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PERFORMANCE AND RISK OF BRAZILIAN EQUITY MUTUAL FUNDS IN THE CONTEXT OF THE COVID-19 PANDEMIC

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ABSTRACT

The goal of this research was to analyze how Brazilian equity investment funds behaved during the Covid-19 period. The analysis was divided into 3 sub-periods: (i) pre-crisis (2019-10-03 to 2020-01-31); (ii) crash (2020-02-19 to 2020-03-23); (iii) and recovery (2020-03-24 to 2020-04-30. The main results showed that during the crash period, in all the categories, more than 50% of the funds obtained a return superior to that of the IBRX100. However, in the recovery period, the scenario is reversed and the vast majority of funds start to underperform the index. However, when performance is analyzed from the perspective of multifactor risk models, it is possible to identify positive alpha generation during the pre-crisis period and negative (destruction of value) during the crash period. In addition, when examining fund flows, it can be seen that there was no "run on the fund" phenomenon to redeem the shares. Actually, in the analyzed period, the inflows surpassed the redemptions. This may indicate that the fund investors are financially more educated and that he or she acted with more caution when waiting for a less turbulent moment. The article concludes that the industry was coming from an excellent performance in the pre-crisis period, which was interrupted by a period of value destruction during the moment of the greatest turmoil, and that, finally, during the recovery period, the performance was below the market index, but without generating or destructing significant value.

Keywords: Equity mutual funds. Performance. COVID-19.

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1 INTRODUCTION

From the first signs of the emergence of an unknown virus in Wuhan, China, to the official statement by the World Health Organization (WHO) of the Covid-19 pandemic, only a few weeks had gone. In the absence of a vaccine readily available, people around the world have been placed in social distancing to try to decrease the rate of contagion, the absolute number of infected people and the long-term losses caused by the coronavirus. This distancing caused a shock of demand in the economy of many countries (Farboodi, Jarosch, & Shimer, 2021; Greenstone & Nigam, 2020; Mazur, Dang, & Vega, 2020).

The measures to curb the pandemic caused the disruption of supply chains, unemployment, adaptations to work remotely, and a decrease in demand with worsening expectations (H. Chen, Qian, & Wen, 2021; Gormsen & Koijen, 2020; Landier & Thesmar, 2020; Pástor & Vorsatz, 2020; Smales, 2021). In this context, governments around the world had to significantly increase their spending on health, social protection, and maintenance of employment and income (Makin & Layton, 2021; Alberola, Arslan, Cheng, & Moessner, 2021; Chudik, Mohaddes, & Raissi, 2021).

Strong impacts were also observed on financial markets, with sharp drop in stock indices around the world (Seven & Yılmaz, 2021). In this sense, the literature on the impacts of the pandemic on financial markets and the economy has been growing rapidly. Illustratively Fahlenbrach, Rageth and Stulz (2021), point out that the actions of companies with greater financial flexibility had a lower fall than those of companies with low flexibility, even controlling by the sector. These results are corroborated by Ramelli and Wagner (2020), which conclude that the degree of indebtedness and retention of money are important elements of companies to explain the variability in the stock prices. Several other studies attest to the unprecedented effects of the Covid-19 pandemic on the stock market (Akhtaruzzaman, Boubaker, & Sensoy, 2021; Harjoto, Rossi, Lee, & Sergi, 2021; Mazur et al., 2020; Smales, 2021).

The literature on investment funds during this period has also been growing. For example, Pástor and Vorsatz (2020), for the American market, found evidence that most active funds had lower performance than passive indices and that funds with higher sustainability scores had good performance, indicating that the assets with greater exposure to the sustainability factor are more resilient in periods of acute crisis. Similarly, Mirza et al. (2020) by analyzing European funds, they show that social entrepreneurship funds (those who invest in companies that help in social issues and do not target profit) were more resilient to shock than others, both in terms of performance and volatility. Falato, Goldstein, and Hortaçsu (2021) point out that American funds in the private securities market had a significant loss of resources during the crisis, and that this fragility was caused by the illiquidity and vulnerability to a rapid sale of the assets held by these funds.

Making a general overview of the Brazilian market, it is observed that the general figures for 2020 and 2021 are alarming, both in health and in the economy. In June 2021, according to data from the State Health Departments, the country surpassed the mark of 500 thousand deaths due to coronavirus. Even with the anticyclic measures, the GDP retraction was 4.1%, according to data from the Brazilian Institute of Geography and Statistics (IBGE). In addition, according to the Central Bank, the accumulated primary deficit of 2020 was R$702.9 billion. Because of this, the financial markets have also been greatly impacted. In March 2020 alone, Ibovespa registered a fall of 29.9%, the worst monthly mark since the Russian crisis in 1998, when Russia declared a moratorium on its external debt. That same month, the Stock Exchange recorded a total of six *circuit breakers* - the same measure that was recorded throughout the 2008 crisis (Alvarenga, 2020).

In contrast to the considerable fall of Ibovespa, however, the Brazilian investment fund industry achieved positive results in the year 2020. To illustrate, from January to December 2020, according to data from the Brazilian Association of Financial and Capital Markets Entities

(Anbima), the net fund flows of the sector was R$196.4 billion. The positive results did not end in 2020: considering only the first quarter of 2021, the sector's net flows was R$206 billion (Anbima, 2021).

