

Disposition effect, demographics and risk taking

Disposition effect

Mariana Oreng, Claudia Emiko Yoshinaga and William Eid Junior
Fundação Getulio Vargas, Escola de Administração de Empresas de São Paulo, São Paulo, Brazil

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Abstract

Purpose – This study aims to investigate the association of demographic characteristics, market conditions and risk taking with the disposition effect using data on Brazilian individual investors.

Design/methodology/approach – This study uses a unique data set with monthly data from June 2007 to February 2017 provided by one of the largest asset management firms in Brazil. This paper computes the proportion of gains realized and the proportion of losses realized to see if investors incur the disposition effect. This paper then performs logistic regressions to verify the association between investors' disposition effects and demographic and portfolio characteristics. This paper analyses the prevalence of cognitive biases depending on market conditions (bull or bear markets) and include regressions by asset class as robustness checks.

Findings – This paper finds evidence that risk averse investors are more prone to the disposition effect, male subjects are less prone to this cognitive bias and age is not associated with the disposition effect. This paper observes that the tendency to incur the disposition effect decreases during bull markets but increases during bear markets. Also, this paper finds that sophisticated investors are more prone to selling winning assets and holding on to losses.

Research limitations/implications – First, paper gains and losses are based on the highest and lowest prices of the month and not on the price at the moment the sale occurred. Second, this paper had access only to end-of-month information, not to actual daily trading records. Third, because the data set relates to individual investors who trade investment funds, this paper cannot determine whether firm size is associated with the disposition effect. Fourth, age may not necessarily be a proxy for investor experience, so one should interpret the lack of significance for age in terms of generational differences.

Practical implications – This paper demonstrates that the disposition effect is prevalent even among wealthier and more educated investors with delegated asset classes. This paper also presents evidence on the association between demographic characteristics and cognitive biases considering a liquidity-constrained, highly volatile and developing market.

Social implications – This paper demonstrates that gender is an important characteristic to understand cognitive biases and that investor sophistication may not necessarily be an attenuation factor for the disposition effect in a liquidity-constrained market.

Originality/value – This is the first study to analyse the role of demographic characteristics and risk taking to explain the disposition effect using real information at the individual level about Brazilian investors. It is also the first to analyse the intensity of cognitive biases during bull and bear markets in the Brazilian economy.

Keywords Individual investors, Disposition effect, Investor behaviour, Behavioural finance

Paper type Research paper

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1. Introduction

The disposition effect is a cognitive bias that manifests when individual investors sell more winning assets from their portfolios than underperforming ones (Shefrin & Statman, 1985), and it occurs because investors are reluctant to accept that the assets they once regarded as best picks are actually underperforming. Some empirical studies on the topic base their conclusions on real data (Odean, 1998; Rangelova, 2001; Dhar & Zhu, 2006; Karsten, 2006; Brown, Chappel, Rosa, & Walter, 2007; Calvet, Campbell, & Sodini, 2009; Leal, Armada, & Duque, 2010; Talpsepp, 2010; Tizziani, Klotzle, Ness, & Motta, 2010; Lucchesi, Yoshinaga, & Castro Junior, 2015; Frino, Lepone, & Wright, 2015; Bashall, Willows, & West, 2018; Leal, Loureiro, & Armada, 2018), while others rely on laboratory results (Weber & Camerer, 1998; da Costa, Mineto, & da Silva, 2008; Lee, 2008; da Costa, Goulart, Cupertino, Macedo, & da Silva, 2013; Aspara & Hoffmann, 2015; Dorow, da Costa, Takase, Prates, & da Silva, 2018).

This study is based on a unique data set that consists of month-end individual portfolios of an asset management firm in Brazil from June 2007 to February 2017. The investors' portfolios are largely concentrated in multi-market funds and real estate funds. This data set allows us to understand the behaviour of Brazilian households that invest in investment funds and present evidence that is still scarce in the Brazilian literature. Except for Prates, da Costa, and Santos (2019), most academic studies on the disposition effect on Brazilian investors rely on information pertaining to mutual funds and professional investors, and the studies that analyse individuals often rely on laboratory experiments. We demonstrate how the demographic characteristics of individuals are associated with the disposition effect considering different asset classes, and we observe investor behaviour during bull and bear markets. Although evidence on the topic suggests that investors with delegated asset classes exhibit a reverse disposition effect (Shapira & Venezia, 2001; Lehenkari, 2011; Chang, Solomon, & Westerfield, 2016), our results demonstrate that this behavioural bias exists even for portfolios concentrated in real estate funds. It is important to emphasize the descriptive nature of this study and its relevance to understanding the behaviour of individuals who invest in delegated asset classes considering a liquidity constrained, highly volatile and developing market. We demonstrate that this cognitive bias is prevalent even among wealthier and more educated investors. This study also offers some evidence on the determinants of the disposition effect, and these findings are consistent with recent studies on the topic (Prates, da Costa, & Santos, 2019).

