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Disposition Effect: Brazilian Investors' Behavior during the Covid-19 Pandemic

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ABSTRACT

This study investigates the disposition effect with regard to Brazilian investors, with focus on the year 2020. The database is composed by more than 12,000 trades by 274 investors. We follow the method of Odean (1998) to estimate the proportions of gains and losses realized and test the null hypothesis of equality of these proportions in each portfolio. The results suggest that Brazilian investors behave in line with the disposition effect. They sell winning stocks too early and hold losing stocks too long. A stock that is gaining value is more likely to be sold from day to day compared to a stock that is losing value. The disposition effect was not found in March, which suggests that investors employed a loss-limit during periods of market stress, no matter if the stock went up or down.

KEYWORDS:

Prospect Theory, Disposition Effect, Behavioral Finance, Loss Aversion

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1. INTRODUCTION

Against a backdrop of increasing supply of financial services and financial deepening, the diffusion of information and the search for knowledge about investing and finance in general are increasing, so understanding the behavior of investors is fundamental, not only to help investors themselves, but also to guide other market agents in the regulatory, commercial, resource allocation, and educational areas.

The expected utility theory and efficient market hypothesis are the basis of this understanding. The theoretical framework and majority of economic studies in the twentieth century were constructed based on the premises that investors are rational and utilize probabilities and preferences to make decisions (Shefrin, 2010).

In recent years, the volume of literature evaluating whether individuals behave according to rational premises has grown. Kahneman and Tversky (1979) proposed a way to evaluate how individuals make decisions in conditions of risk and uncertainty. Shefrin and Statman (1985) utilized those authors' theory to propose the disposition effect, which, according to them, is a reflex of questions such as mental accounting, fear of regret and self-control. The disposition effect posits that investors tend to sell stocks that have risen in value faster than they sell stocks that have lost value.

Our objective here is to identify if retail investors in Brazil acted according to the disposition effect in 2020, a year marked by the coronavirus pandemic. We investigate evidence of this anomaly in the Brazilian market by relying on a novel database obtained from a securities brokerage firm, identifying the trading behavior of a specific group of investors who received professional advice, composed of approximately 20 thousand daily trades between 2014 and 2020. It is important to note that more than 60% of these transactions, both buy and sell, occurred in 2020, probably triggered by the increased uncertainties in the financial market, permitting a complete and robust analysis of the effect in that year. Therefore, in contrast to other works examining the Brazilian market, which have used data from the B3 exchange or investment funds, our data pertain to individual investors trading through a brokerage firm with access to financial advice from certified professionals.

Many ensuing studies have sought to identify different anomalies that influence investment decisions, the factors causing such anomalies and the results obtained, by relying on behavioral aspects that are at odds with what would be expected based on rationality. Among the many dissonances proposed, the disposition effect is one of the most robust behavioral factors documented in studies of investment transactions (Kaustia, 2010). According to that author, the importance of the theme is so great that the systematic verification of the presence of the disposition effect on investors' behavior can lead to a gap between the market prices and fundamental values of assets.

We can identify three main currents of research involving the disposition effect. The first current refers to empirical studies to identify the significance and robustness of the effect in different markets (Odean, 1998; Brown et al., 2006; Chen et al., 2007) and for different asset classes (Genesove & Mayer, 2001; Kaustia, 2004; Choe & Eom, 2009). The second current involves experiments in controlled settings to identify behaviors compatible with the disposition effect in different scenarios (Weber & Camerer, 1998). The third current consists of studies aiming to identify the factors that contribute to explaining this type of effect (Korniotis & Kumar, 2011; Costa et al., 2013). This article contributes to the empirical literature and to the identification of these factors.

The disposition effect, besides running contrary to the idea of “cut your losses and let your profits run!”, is relatively inefficient in fiscal terms (Kaustia, 2010). Investors should sell their losing positions in detriment to winning positions so as to offset future profits realized, or at least achieve a balance between losses and gains with the objective of minimizing the tax burden. The failure to behave rationally, according to the author, represents the transfer of wealth from the investor to society.