Thus, it becomes interesting to analyze more deeply the performance and risk of investment funds in the Brazilian market during the Covid-19 pandemic period, which is the objective of this study. In addition, we analyzed the patterns of fund inflows and redemptions that occurred during this period, as well as the characteristics of the funds that were determinant of their performance. The authors do not know analyzes, with similar characteristics, carried out on the Brazilian funds, which highlights the relevance of the present work.

2 LITERATURE REVIEW

2.1 Investment in funds

An investment fund is a modality of collective financial application, structured in the form of a condominium, in which the contributions of several investors are gathered, and whose amount is applied jointly in the financial market by a professional manager, that should follow pre-defined guidelines and agreed by the members of the fund (CVM, 2014). The gains obtained with these operations, if any, are then divided among the various shareholders in proportion to the value of the deposit of each one through the valuation of their quotas. In return, the shareholders fees are charged as remuneration for the services provided (management fees) and as bonuses for the achievement of goals (performance rates).

There are several advantages of investing in funds. Firstly, they offer professional management of the invested resources, which on average tends to lead to higher returns for the individual investor. On this, Ferreira et al.(2013) they show that the performance of the fund is one of the main determinants of the investor's choice on where to invest. Secondly, the funds facilitate the diversification of investments, because they expand the range of options with some that would in practice be inaccessible from an individual point of view(Borges & Martelanc, 2015; Klapper, Sulla, & Vittas, 2004; Milani & Ceretta, 2013; Varga & Wengert, 2011). Moreover, because they are supervised by the Securities and Exchange Commission (CVM) and Anbima, the funds are also considered relatively safe investment options.

In recent years, the investments funds industry in Brazil has been growing considerably. According to data from Anbima, at the end of 2020 the net worth of the industry reached a historical maximum of R$6 trillion, which corresponds to approximately 80% of the GDP of the same year. If, on the one hand, it is true that part of this is explained by the significant fall in the interest rate, on the other hand, part of this increase can also be attributed to the maturation of the country's capital market. Putting this increase in historical perspective, from December 2008 to December 2018, the average annual growth rate of the funds equity was 9.1%. From 2002 to 2018, while the GDP was multiplied by less than 5, the net worth of the industry was multiplied by 13. According to data from the International Association of Investment Funds (IIFA), the Brazilian industry in 2019 was the tenth largest in the world. Thus, it becomes increasingly necessary to study with rigor the investment funds, at different times, from different approaches.

2.2 COVID-19 pandemic and the equity investment funds

As much as the events associated with the Covid-19 pandemic are still happening, a broad literature already investigates the impacts of the event on global financial markets under different points of view. Zhang, Hu, and Ji (2020), for example, they show that systemic and individual risks increased considerably after the onset of the pandemic. Akhtaruzzaman et al. (2021), in turn, observed that there was an increase in dynamic conditional correlations among the returns of

companies listed on the stock exchange; that this phenomenon was higher for financial companies; and that the *hedge* costs increased substantially in the period.

In addition to these efforts to disseminate the effects of the pandemic on markets in an aggregate form, many researchers have taken a more specific approach. Mirza et al. (2020) and Yarovaya et al.(2021) illustrate to Latin America and European Union countries, respectively, that investment funds with higher human capital efficiency had a higher performance in risk-adjusted return measures compared to funds with lower human capital efficiency.

In addition, a considerable effort was made to analyze how exposure to the sustainability factor impacted the performance and capital flows of investment funds. Döttling and Kim (2020) show that retail investors see exposure to this factor as a luxury asset - the demand for the product falls more than proportionally to the reduction of income - unlike institutional investors, that for reasons of mandate and/or a lower budget restriction tended to maintain positions in funds with ESG bias even after the pandemic shock. In addition, Pástor and Vorsatz (2020) show that the funds that had a higher *sustainability rating* before the crisis had a performance adjusted to the higher risk in the period of greater turbulence.

In addition, in a more global view, Alqadhib, Kulendran and Seelanatha (2022) show that a sample of active investment funds from Saudi Arabia was able to generate a positive and statistically significant alpha during the Covid-19 period. In turn, Maheen (2021) presents evidence that India's active management funds did not have the ability to overcome the market during the period of the health crisis.

Finally, some studies were carried out analyzing the performance and fund flows of the resource management industry as a whole. It is noteworthy that of Pástor and Vorsatz (2020), which shows that the average of equity investment funds had a performance lower than several market indices in the US. As we will see in this work, the performance of Brazilian equity funds during the COVID-19 crisis diverges partially from the results found by Pástor and Vorsatz (2020) to the US market.

3 METHODOLOGY

3.1 Performance and risk measures

The performance of investment funds is analyzed through regression models that measure the relationship between risk factors and the return of their assets. Sharpe (1964), Lintner (1965) and Mossin (1966) developed separately the CAPM (*Capital Asset Pricing Model*), according to which the expected return of any asset is a function of the return of a risk-free asset and the market prize adjusted by a β factor (beta), which measures the systematic risk. More precisely, this model takes the following form:

$$R_i - R_f = \alpha_i + \beta_i\left(R_m - R_f\right) + \varepsilon_i \qquad 1$$

where R_i represents the return of the asset, R_f the return of a risk-free asset and $R_m$the return of a market index. The non-systematic risk, according to Markowitz (1952), can be eliminated through portfolio diversification. An efficient portfolio, in this sense, would be one that maximizes the expected return to a given level of risk, or that minimizes the risk for a given level of return. Still on CAPM, the return part not explained by the model is called α (alpha), which, in other words, measures the degree of excess return of an asset. It also refers to alpha as the "abnormal return rate".