Brazilian investors are increasingly willing to invest in real estate investment funds, and on average, the number of individual investors in this asset class increased 45% per year from 2009 to 2016 (Figure 1). Although our sample consists of individual investors from a single asset management firm, it provides a more accurate representation of the Brazilian average retail investor considering that the number of individual accounts in investment funds is 20 times higher than the number of individual accounts in the Brazilian Stock Exchange (Figure 2). In this sense, the study also offers explanations about the behaviour of individuals once they are confronted with losses in their portfolios.

In sum, our results demonstrate that risk-averse individuals who invest in investment funds and investors who trade more frequently are more prone to selling winning assets and to hold on to underperforming ones. Moreover, we find evidence that male investors are less prone to the disposition effect except for those who invest in multi-market funds. In almost all of the specifications, age is not associated with this cognitive bias except for older investors that trade multi-market funds; however, this finding is inconsistent with that of Menkhoff, Schmeling, and Schmidt (2013). We also observe that the tendency to incur the disposition effect decreases in bull markets but increases during bear markets. These findings are in accordance with Rangelova (2001) and Cheng, Lee, and Lin (2013), who

argues that when confronted with losses, individuals tend to become less risk-averse in an attempt to break even and are more likely to incur behavioural biases. To our knowledge, this study is the first to analyse cognitive biases during bull and bear markets in the Brazilian economy.

2. Literature review

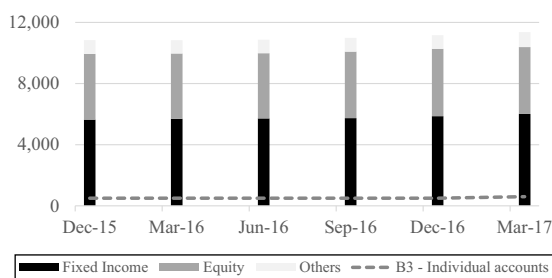
Shefrin and Statman (1985) coined the expression “disposition effect” and Odean (1998) conducted one of the first studies to measure this cognitive bias, which occurs when individual investors sell more winning assets than losing ones. According to behavioural finance, investors act in such a way because they are reluctant to accept that they made mistakes when choosing assets for their portfolios, and they hope that if one of their assets is underperforming, then it will outperform in the future. On the other hand, because a winning asset is a validation that portfolio choices are correct, selling it is less painful. Although investors can also sell assets to rebalance or change transaction costs, this phenomenon is linked to the prospect theory value function proposed by Kahneman and Tversky (1979), who argued that individuals are more averse to losses than they are pleased by gains. This value function is concave for gains and convex for losses.

Authors have analysed the reasons why the disposition effect is prevalent among individual investors in various jurisdictions. Others have explored demographic factors, financial preferences and beliefs associated with such a phenomenon. While some rely on



Source: B3

Figure 1.
Number of investors
in real estate
investment funds (in
thousands)



Source: Anbima and B3

Figure 2.
Retail investors in the
Brazilian economy:
investment funds vs
stock exchange (in
thousands)

real data (Odean, 1998; Rangelova, 2001; Dhar & Zhu, 2006; Karsten, 2006; Brown, Chappel, Rosa, & Walter, 2007; Calvet, Campbell, & Sodini, 2009; Leal, Armada, & Duque, 2010; Talpsepp, 2010; Tizziani et al., 2010; Lucchesi, Yoshinaga, & Castro Junior, 2015; Frino, Lepone, & Wright, 2015; Bashall, Willows, & West, 2018; Leal, Loureiro, & Armada, 2018), others use laboratory experiments and simulations (Weber & Camerer, 1998; da Costa, Mineto, & da Silva, 2008; Lee, 2008; da Costa, Goulart, Cupertino, Macedo, & da Silva, 2013; Aspara & Hoffmann, 2015; Dorow, da Costa, Takase, Prates, & da Silva, 2018).

2.1 Risk aversion, beliefs and preferences

Using the trading records for 10,000 accounts at a large US discount brokerage house from 1987 through 1993, Odean (1998) presents evidence that “investors demonstrate a strong preference for realizing winners rather than losers” and demonstrates that taxation, portfolio rebalancing or transaction costs do not explain such a behaviour. Lakonishok and Smidt (1986) argue that this bias can occur because investors may not hold the market portfolio or may expect that some favourable information is yet to be incorporated into the price.

Karsten (2006) analyses the trading records of Brazilian individual and institutional investors from 2001 to 2004, and consistent with Odean (1998), he demonstrates that individual investors behave according to the disposition effect but obtains mixed results for institutional investors. He also shows that tax purposes, rebalancing, dividend distribution and liquidity do not increase the susceptibility to this behavioural bias.