In Brazil, works such as those by Karsten (2006) and Prates et al. (2019), using both an ample database and considering different types of investors, are references in the investigation of the disposition effect on the behavior of Brazilian investors. The results of these studies suggest that individual (retail) investors have a strong propensity to act according to the disposition effect, while institutional investors have opposite behaviors.

With regard to the period studied, the COVID-19 pandemic not only had a huge impact on public health but also on the global economy due to the limitations imposed on economic activities, while the financial markets reacted to the environment of uncertainty. In this context, in February and March 2020, the Ibovespa suffered a loss of 35.81%, twice the decline of the S&P 500 in the same period. In March 2020 alone, the circuit breaker was activated on the 9th, 11th, 12th (twice), 16th and 18th, where the second time on the 12th happened after a decline of over 15%. These movements call attention to the importance of studies to identify investors' behavior at moments of greater vulnerability of asset prices. Dacey and Zielonka (2013) demonstrated that, in cases of steep market decline at moments of high volatility, investors tend to act contrary to what would be expected according to the disposition effect. Afi (2017) confirmed this result by identifying the absence of the disposition effect at moments of stress or high volatility of the NYSE and Nasdaq. Here we evaluate the reaction of Brazilian stock market investors at moments of greater volatility or uncertainty in the financial market through a month-by-month analysis of an important period of uncertainty.

Like the other works mentioned, we found a strong propensity for the disposition effect among Brazilian investors. The results suggest that Brazilian investors tend to have this behavioral anomaly, selling their winning stocks faster and holding their losing stocks for more time. The results hold for the other years covered by the database. In particular, we identified two moments when the disposition effect did not hold sway: in December 2019, due to the year-end adjustment of portfolios, and in March 2020, affected by the announcement that the COVID-19 outbreak had been classified as a pandemic by the WHO. This result suggests that, in these periods, investors sought to dispose of their positions regardless of profit or loss.

2. THEORETICAL FRAMEWORK

The efficient market hypothesis indicates that the prices of assets and their respective market levels reflect all available information, due to the expected utility theory and rational expectations theory (Fama, 1970). Hence, the hypothesis states that agents make purely rational decisions, based on logic, and that individuals seek to maximize their utility by attributing probabilities to future events, given the need to make decisions under uncertainty. Therefore, since agents act rationally, the prices of assets reflect their intrinsic value.

The distortions found in various decision processes that did not jibe with the logic described above, even before the formulation of the efficient market hypothesis, triggered a series of studies that gave rise to the field of behavioral finance. Allais (1953) demonstrated the inconsistencies of the choices of individuals in comparison with what was expected according to the expected utility theory. Kahneman and Tversky (1979) described the certainty effect as denoting the preference of individuals for a certain result in detriment to the choice of probable alternatives, given the difficulty of understanding notions of probability and expected value.

Earlier, Kahneman and Tversky (1974) stated that individuals' processes of evaluation and decision rely on rules derived from common sense and heuristic processes that reduce complex tasks of evaluating scenarios and probabilities to simpler judgments, causing systematic errors.

Traditional financial theory is based on the idea that individuals are averse to risk, while, in behavioral finance, aversion to loss is more relevant, given individuals' feeling that losses generate an emotional impact twice as strong as that of a gain of the same magnitude (Camerer, 2008). This distinction is of fundamental importance, since, as demonstrated by Kahneman and Tversky (1979), individuals are risk averse when their investments are in the black and exhibit risk propensity when their investments are in the red.

2.1. DISPOSITION EFFECT

Shefrin and Statman (1985) brought the first formal analysis of the disposition effect. They used the database from the study of Schlarbaum et al. (1978), who had evaluated the transactions carried out in the American stock market considering only transactions initiated and closed, to verify the presence of a positive result where investors' gains exceeded that of the market in general by at least 5 percentage points. Shefrin and Statman (1985) questioned the result, indicating that investors tended to sell their winning stocks and hold their losing ones. Their work provided a formal foundation for studies of the disposition effect.

Shefrin and Statman (1985) found that questions such as fear of regret and satisfaction of winning, i.e., realization of profits, cause individuals to have propensity to realize gains faster and to hold their losing assets longer, so as not to suffer the loss.

