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Adoption of Short Selling in Stock Portfolios: Performance of Brazilian Investment Funds Long Only Vs. Long/Short

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Abstract

This paper aims to identify the effect of short selling in equity portfolios on alpha generation and changes in sensitivity to risk factors. Two groups of investment funds were created, comprising long/short and long-only strategies. Data were collected from January 2013 to December 2015, January 2016 to December 2019, and January 2020 to December 2022, and a 5-factor Fama-French model was applied and subsequently compared. Regression models were used to identify quantitative and qualitative factors influencing the observed alpha differences. The results indicate that short strategies hinder alpha generation in uptrends and assist in downtrends; however, they affect only beta sensitivities during risk-aversion periods. Additionally, the intensities and significance of the factors vary with the observed time window, although market size and conservatism remain more representative of the groups. The data suggest that, on average, managers have higher competence in generating alpha during market uptrends, but this ability is compromised in downturns and uncertain scenarios. Finally, it is pointed out that there is a penalty for intensifications in redemptions and lock-up premiums.

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1. Introduction

Investment portfolio construction has been a subject of research since the mid-20th century (Henry, 1952) in his work "Portfolio Selection", presented a method that uses the variance and covariance among various assets to seek a portfolio that maximizes return for a certain level of variance through their weights in the portfolio. Given this criterion, the curve that represents all portfolios was called the "efficient frontier".

Since then, various investors have sought ways to shift the efficient frontier by developing new assets and strategies with different degrees of correlation, risk, and return. Among the assets available in the market are investments in variable income, which are made through the buying and selling of stocks and their derivatives, allowing for numerous allocation strategies.

Two commonly used strategies are long/short and long-only, with the former seeking returns regardless of the direction of the stock market and the latter, through the evaluation of company fundamentals, aiming to build portfolios that generate returns higher than market indices. Fundamentally, the difference between the two lies in the former using short positions, such that it should allow for returns higher than the opportunity cost, regardless of the behavior of the stock market (Gomes & Cresto, 2010).

Equity and multimarket funds in Brazil are regulated by the Securities and Exchange Commission (CVM) and standardized by Resolution CVM nº 175/2022. Additionally, based on information provided by Fund Managers, the Brazilian Association of Financial and Capital Market Entities (ANBIMA) categorizes funds into three levels according to asset class, related risks, and investment strategies, facilitating comparison among various products.

According to ANBIMA data, the investment fund industry in Brazilian stocks grew by 221% between 2011 and 2021, reaching R$ 583 billion invested by the end of 2021, representing about 8.43% of the entire investment fund market. From another perspective, investment funds classified as long/short have a significantly smaller share of the fund industry, reaching R$ 12 billion by the end of 2021.

Considering that the Brazilian stock market exhibits variations in volatility, the adoption of alternative strategies can significantly aid in generating alpha. However, short strategies present leverage risk, as once the stock is sold by the borrower, there is an obligation to repurchase the stock in the future, with no limits to the price, potentially leading to losses exceeding the fund's assets.

It is worth noting that long/short strategies are active, as no index in the Brazilian market reflects exposure to a theoretical short portfolio. Active management is understood as one in which there is an effort by the manager to select assets to achieve performance beyond market indices, while passive management seeks only to track the movement of an index (Diniz, 2021).

Therefore, this study aims to identify whether the adoption of short selling in active variable income portfolios increases the alpha obtained by managers. The methodology used consists of comparing the alpha obtained by long/short multimarket funds and active management variable income funds, using the Fama-French 5-factor model and statistical tests. Additionally, the sensitivities of the strategies to the 5 factors were evaluated.

The alphas obtained in the previous stage were subjected to multiple regression analysis to assess whether the redemption period, management fee, fund classification type, volatility, fund redemption volatility, and fund assets contribute to the differences in alpha observed. The results reveal that short selling contribute to generating alpha in downturn scenarios but impair performance in upturns. In risk-averse scenarios, the short selling only influences beta sensitivities, in common with the other windows.

In positive trends, managers have more capacity to obtain excess returns; however, this proficiency is impaired in low-risk circumstances, despite some managers being able to achieve alpha regardless of the scenario. Market, size, and conservatism factors proved relevant throughout the study, with betas closer to zero for the long/short group. The intensification of redemption volumes in times of uncertainty affects managers' ability to generate alpha, and the data suggest the possible existence of a lock-up premium.

These findings contribute to the literature on the adoption of alternative strategies in investment portfolios, as well as the evaluation of the performance of variable income managers, and reinforce the validity of the Fama-French 5-factor model. Finally, the results contribute to the debate on the ability of variable income managers to generate alpha over time and the effect of withdrawal runs on preserving investors' assets.

Furthermore, the use of leverage instruments and allocation in funds with alternative strategies has been carefully monitored by regulatory and supervisory bodies of institutional investors, controlling the total permitted exposure and which instruments enable this application. In this sense, this study contributes to the literature of these bodies in the evolution of the applicable regulatory framework.

In addition to this introduction, the work has four more sections: the second carries out a literature review on the topic, listing the theoretical bases of the work, the third presents the research methodology, the fourth demonstrates and discusses the results obtained and, finally, the fifth section aims to present the conclusions.

2. Theoretical Framework

The literature on performance evaluation in the stock market is extensive and explores numerous methods to identify performance differences among various strategies that can be used in the stock market (active, passive, leveraged, long/short, etc.), as well as their persistence and the reasons that justify the differences observed. Manser and Schmid (2009) conducted studies to identify the persistence of returns from the long/short strategy, considering a group of 1,150 funds from January 1994 to December 2005, calculating gross returns and risk-adjusted returns using the 4-factor model (3 factors from the Fama-French model, plus Carhart's momentum factor) and comparing them using the portfolio model proposed by Hendricks, Patel, and Zeckhauser (1993).

It was identified that funds that achieved higher gross returns and risk-adjusted returns in one year tended to maintain performance in the following year, with no persistence observed beyond one year. In the case of gross returns, the results were not statistically significant. Gomes and Cresto (2010) conducted studies to evaluate whether long/short funds can generate positive and market-independent returns. They evaluated 76 funds from January 2001 to March 2008 using the CAPM model, including a market timing factor. The author identified that few funds could generate alpha, and this alpha is not usually persistent. Additionally, there is little evidence that there is a relationship between the outcome and market timing.