Rangelova (2001) argues that the disposition effect occurs as a result of individual beliefs rather than preferences. When confronted with a loss in a certain stock, individuals tend to become less risk averse in an attempt to break even. The author analyses the daily trading records of 78,000 clients over a six-year period and document that the disposition effect is concentrated primarily in large-cap stocks and that stocks in the bottom tier of market capitalization exhibit a reverse effect. In accordance, Ben-David and Hirshleifer (2012) argue that trading based on belief revisions can potentially explain the findings on the disposition effect.

2.2 Demographic characteristics

Dhar and Zhu (2006) study the relationship between demographic characteristics and the disposition effect using the trading records of more than 50,000 individual investors between 1991 and 1996 and report that wealthier individuals and individuals employed in professional occupations exhibit a lower disposition effect and that trading frequency tends to reduce this cognitive bias. Consistent with this result, Brown et al. (2007) use daily data from the Australian Stock Exchange and find that traders with larger investments tend to be less affected by the disposition effect.

Calvet, Campbell, and Sodini (2009) also study the relationship between investor characteristics and this cognitive bias, and their results demonstrate that individuals with more education are less prone to such a bias. In accordance, da Costa, Macedo, Zindel, and Arruda (2007) and da Costa et al. (2013) perform simulations on Brazilian data to analyse whether investing experience can dampen the disposition effect and demonstrate that experienced investors are less affected by this cognitive bias. Using real data on more than 60 million transactions from January 2012 to October 2014, Prates, da Costa, and Santos (2019) present similar evidence. Seasholes and Feng (2005) also demonstrate that investor sophistication and trading experience eliminate the reluctance to realize losses. Frino, Lepone, and Wright (2015) examine the relationship between ethnic background and trading behaviour and demonstrate that the disposition effect is more prevalent in investors of

Chinese background, as well as in women and older investors. Using data from a Portuguese brokerage house, [Leal, Loureiro, and Armada \(2018\)](#) demonstrate that individual investors prefer to hold and increase their exposure to losing stocks, and this behaviour is stronger for less sophisticated investors.

Regarding gender and risk aversion, some authors argue that women are more risk averse ([Byrnes, Miller, & Schafer, 1999](#)) while others argue that risk aversion in female investors is framing dependent ([Schubert, Gysler, Brown, & Brachinger, 2000](#)). [Barber and Odean \(2001\)](#) present a series of empirical papers about the role of gender in behavioural finance based on the theory of overconfidence, which postulates that men are more overconfident than women, trade more excessively and yield reduced net returns. Using data from the Taiwan Futures Exchange, [Cheng, Lee, and Lin \(2013\)](#) demonstrate that women and mature traders exhibit a stronger disposition effect and that the strength of this bias varies depending on the asset class. [Rau \(2014\)](#) also demonstrates that women are more prone to the disposition effect and are reluctant to sell capital losses. [Talpsepp \(2010\)](#) uses data on the Estonian stock market and demonstrates that portfolios of older age groups and female investors perform better and that lower portfolio returns are associated with a higher level of the disposition effect. In contrast, [Menkhoff, Schmeling, and Schmidt \(2013\)](#) analyse an online experiment with institutional investors, investment advisors and individual investors and demonstrate that older investors exhibit reduced investment abilities.

[Bogea and Barros \(2008\)](#) and [da Costa, Mineto, and da Silva \(2008\)](#) use data on Brazilian investors to analyse the association between the disposition effect and demographic characteristics. [Bogea and Barros \(2008\)](#) document that the disposition effect is prevalent among 512 households, although it does not exhibit a connection to the personal characteristics, while [da Costa, Mineto, and da Silva \(2008\)](#) demonstrate that the disposition effect in female subjects varies with changing reference points. Using data on the operations of all investors in the Brazilian stock market, [Prates, da Costa and Santos \(2019\)](#) demonstrate that individual investors are more likely to be influenced by the disposition effect than are institutional investors.

2.3 Delegation and portfolio characteristics

[Chang et al. \(2016\)](#) argue that delegation may reverse the disposition effect because investors can blame poor performance on portfolio managers. Indeed, their results demonstrate that investors in mutual funds exhibit a robust reverse disposition effect. [Bashall, Willows, and West \(2018\)](#) analyse the accounts of South African investors and conclude that investors receiving assistance from professional advisors are less likely to exhibit this behavioural bias, and similar conclusions are reached by [Shapira and Venezia \(2001\)](#) and [Lehenkari \(2011\)](#).