However, the CAPM model received several criticisms over time (Roll, 1977; Ross, 1976). With this, other pricing models emerged. Since Fama and French (1993) the factors size (*small-*

minus-big, SMB) and *book-to-market* (*high-minus-low* , HML) were added to the market risk factor. The model is specified in equation 2.

$$R_i - R_f = \alpha_i + \beta_i(R_m - R_f) + \delta_i SMB + \gamma_i HML + \varepsilon_i \quad (2)$$

To these three factors the Carhart's momentum factor (MOM) was added, as shown in equation 3.

$$R_i - R_f = \alpha_i + \beta_i(R_m - R_f) + \delta_i SMB + \gamma_i HML + \omega_i MOM + \varepsilon_i \quad (3)$$

Later Fama and French (2015), expanded their own model with two factors, investment (*conservative-minus-aggressive*, CMA) and profitability (*robust-minus-weak*, RMW). However, regarding the analysis of the performance of investment funds, there is greater acceptability by the models of Fama and French (1993) and Carhart (1997) by the academic community (Castro & Minardi, 2009; J. Chen, Hong, Huang, & Kubik, 2004; Nerasti & Lucinda, 2016; Paz, Iquiapaza, & Bressan, 2017).

Additionally, there are some indexes that make it possible to analyze the risk-adjusted performance of different portfolios. As an example, the Sharpe Index measures the performance of an investment compared to a risk-free asset and normalized by its standard deviation (volatility indicator), according to what is explained in Equation 4.

$$SI_i = \frac{R_i - R_f}{\sigma_i} \quad (4)$$

When the numerator is negative, the usual calculation of SI can lead to erroneous classifications of the investments analyzed, favoring those with higher losses and higher volatility. Israelsen (2005) considered a modification of the formula to obtain consistent indexes, according to Equation 5.

$$SI_i = \frac{R_i - R_f}{\sigma_i^{\frac{R_i - R_f}{abs(R_i - R_f)}}} \quad (5)$$

There are other risk measures in financial operations. VaR (*Value at Risk*) is one of them. It measures, for a given period, with a certain probability, the maximum percentage drop in the value of an asset. Put another way, it indicates what the worst can happen with a value of an asset at a given time, within a pre-established confidence interval. The VAR associated with a α significance level can be defined according to Equation 6.

$$VaR_\alpha(r_i) = -\inf\{r_i | (P(R \leq r_i) > \alpha\} \quad (6)$$

where "*r"* is the return of the asset in question and the negative sign is used to make the term positive, since losses are negative, by definition.

A VaR limitation is that it considers only a critical value associated with a given confidence interval, but nothing indicates about values below it. That is, there is no information about losses greater than the maximum estimated loss for the significance level adopted. To bridge this gap, one can adopt a variation of VaR, called Conditional VaR (CVaR). The intuition behind it is simple. Just calculate the expected value of returns lower than VaR, as it can be seen in Equation 7.

$$CVaR_{\alpha}(r_i) = \mathbb{E}[r_i | r_i \geq VaR_{\alpha}(r_i)] \quad (7)$$

3.2 Sample Data

To achieve the proposed objectives, daily data on the value of the share, the values of redemptions and inflows were used, as well as data on the characteristics of the stock investment funds extracted from SI_ANBIMA and the Economática database. The data covers a period starting on 10/03/2019 and ending on 04/30/2020.

To avoid incubation bias – which occurs when managers create new funds with a certain frequency and only bring to market those with good performance in the incubation period – we limited our sample to funds with a net worth of more than R$5,000,000.00 (Borges & Martelanc, 2015; Malaquias & Maestri, 2017). In addition, for a fund to be part of the universe of analysis, it would need to be present both in the database of Anbima and in the base of the Economática. Finally, we demand that the funds have provided quota for at least 75% of the days.

Since multiple sub-periods are used and to ensure that the analysis is free of survivor bias, we applied the restrictions set out above for each sub-period. After that, the total number of funds is 1405 in the pre-crisis period, 1512 in *the crash* period and 1562 in the recovery period. Active Index funds represent approximately 14% of this total, while free-portfolio funds represent 85% and the rest of the funds only 1%.

For a better understanding of the pandemic impacts on the performance of funds, the sample was divided into three periods, similar to the work of Pástor and Vorsatz (2020), but with some adaptations: the pre-crisis period begins in 10/03/2019 and ends in 01/31/2020; the *crash* period begins on 02/19/2020 – Ibovespa's last positive return day before the *crash* – and ends on 03/23/2020 – the day Ibovespa reached its lowest point by 64,000 points; and the recovery period starts on 03/24/2020 and ends on 04/30/2020, when Ibovespa had an accumulated return of 27% since March 23.

As much as the effects of the Covid-19 pandemic on society were felt tens of months after the end of April 2020, a vast literature indicates that the relationship between the stock markets and the pandemic has weakened considerably after this period. Karavias, Narayan, & Westerlund (2022), for example, develop a new methodology for detecting structural breaks and, in applying for the impact of Covid-19 on capital markets, they find a single structural breakdown in the first week of April 2020. In addition, the authors show that after this structural breakdown, the number of cases and deaths related to Covid ceases to have a significant impact on the performance of the stock markets.