Badrinath and Gubellini (2011) evaluated the return performance of funds classified as long/short, market neutral, and bear, using the traditional CAPM model, Fama-French 3-factor model, 4-factor model (3 factors

from the Fama-French model, plus the Carhart momentum factor), and conditional CAPM model, which asserts that the unconditional return of an asset can be obtained as a linear function of its beta and its sensitivity to the beta premium. Additionally, studies were conducted on the behavior of flows and returns after periods of market highs and lows. They evaluated 110 funds, of which 43 were long/short, 27 were market neutral, and 40 were bear funds. The time series began respectively in July 1982, October 1990, and February 1994, and all ended in December 2007.

Regarding long/short strategies, the results indicate that the strategy exhibits a strong sensitivity to the market factor, with the conditional beta of these funds being positive and relatively independent of the scenario. Additionally, the flow of investments into these assets appears to be independent of whether the market is in an uptrend or a downtrend. Fung and Hsieh (2011) conducted a comprehensive evaluation of performance and risk in long/short funds. They assessed 3,038 long/short funds over the period from 1994 to 2008. Among their conclusions, they identified that the long/short strategy aligns with the 4-factor model, accounting for 80% of the funds' returns. Additionally, less than 20% of the funds exhibit a positive, significant, and persistent alpha. The author also suggests that the identified alphas do not seem to stem from omitted systematic risk factors.

Bali, Brown, and Demirtas (2013) through the evaluation of 11,973 funds across various strategies using the ASD model by Leshno and Levy and the MPPM model by Goetzmann, among their conclusions, identify that long/short funds outperform the US stock market. de Abreu Pontes, Rogers, and Malaquias (2015) on the other hand, aimed to assess the determinants for the returns of long/short funds in Brazil. For the model, variables such as age, size, lock-up period, management fee, and performance were considered. These were analyzed using a regression model with data from 54 funds between May 2009 and May 2014. As a conclusion, only the management fee showed statistical significance, contributing negatively to the funds' results.

Claes (2017) examined whether the returns obtained by long/short managers were related to luck or skill, considering over 8,200 funds from January 1998 to May 2017. The study assessed alpha generation using the 3-factor and 5-factor Fama-French models, 7-factor Fung-Hsieh model, and 8-factor Agarwal-Naik model. The study utilized a bootstrap model to generate 1,000 scenarios and found evidence that the superior performance of long/short funds cannot be solely explained by luck, regardless of the multifactorial model used.

Roschel (2020) employed the 4-factor model to assess the persistence of performance in long/short funds, evaluating 33 funds from January 2014 to December 2018. The author identified that the market factor significantly contributed to the returns of these funds, and occasionally, the SMB (small-minus-big) factor also played a role. The author concluded that these funds generated alpha over time. Noguchi (2021) utilized the 3-factor Fama-French model to assess the ability of active equity fund managers to generate alpha. The study considered the period from January 2011 to December 2020. The author identified that, on average, managers were unable to generate alpha, although there was a group of managers who achieved performance. Additionally, it was found that market trends did not influence the results and that the fund size hurt performance.

In summary, several studies investigate, through different models and databases, the ability of variable income managers, whether long only or long/short, to obtain a positive return adjusted to risk, their determinants, and persistence. The results are divergent about the average alpha generation capacity; however, there is a convergence so that at least some small groups present positive alpha. Thus, this work aims to contribute to the literature by bringing empirical elements to the assessment of the variable income industry's ability to generate performance beyond market expectations, the effects of factors on managers' results, and the effects of increasing management freedom on generating alpha in different scenarios.

3. Methodology

3.1. Data

Data relating to investment funds, such as return, rates, and classification, among others, are available in the Brazilian Association of Financial and Capital Market Entities and the Brazilian Securities Commission databases. In turn, information about the behavior of assets and stock indexes for the Fama-French model is available on the Brazilian stock exchange (B3).

All this data is collected, organized, and distributed by private and/or public database tools. For this research, all data was extracted from the Economatica tool. According to data from August 8, 2023, there are 7,146 investment funds classified as variable income or long/short multimarket, of which 3,944 are active.

The present work considered 3-time windows in which the stock market presented distinct characteristics. The first window, from 2013 to 2015, was marked by a cycle of rising interest rates, going from 7.25% p.a. to 14.25% p.a., and pressure on the Brazilian stock market, with a drop of 28.88% in the period. The second window, from 2016 to 2019, was a positive moment for the Brazilian stock market, with the Ibovespa - the main index of the Brazilian stock market - showing an accumulated return of 166.78% and the interest rates reducing to 5.00% p.a.

The third window, from 2020 to 2022, was marked by the spread of the Coronavirus in Brazil, with consequent social restriction measures that led to a significant increase in risk and uncertainty. The Brazilian

stock market showed a simple retraction (5.11%), however, the level of asset volatility rose from 22.34% p.a. in previous windows to 31.28% p.a. Additionally, the Interest Rates of Brazil, which had been in the process of reduction, reaching the historic low of 2.00% p.a. in August 2020, it quickly reversed its trajectory, ending at 13.75% p.a. Table 1 presents a summary of the Interest Rates and Ibovespa history in the 3 windows.

Table 1. Data Ibovespa.

Window	Initial Interest Rate	Terminal Interest Rate	Return Ibovespa	Std-Dev Yearly
2013-2015	7.25%	14.25%	-28.88%	23.05%
2016-2019	14.25%	5.00%	166.78%	21.73%
2020-2022	5.00%	13.75%	-5.11%	31.28%

Source: Elaborated by authors.

Since the aim is to collect weekly data and apply the regression models in the windows, only funds that have complete data for one or more windows were considered. To reduce the effects of exchange rates on results due to the high allocation abroad, funds with the names "Investment in other countries" or "BDR" were removed. Passive funds were also excluded.

As a way of identifying passive funds that may be included in one of the classifications that make up the long-only group, it was decided to define a cutoff line based on the Tracking Error. For this definition, all indexed funds and active indexes that have data between 2010 and 2022 were listed, with Ibovespa as a benchmark. Then, their annual Tracking Errors were calculated about Ibovespa.

In a third step, the median annual Tracking Errors that each fund presented over time were verified. The median of those was calculated, resulting in a cutoff point of 6.37%, this value being rounded to 6%. Therefore, funds with an annualized Tracking Error of less than 6% were removed from the sample, using the Ibovespa, Idiv, or Small indices as a reference.