Individuals' self-control is also a relevant factor. Shefrin (2010) explained that people feel they are in a situation of conflict when they think of making a rational decision, because they perceive the decision emotionally. Professional investors tend to be more rigid in their decision process, using mechanisms such as stop-loss triggers to avoid this conflict (Shefrin & Statman, 1985).

Another anomaly found in individuals' behavior that generates an impact on their decision processes is status quo bias. According to Kahneman et al. (1991), this bias is an implication of the concept of loss aversion, whereby individuals prefer to maintain their current positions, since the drawbacks of change seem to outweigh the advantages.

Lakonishok and Smidt (1986) compared the turnover between stocks that had increased in value versus those that had lost value in relation to reference prices, identifying greater turnover and trading volume of those showing gains. Odean (1998) evaluated data from 10 thousand retail investor accounts of a discount brokerage firm in the American market and proposed a method to measure the disposition effect, which we use here, in which portfolios are constructed for each account. After the integral sale of a stock, the transaction is classified as a gain or loss realized and the other assets kept in the portfolio are classified as gains or losses not realized, based on the average purchase price of each stock.

Studies published in the footsteps of Odean (1998) sought to evaluate the presence of the disposition effect in different types of investors regarding level of sophistication, the form of acting (whether via professional brokers or individually) and also different markets, both regarding their nature and location.

Shapira and Venezia (2001), studying Israel, found the presence of the disposition effect both in investors with and without professional guidance, with a weaker effect in the former group.

Dhar and Zhu (2006) identified differences in the disposition effect among investors with distinct characteristics. The authors use demographic and socioeconomic variables as proxies of the degree of knowledge of investors, and found that those with greater net worth and those acting professionally were subject to a smaller disposition effect.

Ivkovic and Weisbenner (2009) studied the presence of the disposition effect in investors who act through mutual funds. The authors identified that individuals tend to maintain investments via funds with better performance and redeem their investments in funds with weaker or negative performance, which might be affected by tax issues. However, the authors demonstrated that investors make decisions to invest through mutual funds after evaluating them in relation to benchmarks or based on specific objectives, such as absolute return targets, and choose those with better performance according to the desired parameters. They also found that redemption decisions were motivated by negative absolute results, notwithstanding the comparison with benchmarks.

Kaustia (2004) investigated the behavior of investors based on volume traded after conclusion of an initial public offering (IPO). In an IPO, all initial investors purchase the shares at the same price, but the volume is related to their propensity to sell their positions with a profit or a loss. The author identified that shares that begin trading above the offer price had higher trading volume than those that began trading below the offer price.

2.2. STUDIES OF THE BRAZILIAN MARKET

In Brazil, studies can be divided among those based on data from the B3 exchange, experimental works, and studies based on trading data of investment funds. The results suggest that individual investors are strongly influenced by the disposition effect while institutional investors are less susceptible to this effect. Our database is composed of retail investors of a brokerage house with support of certified professional advisors. This type of database is more aligned with the international literature on the disposition effect. Karsten (2006) tested the relevance of the disposition effect in various categories of investors, and identified its importance to describe the behavior of individual investors, while observing that professional investors had ambiguous behavior. Lucchesi (2010) evaluated the factors underpinning the decision of the portfolio managers of stock funds, identifying that the prospect theory partly explained the decisions made.

Costa et al. (2008) conducted an experiment with a group of individuals with different experiences in the stock market, another with individuals having no experience, and a third group with randomly generated decisions to serve as the control. The authors identified the disposition effect in the majority of individuals.

Klotzle et al. (2010) analyzed the portfolios of all Brazilian stock investment funds between 2003 and 2008 with the aim of identifying the existence of the disposition effect, and did not find evidence of this type of behavior in this type of investor.

More recently, Prates et al. (2019) utilized the large sample available from B3 to identify whether investors from different categories have distinct behavior regarding the disposition effect. They found evidence that retail investors have a strong propensity to behave in line with the disposition effect, while institutional investors have contrary behavior. Lopez et al. (2021) found similar results for individual and institutional investors in a sample from the period 2012 to 2014.