In addition, Mamaysky (2022), using a natural language processing model, present evidence that there was a feedback between news and markets in the first part of the pandemic. However, according to the author, there was a structural breakdown in this feedback effect in March 2020 and, after that date, the relationship between markets and news became considerably weaker. In addition, Capelle-Blancard & Desroziers (2020) claim that after the intervention of central banks last week of April, investors did not seem more concerned about news of the pandemic.

Finally, the daily returns for the risk-free rate and for the risk factors market, *size, value* and *momentum were* extracted from the database of the Research Center in Financial Economics of USP (NEFIN-USP).

3.3 Proposed Analyzes

In order to understand the performance of funds from an exposure to risk factors generating abnormal returns α, we performed the regression exposed in Equation 8.

$$R_{j,t} - R_{rf,t} = \sum_{p=1}^{3} \alpha_{j,p} D_p + \beta_{j,fator_{i,p}} \sum_{p=1}^{3} \sum_{i=1}^{4} R_{fator_{i,t}} D_p + \epsilon_{j,t} \quad (8)$$

in which $R_{j,t}$ is the daily return of the j-th fund; $R_{rf,t}$ it is the return of the risk-free rate; $D_p = D_{crash}, D_{recup}$ in which, D_{crash} is equal to 1 for days comprising the *crash* period and 0 otherwise, D_{recup} is equal to 1 for days comprising the recovery period and 0 otherwise; $fator_i = fator_{mkt}, fator_{SMB}, fator_{HML}, fator_{WML}$ where $fator_{mkt}$ is the return of the market factor – bought in the market index and sold at the risk-free rate – $fator_{SMB}$, is the factor size (*small minus big*) – purchased in companies with lower market capitalization and sold in those with higher capitalization – $fator_{HML}$is the value factor (*high minus low*) – purchased in companies with the highest equity ratio for the price and sold in companies with the least reason -, and $fator_{WML}$ is the factor moment (*winners minus losers*) – purchased in companies with the highest accumulated return in the past and sold in companies with the lowest accumulated return. In addition, $\alpha_{j,p}$ is the intercept and *the intercept dummies*; $\beta_{j,fator_{i,p}}$ they are the angular coefficients; and finally $\epsilon_{j,t}$, is the regression residue.

After studying the performance of the funds during the Covid-19 pandemic, we sought to analyze what features of the funds and what performance/risk measures of the pre-crisis period help explain the variations in the performance and risk of funds in *the crash* period. Thus, to achieve this purpose, *cross-sectional* regression was performed, described in Equation 9.

$$Estat_j = \alpha_j + \sum_{k=1}^{10} \beta_{k,j} X_{k,j} + \epsilon_j \quad (9)$$

in which $Estat_j = \alpha_{crash}\ ou\ IS_{crash}\ ou\ CVaR_{crash}$the dependent variables are the alphas (estimated from Equation 8, the Sharpe indexes and *the Conditional Value at Risk* (CVaR), all estimated for *the crash* period for the fund j. $X_{k,j}$, in turn, it is the matrix of independent variables composed of the Annual Management Fee; a *dummy* indicating whether the fund charges performance rate (1) or not (0); the variation in the PL of the fund in the pre-crisis period based on funds redemption and inflow; a *dummy* indicating whether the fund is open (1) or closed (0); a *dummy* indicating whether the fund is exclusive (1) or not (0); the time of existence of the fund, measured in years; the alpha and beta of the pre-crisis period, estimated on the basis of Equation 8, without *the dummies*; and, finally, the natural logarithm of the fund's net worth. In addition, we have the intercept (α_j), the angular coefficients ($\beta_{k,j}$)and the regression error term (ϵ_j). In the equation for the CVaR we used the same with exchanged signal, thus factors were identified that contributed to the greater risk of loss of the fund.

4 RESULTS

4.1 Return of Funds and Financial Flows

As it can be seen in Figure 1, the cumulative average of returns on stock investment funds, even negative, was slightly higher than the return on the market index IBRX100, although the t-test does not reject the hypothesis of equality of average returns – the results for the Ibovespa index are quite similar. This differs from the standard observed by Pástor and Vorsatz (2020) for the American market, in which it was found that during the Covid-19 crisis, the funds had a significantly lower performance than the benchmark. This difference may be associated with the fact that there is a greater informational asymmetry in the Brazilian market than in the American market, given the disparity in the development of each market (Gul & Qiu, 2002). In this case, the

Brazilian managers could explore this greater informational asymmetry and thus generate a greater relative return when compared to their American peers.