To reduce the effects of double-counting, in the event of two or more funds investing in the same master, only the funds that have the greatest amount of data within the evaluated period were kept in the database, and, in the event of a tie, the oldest fund. Furthermore, for the same reason, multi-manager funds and funds in which the manager of the vehicle sold differs from the master were removed, since, in both cases, the performance obtained derives from another manager, who will be included in another fund.

Restricted and exclusive funds were removed from the sample, as their results may be affected by shareholder decisions, such as asset transfer, pricing criteria, and replacement of the management company, among others. To minimize the effects of survival bias, the work also considered the results obtained by closed funds.

From this sample, and based on its Anbima classification and target audience, two subsamples were extracted. The first, classified as long only, included the Free Stocks, Small Caps, Value/Growth, and Dividend funds, which have, in their regulations, provisions for receiving contributions from EFPCs, to reduce the risk of their being strategies sold in funds belonging to the long-only group.

According to Brazilian Monetary Council Resolution 4,994/2022, such funds could not leverage themselves above 1 times the fund's equity, a characteristic typical of short selling. The second subsample, classified as long/short, was fed by Directional and Neutral long/short multimarket funds. The present study will also tabulate the data every week, covering the periods mentioned above.

3.2. Quantitative Model

Sharpe (1964) presents the CAPM model for asset pricing, in which he estimates that the expected return of an asset is derived from its sensitivity to systematic risk. Equation 1 presents the model, where R_i is the return on asset i, R_L is the return on the risk-free asset, R_M is the return on the market portfolio, β is the degree of sensitivity of the asset to the market portfolio and α is the angular coefficient, which represents the return obtained by the manager's skill (Gomes & Cresto, 2010).

$$R_i - R_L = \alpha + \beta * (R_M - R_L) + \varepsilon \quad (1)$$

According to work later presented by Fama and French (1993) it is understood that the asset's sensitivity to the market is insufficient to explain the return obtained by the manager's skill, complementing the model with the HML factor, related to the difference in performance between shares with high and low equity value/price, and the SMB factor, which considers the premium on the differences in capitalization of companies, resulting in the Fama-French 3-factor model.

In 2015, the authors added two more factors to the equation, the RMW, which relates part of the excess return to the difference between stocks with high and low historical profitability, and the CMA factor, which compares the performance obtained by aggressive versus conservative portfolios. Equation 2 demonstrates the final Fama-French 5-factor model (Diniz, 2021).

$$R_i - R_L = \alpha + \beta(R_M - R_L) + s_i SMB + h_i HML + r_i RMW + c_i CMA + \varepsilon \quad (2)$$

Where, s_i, h_i, r_i, and c_i are the sensitivity levels to the factors. To investigate the contribution of short selling to managers' performance, the Fama-French 5-factor model will be used, considering weekly returns.

As proposed by Diniz (2021) to estimate the model, the CDI will be used for the risk-free rate and the Ibovespa for market return.

To construct the Fama-French 5-factor model, common shares and preferences of companies listed on the Brazilian stock exchange, B3, were used. To avoid distortions in returns and volatility and consider companies that could be investment options in each period analyzed, only shares were chosen that had at least 95% complete data in each window, according to the methodology adopted by B3 for composition. of market indices.

Additionally, for the HML factor, shares that represented negative equity were removed, due to distortions in the VP/P index, as proposed by Mussa, Famá, and Santos (2012). Additionally, samples of companies that did not have monthly quotes for the 12 months before and after each portfolio formation were taken, due to the construction of the RMW and CMA factors.

The market portfolios for the Fama-French model were calculated on December 31 of each year. The SMB factor was calculated through the difference in average return of the 30% of shares with the smallest and largest capitalization. For calculation purposes, capitalization considered the company, and not just the observed role.

The HML was calculated based on the difference between the average return of the 30% of shares with the highest PV/P ratio versus the 30% with the lowest value. For RMW, the difference in the average return of the 30% of stocks with the best and worst performance in the previous 12 months was used. The CMA was calculated based on the difference between the 30% of shares with the lowest and highest volatility in the year.

Subsequently, seeking to evaluate the significance and effect of factors on managers' performance over time for each group and the alpha differences observed, Equation 2 is estimated using the ordinary least squares method, except in models in which heteroscedasticity is identified the data, being, in these cases, estimated by generalized least squares, aiming to overcome possible biases.

The alphas obtained in the previous process were subjected to a multiple regression model to assess whether the differences observed can be justified by qualitative aspects, being defined by the fund's classification in ANBIMA, redemption period, administration fee, type of fund classification, volatility of fund redemptions and their average equity in the researched window.

4. Results

4.1. Fama-French 5-Factor Model

The sample includes 164 funds classified as long only and 42 long/short. The analysis of the results in this chapter was divided into two stages. The first evaluated the generation of alpha and the impact of the model's betas in each period on theoretical portfolios considering the simple average of the weekly return of each fund belonging to each group. The second statistically compared the average alpha obtained by managers for each fund in each group through the same regressive models applied in the first stage for the group in which the fund is included.

4.1.1. Robustness Tests of the Model

The Shapiro and Wilk (1965) model was applied to the distribution of residuals for each regression to test normality. If the p-value is less than 5%, the null hypothesis of normality of the distribution is rejected. Except for the long/short model for the first window and long only for the second, all models showed normality in the distribution of residuals. Table 2 presents the results of the test on the distribution of residues.

Table 2. Shapiro-Wilk Test.

Test	Hypotheses		Results					
	Null	Alternative	Long Only	Long/Short	Long Only	Long/Short	Long Only	Long/Short
Shapiro-Wilk	Normal distribution (p-value > 0.05)	Non-normal distribution (p-value < 0.05)	p-value = 0.0715	p-value < 2.2e-3	p-value = 0.0014	p-value = 0.3411	p-value = 0.1082	p-value = 0.1412
			R^2 = 0.8995	R^2 = 0.0770	R^2 = 0.9094	R^2 = 0.6317	R^2 = 0.9465	R^2 = 0.7446
			2013 to 2015		2016 to 2019		2020 to 2022	

Source: Prepared by the author.