3. SAMPLE

Our data came from a large stock brokerage firm. The sample contained daily trading records between January 2014 and December 2020, during which there were about 20 thousand buy and sell trades, carried out by 274 investors.

The information related to each transaction consisted of the date, the stock traded, whether the trade was for purchase or sale, the code identifying the investor, and if the first transaction with the stock was carried out before 2014. We excluded from the sample transactions with derivatives of any type, shares of real estate investment funds, and shares acquired in initial public offerings (IPOs).

The price quote and transaction records were adjusted for stock splits and reverse splits, as well as considering the dividends and/or interest on equity distributed. Finally, adjustments were made for other possible events, such as spin-offs and mergers. Table 1 presents the data used in the period.

Table 1
Descriptive Statistics of Assets and Transactions

	2014 to 2020	2020
Average number of shares per investor	74	98
Median number of shares per investor	35	21
Average sale transactions per investor	66	47
Median of sale transactions per investor	14	9
Average purchase transactions per investor	94	63
Median of purchase transactions per investor	25	17
Average number of shares per sale	64.000	52.000
Average number of shares per purchase	65.000	50.000
Total of day trade transactions	1408	1086

Source: Prepared by the authors

In 2020, the median number of shares traded per investor was lower than in the total period, as well as the medians of sell and buy transactions. The average quantity of shares sold per investor surpassed the average number of shares purchased per investor in 2020, unlike in the entire period. In this respect, 77% of the day trades occurred in 2020.

3.1. DATABASES OF OTHER STUDIES

In their seminal work on the disposition effect, Shefrin and Statman (1985) worked with panel data from a sample of 2,500 accounts and their respective transactions realized between 1964 and 1970, obtained from Schlarbaum et al. (1978).

Odean (1998) employed a database of 10 thousand investors with transactions carried out from 1987 to 1993 through a single securities brokerage firm in the United States. The data included the transaction costs, total value of the transactions, and types of orders. Multiple transactions on the same day were aggregated. There were limitations regarding the counting of orders carried out through other brokerage houses, as well as in identification of the positions held before 1987.

Taylor (2000) analyzed a sample composed of 125 New Zealand investors who carried out at least one trade in 1992, exclusively via a single brokerage house. He analyzed the impact of professional advice given to these investors on the disposition effect, since the brokerage offered consulting service if investors wanted it.

Shapira and Venezia (2001) utilized a sample of 4,300 accounts of investors who carried out trades in the Tel Aviv Stock Exchange in 1994. Barber et al. (2007) analyzed a large volume of transactions carried out by investors in the Taiwan Stock Exchange. The roughly 1 billion trades evaluated between 1995 and 1999 by approximately 4 million different investors made this study one of the most comprehensive ever published.

In Brazil, Karsten et al. (2006) used a database supplied by the Bovespa (now B3) representing 12 thousand accounts of investors of different types: individuals, non-institutional legal entities, and institutional entities. The transactions included those carried out by a single investor in different brokerages between 2001 and 2004, but there were no records of trades before the study period, so any positions detained previously were disregarded.

4. METHODOLOGY

Starting from the records of the transactions on the initial date of the sample, we composed a portfolio for each individual, with indication of the date of the purchase or sale and the average price of the trade. Besides this, we verified the subsequent realization of gains or losses, or maintenance of the position. It is possible that these assets were not the only ones composing an investor's portfolio, since we disregarded purchases made before the starting date of the sample. However, it is unlikely that the portfolio selection process was biased to the point of only representing those in which investors realized more of their gain or loss transactions (Odean, 1998).

Weber and Camerer (1998) calculated the disposition coefficient according to the following equation:

$$\text{Disposition coefficient} = \frac{NGR - NLR}{NGR + NLR} \quad (1)$$

Where: NGR denotes the number of gains realized and NLR refers to the number of losses realized.

Odean (1998) applied a deeper analysis by constructing a proportion between the gains and losses realized with the quantity of winning and losing positions held in the act of the sale transaction, as indicated by the following equations:

$$PGR0 = \frac{GAINS REALIZED}{GAINS REALIZED + GAINS NOT REALIZED} \quad (2)$$

$$PLR = \frac{LOSSES REALIZED}{LOSSES REALIZED + LOSSES NOT REALIZED} \quad (3)$$

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Where: PGR is the proportion of gains realized and PLR is the proportion of losses realized. The losses and gains not realized (paper gains and losses) are the positions that, on the date of realizing a loss or gain, respectively, were maintained totally or partially by the investor.

