.030%	0.181%	( )	-0.388%	-2.306%	( )
(T -> T+3) *+3 Month*	-4.45	4.35	-8.80	0.590%	2.382%	( )	0.206%	0.826%	( )	-0.384%	-1.529%	( )
(T -> T+6) *+6 Month*	-4.45	4.37	-8.82	0.506%	1.015%	( )	0.872%	1.752%	( )	0.366%	0.733%	( )
(T -> T+12) *+12 Month*	-4.54	4.43	-8.97	0.293%	0.293%	( )	1.547%	1.547%	( )	1.253%	1.253%	( )
(T+4 -> T+5) *+1 Month*	-4.45	4.37	-8.82	-0.198%	-2.349%	( )	0.459%	5.646%	( )	0.657%	8.171%	( )
(T+4 -> T+6) *+2 Month*	-4.45	4.37	-8.82	-0.354%	-2.104%	( )	0.629%	3.837%	( )	0.983%	6.047%	(*)
(T+4 -> T+7) *+3 Month*	-4.47	4.39	-8.86	-0.244%	-0.971%	( )	0.604%	2.437%	( )	0.847%	3.433%	( )
(T+4 -> T+10) *+6 Month*	-4.49	4.43	-8.93	-0.005%	-0.010%	( )	1.040%	2.091%	( )	1.045%	2.101%	( )
(T+4 -> T+16) *+12 Month*	-4.61	4.51	-9.12	-0.971%	-0.971%	( )	1.551%	1.551%	( )	2.522%	2.522%	( )

Panel B: Aggregate Fund Short Trades as Multiple of ADTV (ΔDaysSHORT)

Holding Period	ΔDaysSHORT Mean Value by Tercile			Mean Return: 1st Tercile (Buy)			Mean Return: 3st Tercile (Sell)			1st Tercile minus 3rd Tercile		
	1st	3rd	Δ	Period	Annualized	( )	Period	Annualized	( )	Period	Annualized	( )
(T -> T+1) *+1 Month*	-0.87	1.09	-1.96	0.077%	0.923%	( )	-0.098%	-1.176%	( )	0.175%	2.121%	( )
(T -> T+2) *+2 Month*	-0.87	1.09	-1.96	0.326%	1.969%	( )	-0.274%	-1.632%	( )	0.599%	3.651%	( )
(T -> T+3) *+3 Month*	-0.87	1.09	-1.96	0.161%	0.647%	( )	-0.435%	-1.730%	( )	0.597%	2.409%	( )
(T -> T+6) *+6 Month*	-0.87	1.09	-1.97	0.093%	0.185%	( )	-0.341%	-0.681%	( )	0.434%	0.869%	( )
(T -> T+12) *+12 Month*	-0.89	1.11	-2.00	0.405%	0.405%	( )	0.581%	0.581%	( )	-0.176%	-0.176%	( )
(T+4 -> T+5) *+1 Month*	-0.88	1.09	-1.97	-0.219%	-2.601%	( )	-0.053%	-0.629%	( )	-0.167%	-1.984%	( )
(T+4 -> T+6) *+2 Month*	-0.87	1.09	-1.97	-0.261%	-1.557%	( )	-0.178%	-1.061%	( )	-0.084%	-0.500%	( )
(T+4 -> T+7) *+3 Month*	-0.88	1.10	-1.97	-0.258%	-1.029%	( )	0.068%	0.273%	( )	-0.326%	-1.299%	( )
(T+4 -> T+10) *+6 Month*	-0.88	1.11	-1.99	0.373%	0.747%	( )	-0.008%	-0.017%	( )	0.381%	0.764%	( )
(T+4 -> T+16) *+12 Month*	-0.89	1.13	-2.02	0.565%	0.565%	( )	0.196%	0.196%	( )	0.368%	0.368%	( )

Panel C: Aggregate Fund Net Trades as Multiple of ADTV (ΔDaysNET)