About the long/short group in the first window, R2 presented a low value (0.077). Thus, considering the result of the Shapiro-Wilk test, it is suggested that there may be exogenous variables to the model or impact due to the reduced number of funds observed in the window (26 funds), in addition to the existence of outliers.

Thus, the decision of a few managers may have made the model more sensitive, compromising the interpretation of the result for the window, even though the beta values are consistent with the literature.

Regarding the long-only group for the second window, R2 presented a high value, suggesting the existence of outliers in the model. Figure 1 shows the Chi-Square distribution of the residuals.

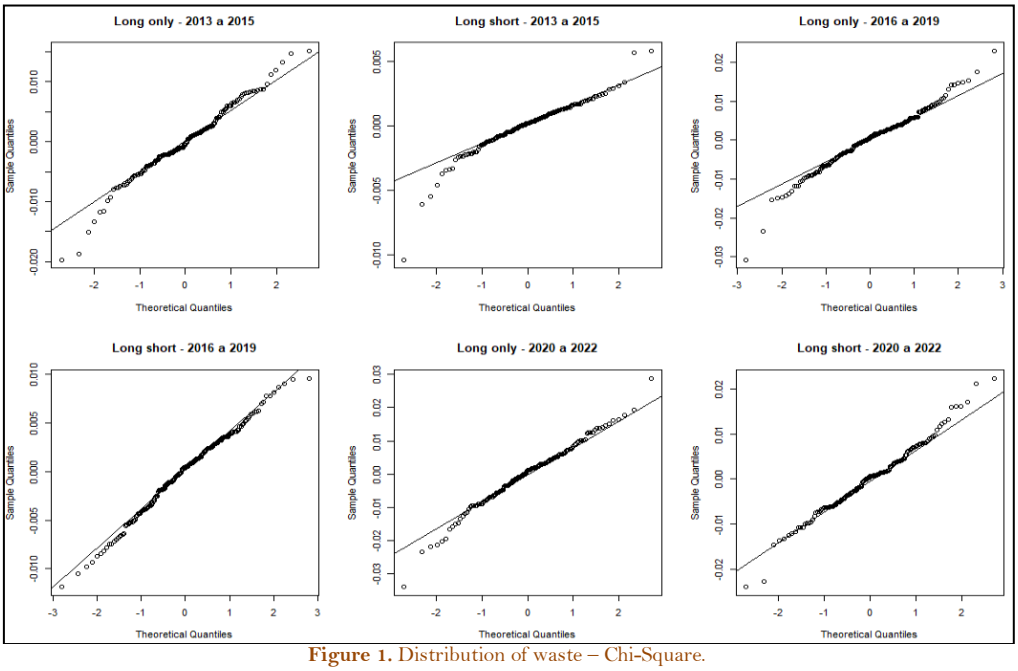

Figure 1. Distribution of waste – Chi-Square.

Source: Elaborated by authors.

Therefore, the Standard Deviation method was used with two standard deviations to detect and remove outliers in the residues of these groups (Bento & Santos, 2018). The weekly periods identified for the long/short window 1 and long-only window 2 groups were also removed from their pairs, to maintain coherence in the comparison between the groups. Table 3 presents the test update, after removing outliers.

Table 3. Shapiro-Wilk Test.

Test	Hypotheses		Results					
	Null	Alternative	Long Only	Long/Short	Long Only	Long/Short	Long Only	Long/Short
Shapiro-Wilk	normal distribution (p-value > 0.05)	Non-normal distribution (p-value < 0.05)	p-value = 0.7357	p-value = 0.2586	p-value = 0.6985	p-value = 0.3606	p-value = 0.1082	p-value = 0.1412
			R^2 = 0.9126	R^2 = 0.1080	R^2 = 0.9407	R^2 = 0.6638	R^2 = 0.9465	R^2 = 0.7446
			2013 to 2015		2016 to 2019		2020 to 2022	

Source: Elaborated by authors.

The adjustment carried out resulted in the removal of 6 periods in the first window and 12 periods in the second, so that the R^2 remained close to previous levels and the p-value was higher than the critical value, demonstrating the robustness of the models. The Breusch and Pagan (1979) was also performed to assess whether there is heteroscedasticity in the model.

The null hypothesis, when p-value < 0.05, points to the existence of heteroscedasticity. As can be seen, the long/short models for the second and third windows suggest the existence of heteroscedasticity in the data. Table 4 presents the test results for the 6 regression models.

Table 4. Breusch-Pagan Test.

Test	Hypotheses		Results					
	Null	Alternative	Long Only	Long/ Short	Long Only	Long/ Short	Long Only	Long/Short
Breusch -Pagan	Heteroscedasticity	Homoscedasticity	p-value = 0.9285	p-value = 0.9715	p-value = 0.3255	p-value = 0.0242	p-value = 0.4927	p-value = 0.0197
	(p-value < 0.05)	(p-value > 0.05)						
			R^2 = 0.9126	R^2 = 0.1080	R^2 = 0.9407	R^2 = 0.6638	R^2 = 0.9465	R^2 = 0.7446
			2013 to 2015		2016 to 2019		2020 to 2022	

Source: Elaborated by authors.

To enable the application of the Fama-French model to the two samples in question, it was decided to use the Generalized Least Squares (GLS) model. After implementing the models, the p-value of the two groups suggested homoscedasticity of the data and the Shapiro-Wilk test continued to point to the normal distribution of residuals. Table 5 presents the results of the tests.

Table 5. Breusch-Pagan and Shapiro-Wilk tests.

Test	Hypotheses		Results					
	Null	Alternative	Long Only	Long/ Short	Long Only	Long/ Short	Long Only	Long/ Short
Shapiro-Wilk	Normal distribution	Non-normal distribution	p-value = 0.7357	p-value = 0.2586	p-value = 0.6985	p-value = 0.3416	p-value = 0.1082	p-value = 0.1412
	(p-value > 0.05)	(p-value < 0.05)						
Breusch-Pagan	Heteroscedasticity	Homoscedasticity	p-value = 0.9285	p-value = 0.9715	p-value = 0.3255	p-value = 0.1479	p-value = 0.4927	p-value = 0.0916
	(p-value < 0.05)	(p-value > 0.05)						
			R^2 = 0.9126	R^2 = 0.1080	R^2 = 0.9407	R^2 = 0.6621	R^2 = 0.9465	R^2 = 0.7446
			2013 to 2015		2016 to 2019		2020 to 2022	

Source: Elaborated by authors.