The need to use the proportions (PGR and PLR) is due to the fact that if we only analyzed the quantities of gains and losses realized, in bull markets there would be a tendency for a greater volume of selling loss positions. Therefore, to verify the disposition of investors to sell positions with gain or loss, it is necessary to compute these transactions in proportion to the total positions in the portfolio (Odean, 1998).

With respect to the accounting of gains or losses, we also follow the method of Odean (1998). On days when no sales were realized, we do not compute the gains or losses, whether or not realized. Barber et al. (2007) also counted gains and losses not realized even when no sale transactions occurred.

To determine whether a sale led to a gain or loss, or an asset maintained in the portfolio denoted an unrealized (paper) gain or loss, it was necessary to establish the reference point. Odean (1998) used the average acquisition price as a reference for these calculations, and identified that when using other reference points, such as greater or lesser acquisition cost or more recent purchase, the results were close. Barber et al. (2007) also used the average purchase price. Since the preference of the investor is not an observable variable and differs according to the perspective of each one, we used the average acquisition price as the benchmark to ascertain the disposition effect.

According to Odean (1998), when a position is sold with a profit or loss, the other assets in the portfolio are appraised in the following form:

If both the daily maximum and minimum prices are above the average purchase price, the position is considered to be a realized gain;

If the average purchase price is between the maximum and minimum price for the day, the position is considered to be neutral; and

If both daily maximum and minimum prices are lower than the average purchase price, the position is considered to be an unrealized loss.

In calculating the results of investors, we did not consider short positions, since the dynamic differs from long positions by factors such as the need to rent shares for coverage, which increases the cost, or the risk of mandatory zeroing by the risk analysis department of the brokerage, or even the unlimited loss potential imposed by this type of transaction. Since we had no knowledge of the positions detained before 2014, sales made without identification of the respective purchase date were treated as short positions, i.e., sales after January 2014 by investors who detained a stock in their portfolio purchased before 2014 were considered to have short positions, not zeroing of an investment in an asset in custody. It is also possible for investors who had short positions before 2014 to have repurchased those positions afterward, in the sample period. In these cases, we treated the respective repurchases as new acquisitions, and classified them as unrealized gains or losses. The respective treatments described above are in line with Karsten (2006), and we do not expect these factors to be relevant, due to the low occurrence of this type of transaction and considering the focus year is 2020.

We did not consider transaction costs. Because of the limits of the sample and possibility of paying different brokerage costs based on the channel through which the investors carried out their transactions, it was impossible to estimate the trading costs. Odean (1998) indicated that the behavior of the investors in his sample did not seem to be influenced by transaction costs.

Besides verifying the disposition effect on the investors during the entire year, by analyzing the aggregate data for that period, Odean (1998) sought to identify whether investors, motivated by tax questions, tended to realize losses to offset gains obtained during the year. Although, in Brazil, it is possible to offset capital gains in normal transactions against losses accrued over the past five years, the losses from day trading can only be offset in the same year.

4.1. HYPOTHESIS TEST

To verify whether investors behave contrary to the logic of selling losing stocks and holding winning ones, i.e., the existence of the disposition effect, it is necessary to test the null hypothesis that the difference between the proportions of gains and losses is less than or equal to zero. For the test to be valid, it is necessary for investors' decisions that resulted in losses or gains, realized or not, to be independent. Therefore, we have $H_0: PGR - PLR \leq 0$.

In line with Karsten (2006), we applied the Z-test. With the null hypothesis defined above, we have:

$$Z = \frac{\bar{PGR} - \bar{PLR}}{\hat{\sigma}_{\bar{PGR} - \bar{PLR}}} \quad (4)$$

Where $\hat{\sigma}_{\bar{PGR} - \bar{PLR}}$ is:

$$\sqrt{\frac{PGR \times (1 - PGR)}{N_{GR} + N_{PG}} + \frac{PLR \times (1 - PLR)}{N_{LR} + N_{PL}}} \quad (5)$$

In turn where N_{GR} , N_{PG} , N_{LR} and N_{PL} , are, respectively, the number of realized gains, the number of unrealized gains, the number of realized losses and number of unrealized losses.