Holding Period	ΔDaysNET Mean Value by Tercile			Mean Return: 1st Tercile (Sell)			Mean Return: 3st Tercile (Buy)			3rd Tercile minus 1st Tercile		
	1st	3rd	Δ	Period	Annualized	( )	Period	Annualized	( )	Period	Annualized	( )
(T -> T+1) *+1 Month*	-4.43	4.15	-8.58	0.023%	0.280%	( )	-0.148%	-1.765%	( )	-0.172%	-2.040%	( )
(T -> T+2) *+2 Month*	-4.43	4.15	-8.58	0.364%	2.207%	( )	0.015%	0.089%	( )	-0.350%	-2.079%	( )
(T -> T+3) *+3 Month*	-4.43	4.15	-8.59	0.656%	2.649%	( )	0.162%	0.650%	( )	-0.494%	-1.960%	( )
(T -> T+6) *+6 Month*	-4.44	4.16	-8.60	0.160%	0.320%	( )	0.770%	1.547%	( )	0.610%	1.225%	( )
(T -> T+12) *+12 Month*	-4.53	4.23	-8.75	0.032%	0.032%	( )	1.179%	1.179%	( )	1.148%	1.148%	( )
(T+4 -> T+5) *+1 Month*	-4.44	4.17	-8.61	-0.459%	-5.369%	( )	0.223%	2.712%	( )	0.682%	8.499%	( )
(T+4 -> T+6) *+2 Month*	-4.44	4.16	-8.60	-0.793%	-4.666%	(*)	0.602%	3.665%	( )	1.395%	8.668%	(**)
(T+4 -> T+7) *+3 Month*	-4.46	4.19	-8.64	-0.820%	-3.240%	( )	0.528%	2.130%	( )	1.348%	5.503%	(*)
(T+4 -> T+10) *+6 Month*	-4.48	4.22	-8.70	-0.775%	-1.544%	( )	0.838%	1.684%	( )	1.613%	3.253%	( )
(T+4 -> T+16) *+12 Month*	-4.60	4.29	-8.89	-1.202%	-1.202%	( )	1.482%	1.482%	( )	2.684%	2.684%	(*)

Significance:
* 0.05 probability level
** 0.01 probability level
*** 0.001 probability level