We sought to test the multicollinearity of the data through the Variance Inflation Factors (VIF) model. None of the models presented a VIF greater than 10, indicating that there is no effect of multicollinearity on the regression coefficients (Miloca & Conejo, 2008). Table 6 presents the multicollinearity test of the models.

Table 6. VIF.

Model	IBOV	SMB	HML	CMA	RMW
Long Only 13-15	3.264	4.798	1.847	2.622	2.923
Long/Short 13-15	3.264	4.798	1.847	2.622	2.923
Long Only 16-19	1.683	2.301	1.645	2,970	1.412
Long/Short 16-19	1.721	2.165	1.768	2.950	1.499
Long Only 20-22	2.123	4.165	1.256	6.556	1.425
Long/Short 20-22	2.123	4.165	1.256	6.556	1.425

Source: Prepared by the author.

4.1.2. Application of the Fama-French Model

This step aims to apply the Fama-French model to the average portfolios calculated for the long-only and long/short groups in the three study windows. In the first scenario, both groups obtained negative and non-significant alpha. The market, size, and conservatism factors were statistically significant for both samples, with the long/short group having betas closer to zero.

This effect is consistent with the type of strategy, since short positions generate a negative effect on global betas, tending them towards zero about fully targeted strategies. Table 7 presents the results of applying the Fama-French models to the average long-only and long/short portfolios.

Table 7. Fama-French Model.

	Dependent Variable					
	Long Only	**Long/Short**	**Long Only**	**Long/Short**	**Long Only**	**Long/Short**
Intercept	-0.0007	-0.0001	0.0010**	0.0007	-0.0005	0.0002e-1
	(0.0005)	(0.0001)	(0.0004)	(0.0005)	(0.0007)	(0.0006)
MER	0.6579***	0.0187**	0.8405***	0.2123***	0.9162***	0.2744***
	(0.0278)	(0.0072)	(0.0186)	(0.0179)	(0.0285)	(0.0233)
SMB	0.1471***	0.0278**	0.1488***	0.0498***	0.0224	0.0021
	(0.0439)	(0.0114)	(0.0216)	(0.0179)	(0.0514)	(0.0420)
HML	-0.0317	0.0159	-0.0649**	-0.0351	-0.0449	-0.0064
	(0.0386)	(0.0100)	(0.0275)	(0.0249)	(0.0527)	(0.0431)
CMA	0.1571***	0.0400***	0.0883***	-0.0095	-0.1252**	-0.0847*
	(0.0454)	(0.0117)	(0.0273)	(0.0228)	(0.0594)	(0.0485)
RMW	0.0079	0.0143	0.0228	0.0304.	0.0058	-0.0288
	(0.0468)	(0.0121)	(0.0213)	(0.0182)	(0.0321)	(0.0263)
Window	2013 to 2015		2016 to 2019		2020 to 2022	
N_Funds	113	26	96	22	122	28
N_Períods	142	142	186	186	148	148
R^2	0.9126	0.1080	0.9407	0.6621	0.9465	0.7446

Note: *p<0.1; **p<0.5; ***P<0.01.
Source: Elaborated by authors.

In analyzing the second window, relating to the upward trend period, the intercepts were positive, however, significant at 5% only for the long/only group. The HML factor showed negative beta for both groups and statistical significance only for the first. Considering that the factor in question had a positive return for the period, this indicates that managers were more positioned in companies focused on growth. Figure 2 presents the accumulated return for the HML factor.

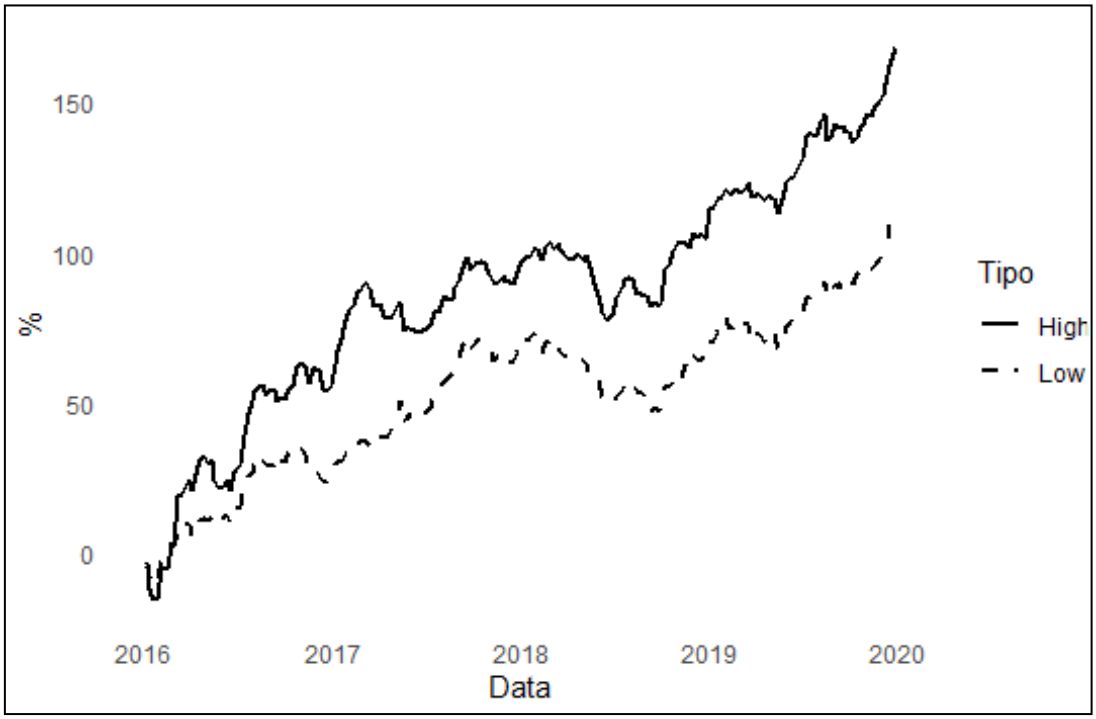

Figure 2. Return Factor HML – Period 2016 to 2019.
Source: Elaborated by authors.

All factors, except RMW, showed some level of significance for the long-only group, while for the other, the CMA and HML factors did not show significance. Again, the significant common factors for both groups point to the tendency of the long/short group to present values closer to zero.