As pointed out by Odean (1998), it should be assumed that investment decisions are not made with perfect independence. For example, a decision not to sell on one day is probably not independent of the decision to sell on another day. Another possibility is that investors are motivated to sell the same stock for the same reasons on different days, such as repeatedly receiving the same information.

Odean (1998) indicated that the lack of independence is not sufficient to bias the proportions observed. Besides this, he used another test to give robustness to the findings. He assumed that independence was only verified between investors, not at transaction levels, thus performing the calculation of the proportion of gains realized as well as the differences in these proportions for each investor. Other suppositions were made in a series of tests, all of which rejected the null hypothesis with high statistical significance.

5. RESULTS

In this section, we present the results, and, besides the rejection or not of the null hypothesis, we seek to give economic intuition to the results by comparing them with those of the main previous studies of the theme.

Table 2 reports the aggregate results for the entire period and specifically for 2020, i.e., the sum of all the gains and losses, realized or not, categorizing them as applied below for the total of gains realized (N_{GR}):

$$N_{GR} = \sum_{i=1}^n N_{GRi} \quad (6)$$

The percentage of realized losses in relation to the unrealized (paper) losses rose from 17% in the entire period to 22% in 2020, while the percentage of realized gains in relation to unrealized gains declined from 24% in the whole period to 23% in 2020. This greater realization of losses is discussed below.

Table 2

Aggregate transactions

	2014 to 2020	2020
Total number of investors	274	274
Total realized gains (Ngr)	2195	1188
Total realized losses (Nlr)	1561	971
Total realized gains (Npg)	8971	5170
Total unrealized losses (Npl)	8783	4386

Source: Prepared by the authors

As described in the methodology section, based on the data indicated above it is possible to calculate the proportion of realized gains (PGR) and proportion of realized losses (PLR). The proportions for the aggregate data are reported in Table 3, along with the respective tests. The results for 2020 are presented afterward, to identify the occurrence of the effect on a monthly basis.

Table 3

PGR, PLR and Z-test– total sample period

PGR	0.197623
PLR	0.151304
PGR – PLR	0.045670
Standard error	0.005169
Z-test	8.960.271
P-value	0.00

Source: Prepared by the authors

The results in Table 3 indicate rejection, at significance of 1%, of the null hypothesis that the proportions of realized gains and realized losses are equal. Therefore, if PGR is greater than PLR and the null hypothesis is rejected, we have evidence of the disposition effect on investors' decisions, i.e., individuals' decisions run counter to the logic of realizing losses faster than realizing gains. These results are in line with those of Odean (1998), Karsten (2006) and other papers on the theme. In this respect, the statistics can have some degree of inflation due to the absence of perfect independence of the decisions, and hence of the data.

Note that the PGR/PLR ratio in the whole period was 1.31, indicating that a stock that is in the black had a 31% greater chance of being sold than another that was in the red.

Before conducting robustness tests, in Table 4 we evaluate jointly the aggregate data on transactions in December and the rest of the year. The objective of this evaluation is to indicate whether investors have greater propensity to sell losing positions in December than in the remainder of the year. For that purpose, we evaluate the differences between the proportions of realized gains and losses between January and November and in December.

Table 4
Aggregate data for December and the rest of the year

	December	Jan to Nov
Total realized gains (Ngr)	213	1,982
Total realized losses (Nlr)	147	1,414
Total realized gains (Npg)	884	8,028
Total unrealized losses (Npl)	607	8,149
PGR	0.194166	0.198002
PLR	0.194960	0.147862
PGR – PLR	-0.000794	0.050140
Standard error	0.018729	0.005389
Z-test	-0.042410	9.304.516
P-value	0.67364	0.00

Source: Prepared by the authors

As indicated in Table 4, the difference of the proportion of realized gains and proportion of realized losses in December is negative, so according to the test to verify the difference of proportions, it is not possible to reject the null hypothesis of equality of the proportions for the transactions carried out in December. Therefore, we cannot affirm the existence of the disposition effect on investors in that month.