Figure 1: Brazilian Investment Fund Industry: Total Assets Under Management and Number of Investment Funds (December 2000 – June 2019)
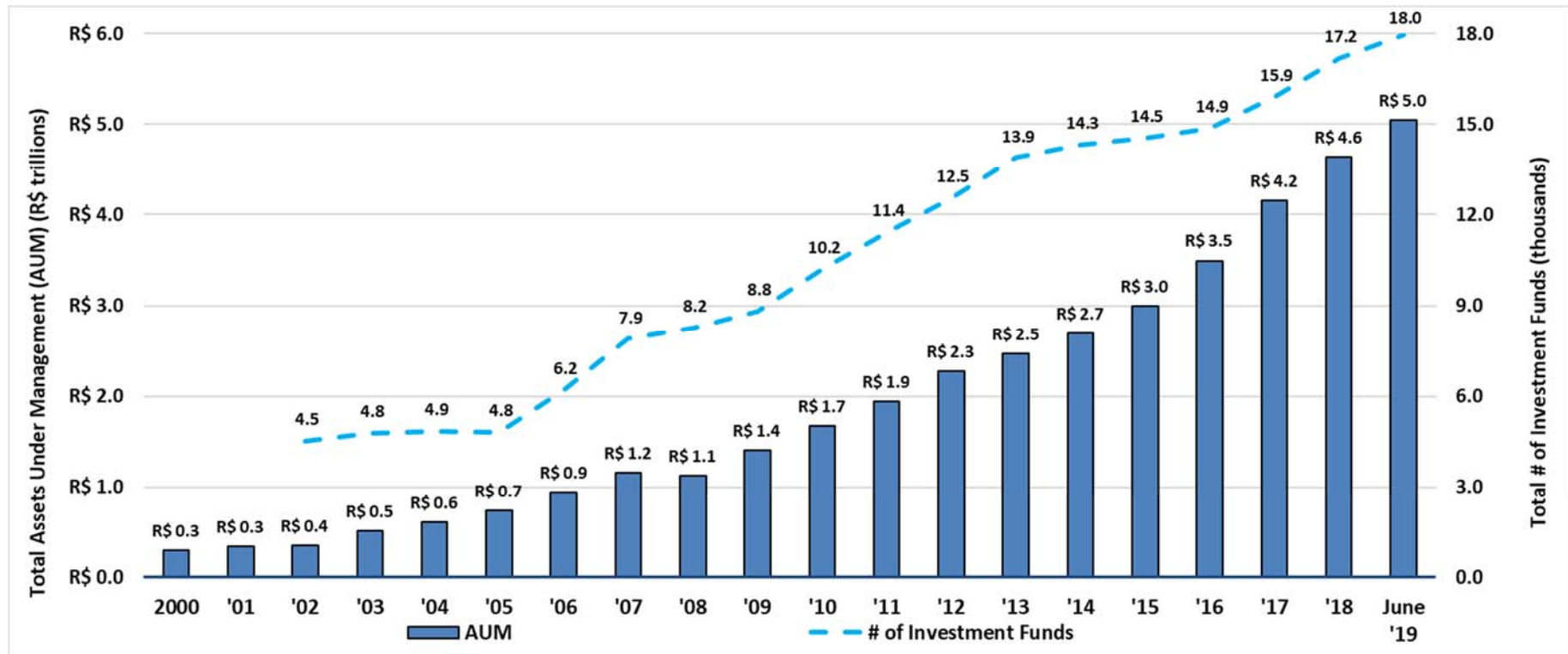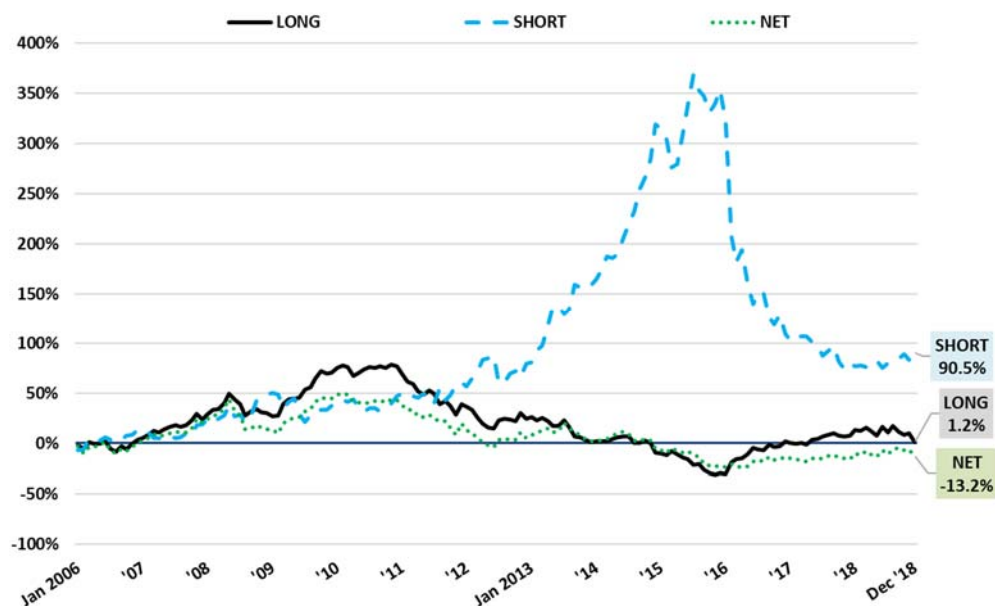*Source: ANBIMA (Brazilian Financial and Capital Markets Association)*

Figure 2: Accumulated Returns Utilizing Fund Holdings as % of Market Cap. Variables