The third window observed showed a significant change in market volatility due to the effects of the restrictive measures imposed to contain the spread of COVID-19. In this window, the alphas generated by managers did not show statistical significance, being positive for the long/short group and negative for the long-only group.

About betas, only market behavior and the conservatism factor were statistically significant. Regarding the conservatism factor, it is noteworthy that beta has a negative sign for both groups. Figure 3 presents the accumulated return for the CMA factor.

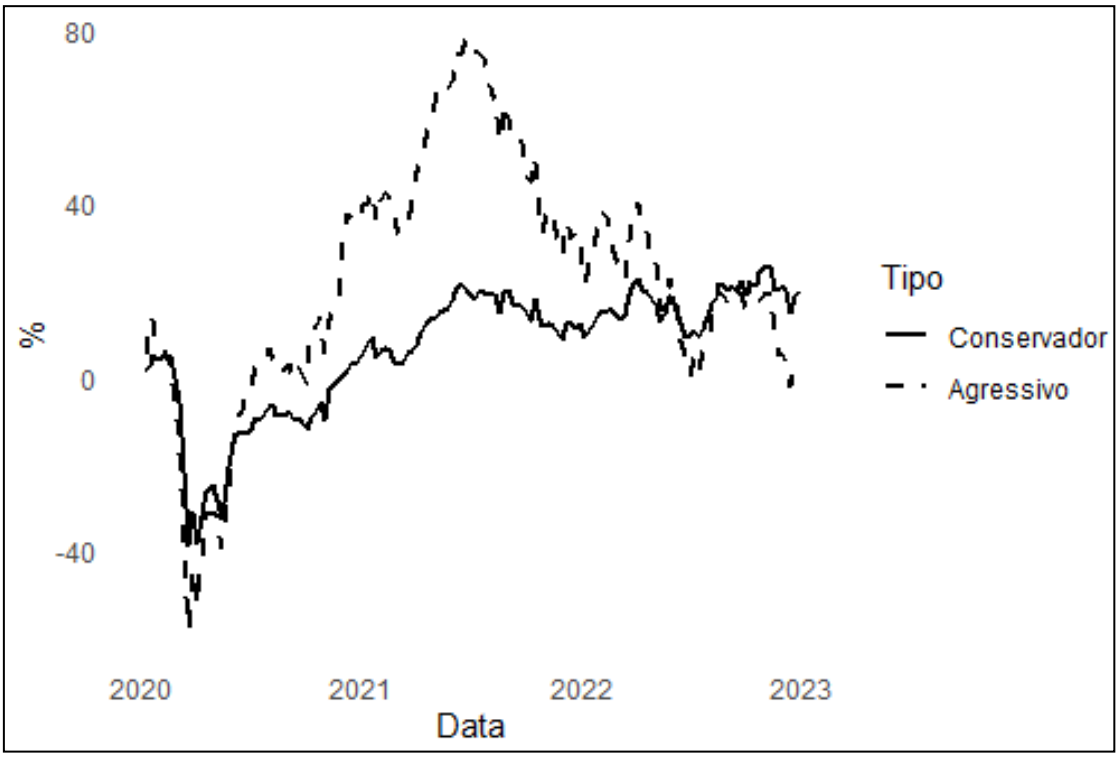

Figure 3. Return Factor CMA – Period 2020 to 2023.

Source: Elaborated by authors.

According to the graph, although there are times when the aggressive part of the factor presents superior performance, especially in the post-March/2020 recovery period, more conservative securities obtained a higher accumulated return. Thus, it is suggested that managers were more positioned in more aggressive roles for this window of greater volatility.

4.1.3. Difference Tests

Because the samples were small, especially in the long/short group, it was decided to perform the Mann-Whitney mean comparison Mann and Whitney (1947) which is a non-parametric test that does not assume the normal distribution of the groups comparison, being more recommended for the data profile in question. Table 8 presents the test results.

Table 8. U of Mann-Whitney Test.

	2013 to 2015		2016 to 2019		2020 to 2022	
	Long Only	**Long/Short**	**Long Only**	**Long/Short**	**Long Only**	**Long/Short**
Intercept	-0.00073	-0.00016**	0.00100	0.00048	-0.00053	0.00069
MER	0.65791	0.01873***	0.84052	0.21757***	0.91621	0.29115***
SMB	0.14719	0.02789***	0.14886	0.05415***	0.02248	0.01068
HML	-0.03178	0.01600***	-0.06491	-0.04308***	-0.04492	-0.02254
CMA	0.15716	0.04006***	0.08835	-0.00669***	-0.12521	-0.04599**
RMW	0.00797	0.01439	0.02284	0.02637	0.00590	-0.02374

Source: Elaborated by authors.

About the first window, 27.43% and 42.30% of long-only and long/short managers, respectively, presented positive alpha, contributing to the conclusions pointed out by Fung and Hsieh (2011) and Claes (2017) that Some managers have superior skills and the ability to generate positive and consistent alpha.

Furthermore, all factors, except for robustness, have a statistically significant difference. When evaluating the intercept, the test was significant at 5% and higher for the long/short group, suggesting that these funds may have additional support in market deterioration scenarios, despite the R2 for the model proving to be a limiter for the conclusions.

Observing the second window, around 84.38% of long-only managers and 86.36% of long/short managers presented positive alpha. The statistical significance for the factors remained similar to those observed in the first window. From the perspective of alpha generation, the intercept of the long/only group appears larger and significant at 10%, which denotes that such a scenario may favor managers long on the stock exchange.

In the third window, 22.95% of long-only managers and 39.29% of long/short managers managed to generate alpha. Only the market and conservatism factors showed statistically significant differences. About alpha, although on average, structures with sold portfolios showed superiority, the difference was not statistically significant.

Observing the results related to alpha, in moments of market normality and positive trends, managers from both groups have a greater capacity to position themselves in the face of the scenario and generate positive alpha, regardless of the strategy used. However, this capacity is compromised in moments of risk aversion and loss tendency, refuting the findings of Noguchi (2021) on the impact of tendency on alpha generation.

On the other hand, this interpretation suggests that divergences regarding risk premium levels, in which Manser and Schmid (2009); Gomes and Cresto (2010) and Fung and Hsieh (2011) point to non-capacity and Bali et al. (2013) and Roschel (2020) point out that managers obtain excess returns, which may, among other points, be related to the market trend of the periods analyzed.