For the other months of the year, in line with the finding for the entire period, the null hypothesis of equality between the proportions of realized gains and losses is rejected. In other words, the existence of the disposition effect on investors' decisions in the period from January to November is confirmed based on the aggregate results.

To test the robustness of the results, we partition the data into two periods: from 2014 to 2017 (inclusive) and from 2018 to 2020. Besides this, we divide the transactions between investors according to their trading frequency, separating those with the highest 10% frequency from the other 90%. The hypothesis here is that investors who trade more actively tend to have smaller portfolios, and thus their proportion of realized gains and losses is greater (Odean, 1998). Table 5 reports the aggregated data for each partitioned group.

Table 5
Data aggregated by periods and by more or less active traders

Jan – Dec	2014 - 2017	2018 – 2020	More Active	Less Active
Ngr	249	1946	1280	915
Nlr	190	1371	1004	557
Npg	386	8.526	5.151	3.761
Npl	564	8192	5265	3491
December	2014 - 2017	2018 – 2020	More Active	Less Active
Ngr	14	199	126	87
Nlr	16	131	104	43
Npg	17	867	444	440
Npl	28	579	332	275
Jan – Nov	2014 - 2017	2018 – 2020	More Active	Less Active
Ngr	235	1747	1154	828
Nlr	174	1240	900	514
Npg	369	7.659	4.707	3.321
Npl	536	7613	4933	3216

Source: Prepared by the authors

Based on the above data, we calculated the proportions of realized gains and losses and applied the tests of the respective hypotheses to verify the existence or not of the disposition effect. Table 6 compiles the calculations carried out and the respective test results.

Table 6
Difference between PGR and PLR and Z-test results

Entire year	2014 - 2017	2018 - 2020	More Active	Less Active
PGR - PLR	0.140137	0.042464	0.038883	0.058081
Standard error	0.025007	0.005224	0.0068	0.007936
Z-test	5.603.837	8.128.618	5.717.758	7.319.087
P-value	0.00	0.00	0.00	0.00
December	2014 - 2017	2018 - 2020	More Active	Less Active
PGR - PLR	0.087977	0.002172	-0.01748	0.029865
Standard error	0.115101	0.018824	0.026808	0.025085
Z-test	0.764343	0.11539	-0.65202	1.190.557
P-value	0.19766	0.44034	0.77337	0.105650
Jan – Nov	2014 - 2017	2018 - 2020	More Active	Less Active
PGR - PLR	0.144002	0.045667	0.0426002	0.061765
Standard error	0.025576	0.005448	0.007025	0.008388
Z-test	5.630.451	838.189	60.641.134	7.363.685
P-value	0.00	0.00	0.00	0.00

Source: Prepared by the authors

According to Table 6, when partitioning the analysis by windows, the null hypothesis of equality between the proportions of realized gains and realized losses is rejected, i.e., the disposition effect exists when analyzing the aggregated data within each window for the entire year. This result is in line with that of Odean (1998) and with what was found in Table 2.

According to analysis of the data for the month of December, both for the window from 2014 to 2017 (with a very small sample) and for the period from 2018 to 2020, the null hypothesis of equality between the proportions is not rejected, i.e., it cannot be stated that the disposition effect influenced investors' decisions in that month. Thus, the result implies that Brazilian investors tend to realize their losses in December in a greater proportion than realizing gains. These results are in line with Odean (1998). As stated previously, in the Brazilian market, capital losses from day trading can be offset against gains for tax purposes until year end, while losses realized in periods longer than one day can be offset for up to five years.

According to the evaluation of the groups of more and less active traders, the null hypothesis of equality between the proportions of realized gains and losses for the period from January to November is rejected, both for more active investors (top 10% in number of transactions) and for the other 90%. Hence, this confirms the existence of the disposition effect on the decisions of these groups, within these windows. For December, as is the case of all the aggregated data, the null hypothesis of equality between the proportions of realized gains and losses is not rejected.