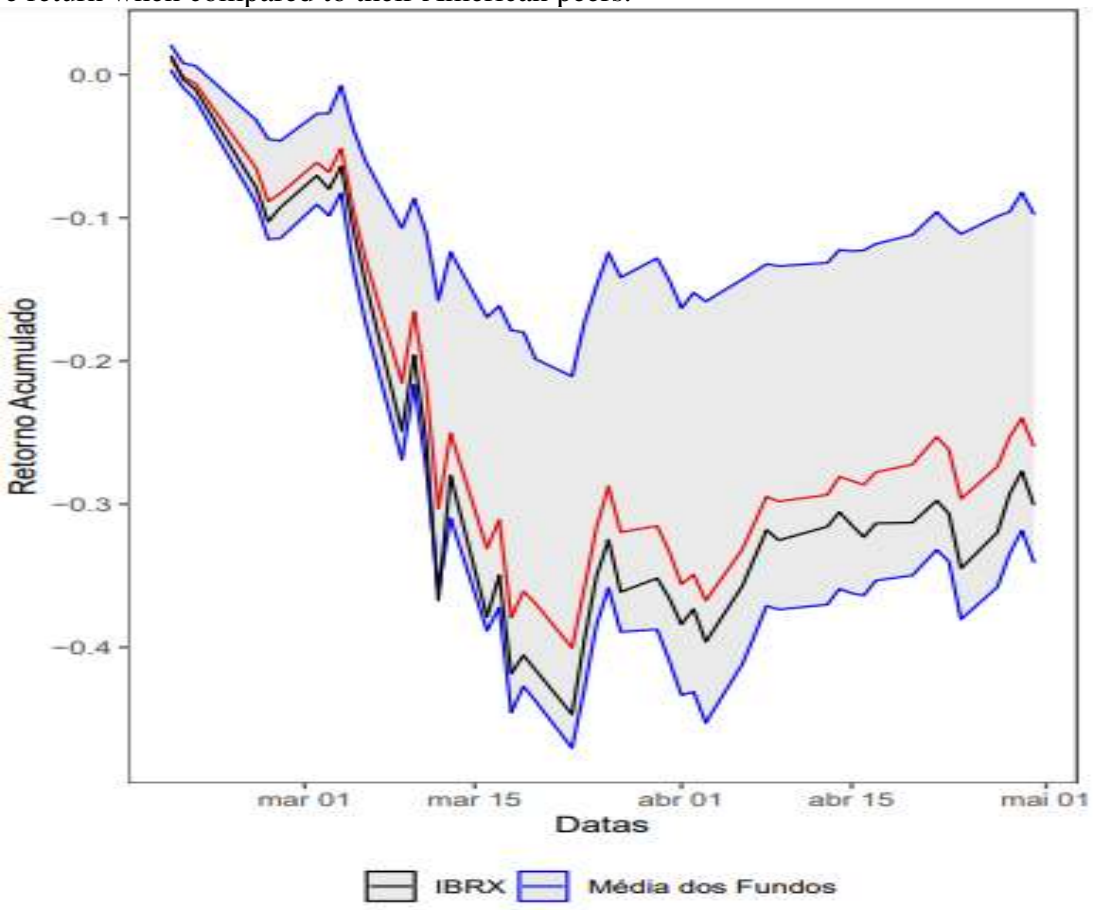

Figure 1. Accumulated Return of Funds – Crash and Recovery 2020
Source: Elaborated by the authors from the data of the research.

Next, we can observe the distribution of returns from the funds in Table 1. It is noticed that in the pre-crisis period the funds had a higher return compared to the reference index, so that more than 60% of the funds exceeded IBRX100, with the exception of the funds of the "Other Shares" category. In *the crash* period, the percentage of funds with a higher return increased indicating that the industry was able to generate value to the shareholder by preventing losses from being higher than those of the index. According to Mirza et al. (2020), the human capital may have been an important factor in this period of greater turbulence. Finally, in the recovery period, the scenario reverses and less than half of the funds can overcome *the benchmark*, possibly indicating that managers have changed their portfolio toward more conservative assets and, therefore, they were not able to capture the beginning of the recovery of the stock market. This idea will be tested in the subsequent analyzes.

Table 1
Percentage of Funds that exceeded the IBRX100 index

	All	Active Index Shares	Free Portfolio	Other Shares
Pre Crisis	0.707	0.664	0.720	0.375
Crash	0.837	0.774	0.848	0.760
Recovery	0.329	0.265	0.343	0.125

Source: Elaborated by the authors from the data of the research.

However, even though the results presented so far indicate that the industry has generated value for the shareholders, the analyzes have been totally dissociated from the risk at which the funds have incurred to obtain such a higher return. Thus, in order to close this *gap*, we analyzed the performance and risk statistics in the pre-crisis period, during the crisis and during the recovery in Table 2.

Thus, Table 2 presents statistics of the performance and risk of the sample funds during the Pre-Crisis, Crash and Recovery periods. It is noticed that in the pre-crisis period the annualized average returns of the different types of funds were higher in relation to the return of the market index, with volatility very close to the market, resulting in superior performances, measured by the Sharpe Index and alpha of the 4-factor model. When analyzing the *crash* period, it is noticed that this relationship remained, with all types of funds, having had less expressive losses than the IBRX index, while presenting a lower volatility. That is, the funds were, on average, less risky and more profitable investments than the index in these periods. Nevertheless, it was a period of high volatility, as noted by Zhang et al. (2020).