Still, in these scenarios, the significance identified for the market and size factors throughout the windows corroborates the findings of Badrinath and Gubellini (2011) and Roschel (2020) although it is not possible to verify the contribution of the size factor in the third window. Additionally, the conservatism factor also proved to be relevant.

Finally, it is observed that in scenarios where trend verification is possible, long-only managers stand out on the rise and long/short managers on the fall, despite this having a negative average alpha and limitations due to the R2 of the model. In the scenario of increased risk aversion, it was not possible to confirm differences in strategies. Therefore, short positions only allow the control and reduction of market betas, functioning as protection against exposure to factors.

4.2. Qualitative Aspects

As a second stage of the work, it was verified whether there are qualitative factors that could affect the alpha obtained by managers. Initially, managers who had alphas considered as outliers were removed from all models, to avoid distortions in the analysis, using the Standard Deviation method previously carried out. The adjustment resulted in the withdrawal of 7 managers in the first window, 4 in the second, and 1 in the third, leaving 132, 114, and 149 funds, respectively, in each window. Table 9 presents the statistical summary of the data used in the regressions.

Table 9. Summary of fund data – Mean and Standard Deviation.

Window	Alpha	Redemption Period (% 252 days)	Administration fee	Volatility	Standard Deviation of Withdrawals	Net Worth in Billions
2013-2015	-0.0620%	7.0287%	2.3588%	13.5042%	1.0944%	0.1080
	(0.0012)	(0.0844)	(0.0084)	(0.0588)	(0.0084)	(0.1507)
2016-2019	0.0904%	6.9276%	2.3412%	16.3436%	1.0671%	0.1665
	(0.0012)	(0.0603)	(0.0069)	(0.0658)	(0.0112)	(0.1951)
2020-2022	-0.0298%	8.2646%	2.2616%	27.7693%	0.8531%	0.3647
	(0.0033)	(0.0810)	(0.0061)	(0.1021)	(0.0106)	(0.4674)

Source: Elaborated by authors.

After running the regression model using the Ordinary Least Squares (OLS) method, the Breusch-Pagan test was performed to identify heteroskedasticity, with the first two windows confirming the homoscedasticity of the errors and only the last window pointing to the existence of heteroskedasticity. Table 10 presents the Breush-Pagan test result.

Table 10. Breusch-Pagan Test.

Test	Hypotheses		Results		
	Null	Alternative	2013 to 2015	2016 to 2019	2020 to 2022
Breusch-Pagan	Heteroscedasticity	Homoscedasticity	p-value = 0.1768	p-value = 0.9223	p-value = 0.0283
	(p-value < 0.05)	(p-value > 0.05)			
			R^2 = 0.4342	R^2 = 0.6536	R^2 = 0.2320

Source: Elaborated by authors.

Therefore, for the sample from 2020 to 2022, we chose to use the Generalized Least Squares model. Additionally, the Kolmogorov-Smirnov test (Stephens, 1992) was performed to check whether there is normality in the distribution of residuals. If the p-value is greater than 5%, the null hypothesis of data normality is not rejected. Both tests were satisfactory for all models. Table 11 presents the results of the tests.

Table 11. Qualitative model final test.

Test	Hypotheses		Results		
	Null	**Alternative**	**2013 to 2015**	**2016 to 2019**	**2020 to 2022**
Kolmogorov-Smirnov	Normal distribution (p-value > 0.05)	Non-normal distribution (p-value < 0.05)	p-value = 0.9924	p-value = 0.8803	p-value = 0.1877
Breusch-Pagan	Heteroscedasticity (p-value < 0.05)	Homoscedasticity (p-value > 0.05)	p-value = 0.1768	p-value = 0.9223	p-value = 0.2061
			R^2 = 0.4342	R^2 = 0.6536	R^2 = 0.0799

Source: Elaborated by authors.

After processing the data and choosing the appropriate models, the results were verified. About the first window, all classes in the long-only group were significant and with negative beta, demonstrating that the bearish scenario had the same effect, regardless of the stock strategy purchased.

The funds' assets were positively related to the alpha generated, with significance at 0.1%, however, the perceived impact on the generation of alpha is low, so each additional billion that the funds have in assets influences 0.0025 the alpha. It is worth remembering that the R^2 for the long/short group in this window presented a low value, which limits the conclusions about this window. Table 12 presents the results of the evaluation of qualitative variables on the alpha obtained by managers.

Table 12. Qualitative regression.

	Dependent Variable		
	2013 to 2015	**2016 to 2019**	**2020 to 2022**
Dividend Stocks	-0.00120***	-0.00041	-0.00070
	(0.00035)	(0.00035)	(0.00054)
Free Stocks	-0.00081**	0.00022	-0.00102**
	(0.00031)	(0.00031)	(0.00048)
Small Caps Stocks	-0.00174***	0.00161***	-0.00071
	(0.00043)	(0.00044)	(0.00066)
Value/Growth Stocks	-0.00119***	0.00056	-0.00130**
	(0.00040)	(0.00041)	(0.00057)
L/S Directional Hedgefund	-0.00056	-0.00003	-0.00111**
	(0.00034)	(0.00036)	(0.00053)
L/S Neutral Hedgefund	-0.00050	-0.00075	-0.00080
	(0.00048)	(0.00046)	(0.00080)
Redemption Period	-0.00007	0.00307**	0.00299**
	(0.00097)	(0.00128)	(0.00128)
Administration fee	0.00192	0.01589	0.01669
	(0.01008)	(0.01106)	(0.01752)
Withdraw/NW	0.00142	-0.00517	-0.01749.
	(0.00978)	(0.00658)	(0.01024)
NW (in billions)	0.00250***	0.00083**	-0.00003
	(0.00055)	(0.00039)	(0.00023)
Window	132	114	149
R^2	0.4342	0.6536	0.0799

Note: *p<0.1; **p<0.05; ***p< 0.01.
Source: Elaborated by authors.

About the second window, only Small Caps funds showed statistical significance, with a positive coefficient. Furthermore, the redemption period was also significant (1%), contributing positively to the generation of alpha, despite having little elasticity, suggesting the possibility of a lock-up premium in this window, contrary to the findings of de Abreu Pontes et al. (2015). The size of the funds was also significant for this period; however, with low elasticity.