Note:
- *Equal-weighted long-short portfolios rebalanced on a monthly-basis. (1-month holding periods)*
- *Portoflio long (short) components based on 3rd tercile stocks (1st tercile stocks) for the LONG and NET variables.*
- *Portfolio long (short) components based on 1st tercile stocks (3rd tercile stocks) for the SHORT variable.*
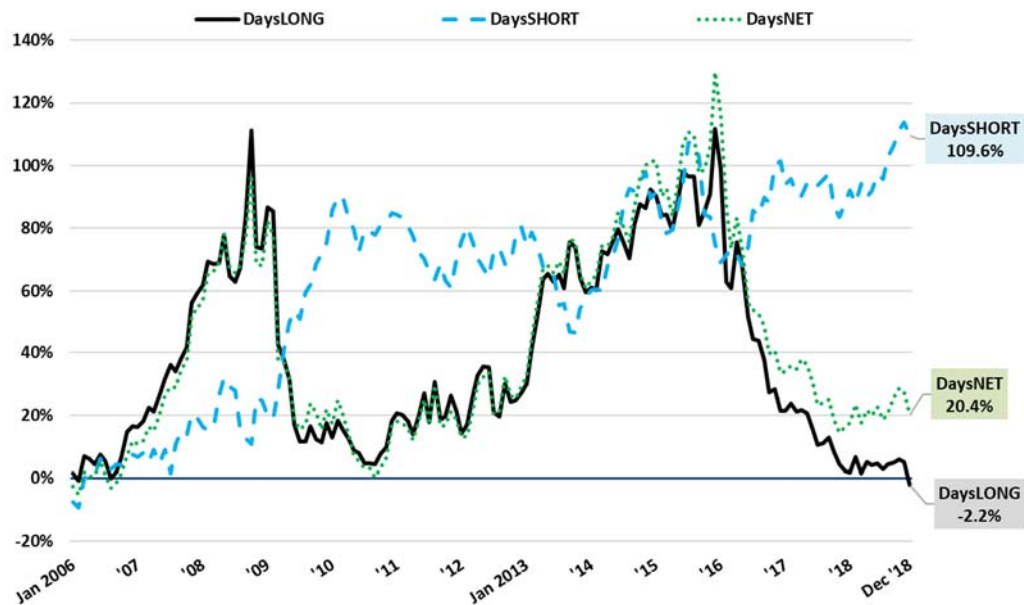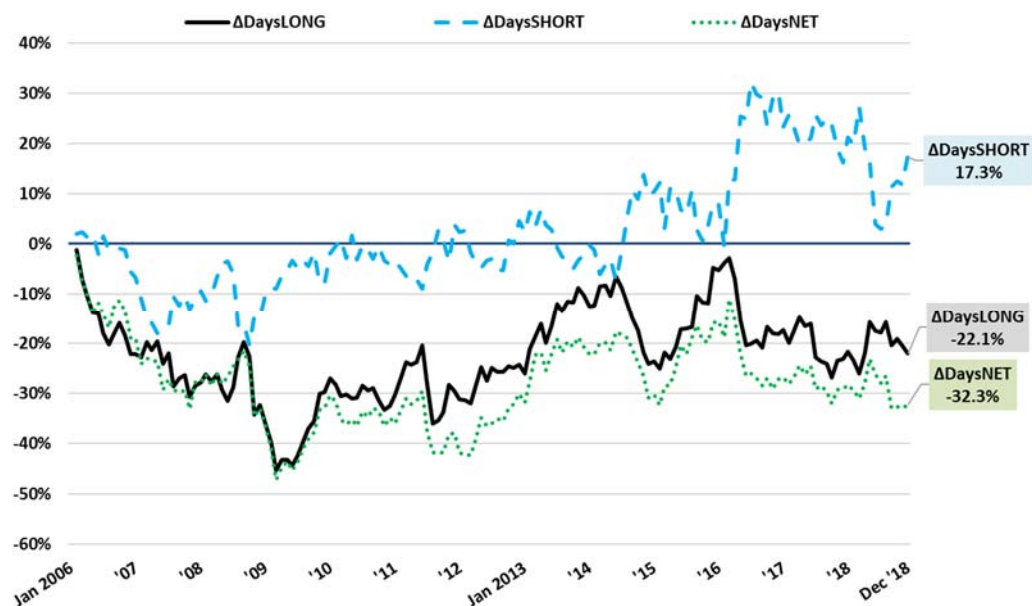
Figure 3: Accumulated Returns Utilizing Fund Trades as % of Market Cap. Variables
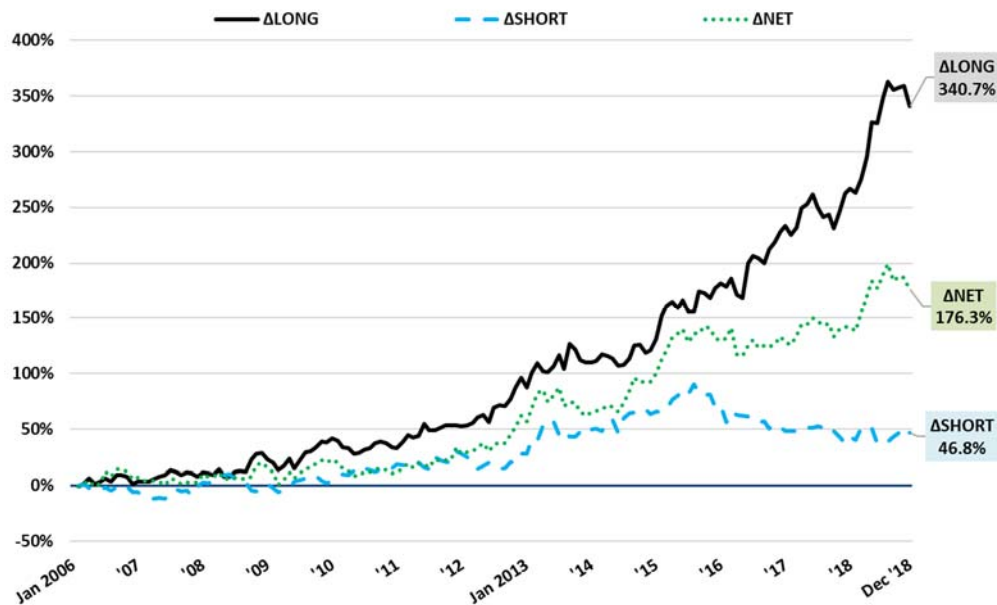
Note:

- *Equal-weighted long-short portfolios rebalanced on a monthly-basis. (1-month holding periods)*
- *Portoflio long (short) components based on 3rd tercile stocks (1st tercile stocks) for the ΔLONG and ΔNET variables.*
- *Portfolio long (short) components based on 1st tercile stocks (3rd tercile stocks) for the ΔSHORT variable.*

Figure 4: Accumulated Returns Utilizing Fund Holdings as Multiple of ADTV Variables

Note:
- *Equal-weighted long-short portfolios rebalanced on a monthly-basis. (1-month holding periods)*
- *Portoflio long (short) components based on 3rd tercile stocks (1st tercile stocks) for the DaysLONG and DaysNET variables.*
- *Portfolio long (short) components based on 1st tercile stocks (3rd tercile stocks) for the DaysSHORT variable.*

Figure 5: Accumulated Returns Utilizing Fund Trades as Multiple of ADTV Variables

Note:

- *Equal-weighted long-short portfolios rebalanced on a monthly-basis. (1-month holding periods)*
- *Portoflio long (short) components based on 3rd tercile stocks (1st tercile stocks) for the ΔDaysLONG and ΔDaysNET variables.*
- *Portfolio long (short) components based on 1st tercile stocks (3rd tercile stocks) for the ΔDaysSHORT variable.*