Table 2
Performance and Risk Statistics – Pre Crisis, Crash and Recovery 2020

Panel A: Returns Statistics - Pre Crisis

	Type	Ret.	Vol.	VaR	CVaR	IS	β	α (4F)
Mean	All	0.041	0.042	-0.013	-0.018	0.937	0.826	0.007
Median	All	0.040	0.041	-0.013	-0.018	0.934	0.873	0.005
Deviation	All	0.019	0.017	0.006	0.008	0.341	0.269	0.015
Mean	Active Index	0.036	0.045	-0.015	-0.020	0.757	0.981	0.001
Median	Active Index	0.036	0.043	-0.014	-0.019	0.740	0.994	0.001
Deviation	Active Index	0.011	0.014	0.006	0.007	0.250	0.166	0.008
Mean	Free Shares	0.042	0.041	-0.012	-0.018	0.970	0.798	0.008
Median	Free Shares	0.042	0.040	-0.012	-0.017	0.980	0.842	0.006
Deviation	Free Shares	0.020	0.018	0.006	0.008	0.344	0.275	0.016
Mean	Other Shares	0.039	0.045	-0.013	-0.019	0.786	0.900	0.009
Median	Other Shares	0.039	0.044	-0.013	-0.019	0.822	0.948	0.006
Deviation	Other Shares	0.016	0.009	0.003	0.004	0.337	0.230	0.014
IBRX	Index	0.033	0.044	-0.015	-0.021	0.657	1.033	-0.001

Panel B: Returns Statistics - Crash

	Type	Ret.	Vol.	VaR	CVaR	IS	β	α (4F)
Mean	All	-0.388	0.255	-0.109	-0.111	-0.101	0.793	-0.010
Median	All	-0.413	0.268	-0.116	-0.116	-0.112	0.850	-0.011
Deviation	All	0.079	0.043	0.018	0.016	0.058	0.155	0.062
Mean	Active Index	-0.416	0.267	-0.115	-0.116	-0.113	0.835	-0.024
Median	Active Index	-0.425	0.270	-0.116	-0.116	-0.115	0.860	-0.029
Deviation	Active Index	0.050	0.023	0.007	0.006	0.019	0.095	0.063
Mean	Free Shares	-0.383	0.253	-0.108	-0.110	-0.099	0.785	-0.008
Median	Free Shares	-0.409	0.267	-0.116	-0.116	-0.110	0.847	-0.010
Deviation	Free Shares	0.082	0.045	0.019	0.017	0.062	0.163	0.061
Mean	Other Shares	-0.392	0.256	-0.110	-0.112	-0.103	0.819	-0.015
Median	Other Shares	-0.413	0.270	-0.116	-0.116	-0.110	0.847	-0.019
Deviation	Other Shares	0.071	0.038	0.017	0.014	0.025	0.100	0.059
IBRX	Index	-0.432	0.317	-0.136	-0.143	-0.138	1.031	-0.018

Panel C: Returns Statistics - Recovery

	Type	Ret.	Vol.	VaR	CVaR	IS	β	α (4F)
Mean	All	0.187	0.157	-0.044	-0.051	1.192	0.916	0.008
Median	All	0.195	0.164	-0.047	-0.052	1.199	0.994	0.006
Deviation	All	0.057	0.034	0.012	0.013	0.316	0.238	0.046
Mean	Active Index	0.193	0.167	-0.048	-0.055	1.155	1.013	-0.001
Median	Active Index	0.197	0.166	-0.048	-0.054	1.179	1.022	0.002
Deviation	Active Index	0.050	0.021	0.010	0.010	0.261	0.132	0.039
Mean	Free Portfolio	0.186	0.155	-0.044	-0.050	1.200	0.899	0.009
Median	Free Portfolio	0.193	0.163	-0.046	-0.052	1.211	0.985	0.006
Deviation	Free Portfolio	0.058	0.035	0.013	0.014	0.324	0.248	0.047
Mean	Other Shares	0.177	0.166	-0.048	-0.056	1.062	0.992	-0.011
Median	Other Shares	0.173	0.164	-0.047	-0.054	1.153	1.004	-0.003
Deviation	Other Shares	0.046	0.026	0.010	0.010	0.261	0.162	0.036
IBRX	Index	0.209	0.171	-0.050	-0.055	1.205	1.063	0.009

Notes. Ret.= monthly average return; Vol.= monthly volatility; VaR= value at risk at 5% (day); CVaR = value at conditional risk at 5% (day); IS= Monthly Sharpe Index, with correction of Israelsen (2005); α (4F) = alpha of the 4-factor model (monthly); Deviation = standard deviation.
Source: Elaborated by the authors from the data of the research.

In the recovery period this relationship changes and all classes begin to present a return and volatility lower than the market index. A specific study about the portfolio of these funds may clarify this point, but the data seem to indicate that there was some market *timing* power by

Brazilian managers in relation to the market. Analyzing the market beta of the funds as a whole, we can see that it was numerically smaller during *the crash* period than during the pre-crisis period, but it was higher during the recovery period than during the previous periods.

That is, the managers seem to have had the ability to direct their portfolios toward more conservative assets during the period of greatest turmoil and then expose the portfolio to assets with a slightly larger beta (but still less risky than the market) to take advantage of the recovery of the stock market. This would be in line with Khelifa and Arsi (2022), in which European Islamic fund managers had market timing capability during the period of the health crisis, even though the Asian and American peers did not have such a power. Entering the analysis of fund flows, it can be observed, in Figure 2, that the net fund flows fell in a dizzying way during and after *the crash* period, but reaches negative ground (Redemption > Inflow) in just two weeks, already at the end of the series. This may indicate that investors are more financially aware and that they understand that investments in the stock market are subject to fluctuations – sometimes aggressively. In this sense, there was no significant loss of resources as documented by Falato et al. (2021).