In the third window, the free, value/growth, and long/short directional share classes showed statistical significance and negative beta, demonstrating that the aversion scenario affects management capacity, regardless of the strategy. Additionally, the redemption period was significant, reinforcing the thesis of the existence of a lock-up premium.

In conclusion, the volatility of the level of redemptions, with a negative coefficient and significance, suggests that, hypothetically, the increase in risk perception may have intensified withdrawal requests from a group of funds, compromising the generation of alpha, since This scenario may force the manager to sell the assets at any price.

5. Conclusion

The main objective of this work was to verify whether the adoption of strategies sold in variable income portfolios allows an increase in the alpha generated. In this sense, it was found that, in moments of growth, long strategies stand out, and, in moments of decline, strategies that use short positions present higher alpha, despite being negative. In times of risk aversion, short strategies only affect the sensitivity of betas.

In a period of normality with an upward trend, variable income managers, on average, have greater competence in generating alpha. This ability is compromised in low scenarios and increased risk aversion. It is important to highlight that, in all windows, it was possible to identify that some managers managed to present a positive intercept, regardless of the strategy.

Depending on the market scenario, the factors begin to respond with different intensities and significances; however, there is a tendency for market factors, size, and conservatism to be representative of the groups throughout the study, presenting betas closer to zero for the group with short selling. It was noticed that the intensification of fund redemptions in windows of greater uncertainty affects the managers' ability to generate alpha and points to the possible existence of a lock-up premium.

These findings are useful in the literature on performance assessment of variable income managers and allow us to reinforce the evidence regarding the validity of the Fama-French 5-factor model. It also contributes to evaluating the effects of short selling on portfolio construction, the ability of variable income managers to obtain alpha over time, and the effects of withdrawal races on investment returns.

Finally, as a suggestion for future research, it is recommended to evaluate the alpha generation capacity of variable income managers segmented by market trends in other countries, as well as the effects of variations in redemption requests on alpha generation.

References

Badrinath, S. G., & Gubellini, S. (2011). On the characteristics and performance of long-short, market-neutral and bear mutual funds. *Journal of Banking & Finance, 35*(7), 1762-1776. https://doi.org/10.1016/j.jbankfin.2010.12.005

Bali, T. G., Brown, S. J., & Demirtas, K. O. (2013). Do hedge funds outperform stocks and bonds? *Management Science, 59*(8), 1887-1903. https://doi.org/10.1287/mnsc.1120.1689

Bento, G. M., & Santos, R. T. (2018). *Evaluation of outlier removal methods and their impacts on the accuracy of interpolation methods.* Paper presented at the Proceedings of the 1st Mato Grosso Symposium on Agricultural Mechanization and Precision Agriculture (pp. 125–138). Federal University of Mato Grosso, Sinop, Brazil.

Breusch, T. S., & Pagan, A. R. (1979). A simple test for heteroscedasticity and random coefficient variation. *Econometrica: Journal of the Econometric Society, 47*, 1287-1294. https://doi.org/10.2307/1911963

Claes, M. (2017). *Managerial skills of long/short capital hedge funds: the dependence of the factor model.*

de Abreu Pontes, G., Rogers, P., & Malaquias, R. F. (2015). Os fundos long and short entregam o prêmio de lockup? Evidências empíricas no Brasil. *Contabilidade Vista & Revista, 26*(3), 106-123.

Diniz, G. S. (2021). *Performance analysis of Brazilian equity funds: active and passive management strategies.* Master's Thesis. Brazilian Institute of Education, Development and Research, Brasília, Brazil.

Fama, E. F., & French, K. R. (1993). Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics, 33*(1), 3-56. https://doi.org/10.1016/0304-405X(93)90023-5

Fung, W., & Hsieh, D. A. (2011). The risk in hedge fund strategies: Theory and evidence from long/short equity hedge funds. *Journal of Empirical Finance, 18*(4), 547-569. https://doi.org/10.1016/j.jempfin.2011.04.001

Gomes, F. A. R., & Cresto, V. (2010). Performance evaluation of long-short funds in Brazil. *Revista Brasileira de Finanças, 8*(4), 505-529.

Hendricks, D., Patel, J., & Zeckhauser, R. (1993). Hot hands in mutual funds: Short-run persistence of relative performance, 1974–1988. *The Journal of Finance, 48*(1), 93-130. https://doi.org/10.1111/j.1540-6261.1993.tb04703.x

Henry, M. (1952). Portfolio selection. *Journal of Finance, 7*(1), 77-91.

Mann, H. B., & Whitney, D. R. (1947). On a test of whether one of two random variables is stochastically larger than the other. *The Annals of Mathematical Statistics*, 50-60.

Manser, S., & Schmid, M. M. (2009). The performance persistence of equity long/short hedge funds. *Journal of Derivatives & Hedge Funds, 15*(1), 51-69. https://doi.org/10.1057/jdhf.2008.28

Miloca, S. A., & Conejo, P. D. (2008). Multicolinearidade em modelos de regressão. In (pp. 25-34). Cascavel, Brazil: XXII Semana Acadêmica da Matemática.

Mussa, A., Famá, R., & Santos, J. O. d. (2012). The addition of the momentum risk factor to the Fama & French three-factor asset pricing model applied to the Brazilian stock market. *REGE-Revista de Gestão, 19*(3), 431-447.

Noguchi, A. (2021). *Impacts of stock market direction and asset size on alpha generation of Brazilian funds.* Master's Thesis. Insper – Instituto de Ensino e Pesquisa, São Paulo, Brazil.

Roschel, C. M. (2020). *Persistence of performance in long-short funds in Brazil.* Thesis (Master's in Economics) - Fundação Getúlio Vargas.

Shapiro, S. S., & Wilk, M. B. (1965). An analysis of variance test for normality (complete samples). *Biometrika, 52*(3-4), 591-611.

Sharpe, W. F. (1964). Capital asset prices: A theory of market equilibrium under conditions of risk. *The Journal of Finance, 19*(3), 425-442. https://doi.org/10.1111/j.1540-6261.1964.tb02865.x

Stephens, M. A. (1992). Introduction to Kolmogorov (1933) on the empirical determination of a distribution. In Breakthroughs in statistics: Methodology and distribution. In (pp. 93-105). New York: Springer New York.