The change in the behavior of investors in December can possibly be attributed to the window dressing practice, mainly found among investment fund managers, which in the window nearest the disclosure of the performance of their portfolios alter their positions so as to maintain those whose historical performance has been most advantageous since acquisition. Marques et al. (2019) identified the window dressing practice of investment funds managed by small financial institutions and those that had underperformed the Bovespa Index. Even though this study involves individual investors, we believe that the investment advisers associated with the brokerage house might have influenced this behavior.

It is interesting to note that in the entire period, the sample of more active investors had a lower PGR/PLR ratio than less active investors. This can indicate that those who engaged in more transactions tended to rely on previously defined strategies, such as the stop loss tool indicated by Shefrin and Statman (1985). However, it is reasonable to expect that the access to more specialized information of brokerages would reduce the difference between the ratios of these two groups of investors.

With the goal of evaluating the performance of investors at moments of strong volatility and uncertainty, we studied the behavior in 2020, marked by the Coronavirus pandemic. As in the other comparisons, we applied hypothesis tests to evaluate whether or not the proportions of realized gains (PGR) were equal to the proportions of realized losses (PLR).

Table 7
Data for March 2020 and other months

	March	Other months
Total realized gains (Ngr)	84	1104
Total realized losses (Nlr)	181	790
Total realized gains (Npg)	274	4896
Total unrealized losses (Npl)	594	3792
PGR	0.234637	0.184000
PLR	0.233548	0.172414
PGR – PLR	0.001088	0.011586
Standard error	0.027067	0.007494
Z-test	0.040215	1.545.998
P-value	0.48405	0.06178

Source: Prepared by the authors

The results in Table 7 show the absence of a disposition effect in March 2020, when the World Health Organization (WHO) officially declared the outbreak of Covid-19 to be a pandemic (March 11th). The result suggests that, in moments of uncertainty, investors seek to limit possible losses regardless of whether the position is above or under water. The effect was repeated in the other months (except in December, as indicated previously): a stock in the black had a 6.7% greater chance of being sold than one in the red.

6. CONCLUSION

The objective of this study was to identify whether retail investors were subject to the disposition effect in their decisions in the Brazilian market during 2020. The behavioral anomaly is contrary to the logic of holding stocks with gains longer and selling those with losses faster.

The examination of the disposition effect is important to help investors and other market agents to improve their decisions, the regulatory framework, commercial processes, services rendered to investors, allocation of resources, and education about finance.

To validate the hypothesis of the existence of the disposition effect, we used a sample of 274 investors who engaged in over 20 thousand transactions between 2014 and 2020 through a securities brokerage firm, with most of the data pertaining to 2020. The data were arranged in chronological order, containing each investor's identification number, date of each transaction, type of order (buy or sell), stock traded, quantity transacted and price.

The results suggest the presence of the disposition effect on the decisions of this class of investors, for whom the probability was greater of selling winning positions in comparison with losing positions. It was not possible to support the existence of the disposition effect in the transactions carried out in December. This behavior can be attributed, among many possibilities, to the practice of window dressing, identified among investment fund managers who alter their portfolios at the end of the year so as to maximize their winning positions. Because this study covers retail investors, future studies are needed to determine the possible influence of investment advisers on this type of behavior. Future works can also evaluate whether this predisposition only affects day trading or longer term investments, since in Brazil the losses from day trading can only be offset against gains for tax purposes in the same year, while for longer terms, the compensation can occur in up to five years.

We found a change in investors' behavior in March 2020, with failure to identify the disposition effect. This result suggests that at moments of greater volatility and/or uncertainty, investors try to limit possible losses irrespective of realizing a profit or loss.

We performed tests of other years to ascertain the robustness of the results found. In this case, we performed the same tests for investors in two groups – more versus less active traders – as well as with distinct windows. The results corroborate the existence of the disposition effect among Brazilian investors.

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AUTHOR'S CONTRIBUTION

PLAB: conception of the article; formatting and analysis of data; application of the method; development and writing of the article. **CHSB:** conception of the article; conduction of the investigation; adjustment of the method; supervision, validation, writing and editing of the article. **ECS:** management of the project; supervision, validation and editing of the article.

CONFLICTS OF INTEREST

None to report.