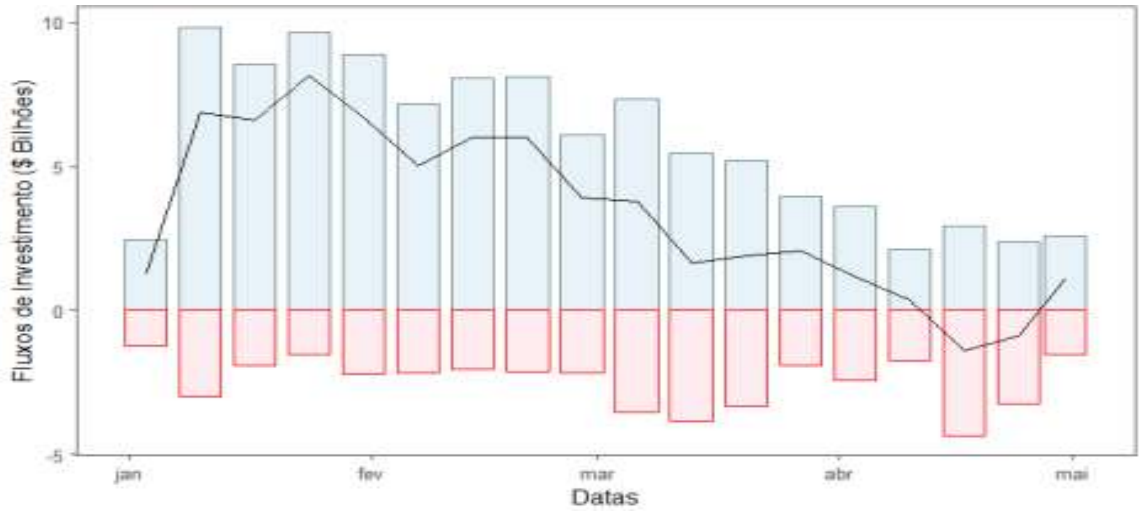

Figure 2. Fund Flows (Jan. 2020 to Apr. 2020)
Note. In blue we have the accumulated inflows in a given week; in red the redemptions; and the black line refers to net fund flows.
Source: Elaborated by the authors from the data of the research.

In addition to Figure 2, it can be seen that in the pre-crisis period there was a very strong net fund flows, while, in *the crash* period and in the recovery period, the net fund flows fell a lot, becoming more centered around zero than before. Only in some specific classes there is a weighted average redemption higher than the weighted average inflows.

4.2 Econometric Analyzes

Table 3 shows the regression results estimated for Equation 8. Some non-significant parameters were omitted from the table for space reasons. Analyzing this table, it can be seen that in *the crash* period, exposure to the market factor decreased substantially for all fund classes, while increasing exposure to the size factor is observed. However, what most draws attention in this period is the very significant reduction in exposure to the moment factor. In this case, the beta in relation to this factor was 0.16 in the pre-crisis period to -0.13 in the *crash* period. In addition, the *dummy* for *crash* was significant and negative in all regressions, showing that on average the funds had a destruction of their portfolios value during the period of greater turbulence, in line with the literature (Pástor & Vorsatz, 2020; Zhang et al., 2020).

Analyzing the recovery, we noticed that most of the parameters related to this period are not significant, indicating that after a structural break in *the crash* period, the parameters returned to behave in the way they behaved in the pre-crisis period.

Table 3
Regression of Daily Returns

	Dependent Variables			
	Return of Funds			
	All	Active Index	Free portfolio	Others
	(1)	(2)	(3)	(4)
Market	0.849***	0.994***	0.823***	0.927***
	(0.003)	(0.007)	(0.004)	(0.025)
Size	0.128***	0.049***	0.141***	0.131***
	(0.005)	(0.010)	(0.005)	(0.039)
Value	-0.026***	-0.004	-0.030***	-0.053
	(0.007)	(0.014)	(0.008)	(0.058)
Moment	0.156***	0.102***	0.166***	0.152***
	(0.005)	(0.010)	(0.005)	(0.038)
Dummy Crash * Market	-0.043***	-0.130***	-0.027***	-0.091***
	(0.003)	(0.007)	(0.004)	(0.027)
Dummy Crash * Size	0.220***	0.317***	0.203***	0.235***
	(0.006)	(0.013)	(0.007)	(0.047)
Dummy Crash * Value	-0.092***	-0.135***	-0.084***	-0.109
	(0.008)	(0.017)	(0.009)	(0.067)
Dummy Crash * Momentum	-0.284***	-0.302***	-0.281***	-0.305***
	(0.007)	(0.014)	(0.007)	(0.051)
Dummy Recovery * Market	0.014***	-0.015*	0.020***	0.018
	(0.004)	(0.008)	(0.004)	(0.028)
Dummy Recovery * Momentum	-0.016**	-0.019	-0.016**	-0.020
	(0.006)	(0.013)	(0.007)	(0.049)
Dummy Crash	-0.001***	-0.001***	-0.001***	-0.001
	(0.0001)	(0.0002)	(0.0001)	(0.001)
Intercept	0.0003***	0.00002	0.0004***	0.0002
	(0.00003)	(0.0001)	(0.00003)	(0.0003)

Observations	199.530	28.568	168.339	2.623
Adjusted R²	0.875	0.924	0.866	0.920
F Statistic	99,338.180***	24,732.120***	77,715***	2,145***

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

Additionally, by the regression results presented in Equation 9, shown in Table 4, it can be seen that the independent variables, pre-crisis redemption, pre-crisis inflows, *dummy* that indicates whether the fund is open, pre-crisis alpha, and beta in the pre-crisis period were statistically significant variables for explanation of alpha (%) in this *crash* period. Regarding the risk of the CVaR fund (%) it is observed that the performance rate charge, the age of the fund, the pre-crisis alpha and the pre-crisis beta were statistically significant variables in explaining the risk difference of the funds. The fund size (net assets logarithm) was significant only in the alpha equation. The inflows and redemptions may have been used efficiently to reshape portfolios for assets that contributed to the best performance.

Table 4
Regression Performance Measures

	Alpha	IS	CVaR
	Alpha Crash	IS Crash	CVaR Crash
	(1)	(2)	(3)
Management Fee	-0.001	0.00001	0.001
	(0.001)	(0.0005)	(0.003)
Dummy Perf. Fee	0.015	-0.005	0.284***
	(0.014)	(0.012)	(0.075)
Redemption Pre-Crisis	0.076***	-0.001	0.129
	(0.023)	(0.019)	(0.123)
Inflows Pre-Crisis	0.039**	0.019	0.047
	(0.016)	(0.013)	(0.082)
Dummy Open	0.191***	0.009	0.239
	(0.060)	(0.050)	(0.316)
Dummy Exclusive	0.024	0.001	0.048
	(0.016)	(0.014)	(0.086)
Time Life	0.002	0.0003	0.018**
	(0.001)	(0.001)	(0.007)
Alpha Pre-Crisis	3.273***	1.206***	17.953***
	(0.488)	(0.403)	(2.559)
Beta Pre-Crisis	-0.326***	-0.244***	3.589***
	(0.027)	(0.022)	(0.140)
log NA	0.016***	0.006	0.025
	(0.005)	(0.004)	(0.024)
Constant	-0.312***	-1.466***	6.983***
	(0.107)	(0.088)	(0.560)
Observations	1,289	1,289	1,289
R²	0.190	0.115	0.352
Adjusted R²	0.184	0.108	0.347

Residual Std, Error	0.251	0.207	1.316
F Statistic	29.970***	16.572***	69.476***

*p<0.1; **p<0.05; ***p<0.01; Perf. Fee= performance fee; log NA = net assets logarithm.
Source: Elaborated by the authors.

5 CONCLUSION

This article analyzed the performance of Brazilian stock investment funds during the Covid-19 crisis. For this purpose, daily fund data were used during the period from 09/02/2019 to 04/30/2020. The main results showed that during *the crash* period (02/19/2020 to 03/23/2020) all categories of funds obtained more than 50% of funds with a return higher than IBRX100, with similar results when using the Ibovespa index. However, in the recovery period (03/24/2020 to 04/30/2020) the percentage of funds exceeding the index decreases significantly, however the free portfolio category presented a higher percentage of funds exceeding the index (34.3%).

When the focus is changed to the mean return of the industry under the prism of multifactorial models, it is possible to affirm that the funds generated abnormal returns in the pre-crisis period, given the statistical significance of the intercept in Table 3. But considering the risk-adjusted performance in *the crash* period, there was a destruction of the value of the funds' portfolios. This last observation is in line with previous evidence for North-American funds (Pástor & Vorsatz, 2020).

In addition, it was sought to understand the variables that were capable of explaining the differences in alpha, Sharpe Index and CVaR among the funds in *the crash* period. A positive relationship was found among the inflows, redemptions and alpha of the fund in the pre-crisis period and the alpha generated in *the crash* period, and it was also observed that the performance rate charge, the age of the fund, the Alpha and Beta of the pre-crisis fund impacted the risk of loss (CVaR) of the fund. These results indicate that the funds that charge performance rates and newer generated higher risk, while the riskiest funds in the pre-crisis period (higher beta coefficient) generated worse performance.

In addition, when examining the fund flows, it can be seen that there was no "run on the fund" phenomenon to redeem the shares. Actually, in the analyzed period, the inflows surpassed the redemptions. This may indicate that the fund investors are financially more educated and that he or she acted with more caution when waiting for a less turbulent moment to re-evaluate his or her portfolio, it may also reflect a lack of alternatives, since the Central Bank continued to reduce the basic interest rate during this same period.

Regarding the contributions of the present study, the main thing is to highlight how the performance of Brazilian stock investment funds was during a period of great turbulence as the initial period of the Covid-19 pandemic. This is important, given that during an investor's financial planning, it is necessary that he or she understands (or approaches) what the future distribution of returns from different asset classes in different scenarios so that he or she is able to build a balanced and efficient portfolio. This point is of particular relevance when dealing with crises, since the marginal utility of consumption tends to increase and, with this, the importance of minimizing losses. Finally, it is worth emphasizing that the results found are not free of limitations since they may have been influenced by the period and sample studied and that there is still wide space for research related with the theme. An opportunity for the interested researchers is to analyze how the funds' portfolios evolved during this turmoil period. Another interesting point would be to analyze the turnover level (trading volume) of the funds' portfolio during the period of greater turbulence and the relationship of this with the performance generated (Silva et al., 2020). Were the managers capable to anticipating the recovery? Moreover, the long-term impacts of this crisis on capital markets can also be analyzed.

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