[Lucchesi, Yoshinaga, and Castro Junior \(2015\)](#) analyse the monthly transactions of 51 Brazilian equity funds from 2002 to 2008 and demonstrate that fund managers are prone to the disposition effect. [Tizziani, Klotzle, Ness Jr, and Motta \(2010\)](#) analyse all Brazilian equity fund portfolios from November 2003 to March 2008 and demonstrate that the disposition effect is prevalent among fund managers, although this prevalence is not observed when they base the analysis on trading volumes.

[Prates, da Costa, and Santos \(2019\)](#) analyse 60 million trading records in the Brazilian Stock Exchange and demonstrate that investors with lower average returns are likely to be influenced by the disposition effect while individual investors are more likely to realize small gains than institutional investors. They follow the methodology of [Kaustia \(2010\)](#), who demonstrates that the propensity to sell a stock may be a function of the asset price and the capital gain/loss over various ranges, which can contradict prospect theory. Indeed,

Frazzini (2006) uses data on mutual funds and demonstrates that the magnitude of capital gains and losses is relevant to explaining the disposition effect.

2.4 Market conditions

Leal, Armada, and Duque (2010) use data on the Portuguese stock market and demonstrate that investors in smaller markets with less liquidity are more prone to the disposition effect. They also show that the disposition effect is more evident in bull markets than bear markets. In contrast, Cheng, Lee, and Lin (2013) use data on the Taiwan Futures Exchange and find evidence that the disposition effect is stronger during bear markets.

3. Methodology

Given the findings in the literature about the role of risk taking and demographic conditions in explaining the disposition effect and the findings that the size of the market and its liquidity can also be associated with this cognitive bias, our null hypothesis is as follows:

H₀. Demographic characteristics, market conditions and risk-taking profiles are not associated with the disposition effect.

3.1 Measuring the disposition effect

Barberis and Xiong (2009) demonstrate that defining the disposition effect based on realized gains and losses is more reliable than using annual gains and losses. Following most of the literature, we assume that the reference point is the average purchase price. Specifically, we follow Odean (1998) and measure the disposition effect according to the following: for each date on which the investor makes an asset sale, we identify, which asset was sold and the value of the investor's portfolio at that time. Firstly, for each asset sold, we compare the sale price to the average purchase price. If the sale price is higher than the average purchase price, we compute it as a realized gain (RG), whereas if it is lower, we compute it as a realized loss (RL). Secondly, for each asset in the portfolio on that date, we compare the month's highest and lowest prices to the average purchase price. If the highest and the lowest prices are both above the average purchase price, we compute it as a paper gain (PG), whereas if they are below the average purchase price, we compute it as a paper loss (PL).

Using these measures, we compute the proportion of gains realized (PGR) and the proportion of losses realized (PLR); these results are given by the following expressions:

$$PGR = \frac{RG}{RG + PG} \quad (1)$$

$$PLR = \frac{RL}{RL + PL} \quad (2)$$

If the *PGR* is higher than the *PLR*, individual investors are more prone to selling winning assets and holding on to losing ones, which is evidence in favour of the disposition effect.

Using month-end data, we rebuilt the portfolios so that we could determine whether the investor purchased, sold or did nothing with her holdings during a specific month. To determine whether a transaction occurred, we based our calculations on public information for each asset. For stocks, we calculated the number of shares in a portfolio based on the closing price of that stock during that month. For the following month, if the number of

shares increased or decreased, then we count it as a negotiation. The same applies to funds, although net asset values are used in this case.

3.2 Empirical strategy

After calculating the PGR and the PLR, we use a categorical variable to represent the investor's behaviour, which assumes a value of 1 if the investor behaves according to the disposition effect theory (that is if the PGR is higher than the PLR) and a value of zero otherwise. Some studies use the ratio PGR/PLR to conduct their analyses; however, this ratio is not used here because in a significant number of cases, the PLR is equal to zero, which would have significantly reduced the number of available observations. We then perform logistic regressions to verify the association between investors' disposition effects and demographic and portfolio characteristics according to the following equation:

$$\text{Dispos} = f(\text{Risk_taker}, \text{Gender}, \text{Educ}, \text{Age}, \text{Balance}, \text{ntrades}) \quad (3)$$

Regarding risk exposure, the asset management firm that provided us with the data categorizes investors in four groups, namely, if the investor is conservative, if she is moderate without volatility, if she is moderate with volatility and if she is aggressive. In Brazil, risk assessment is an obligation of investment firms registered with the Securities and Exchange Commission of Brazil, and firms are required to offer products that meet their clients' risk profiles. For simplicity, we divide investors into two groups and create the variable *Risk_taker*, namely, investors classified as moderate with volatility or aggressive are considered risk takers while investors classified as conservatives and moderate without volatility are considered risk averse.

Gender is a categorical variable that takes a value of 1 if the investor is male and zero if she is female. *Educ* is a categorical variable indicating whether the investor has higher education. *Age* indicates how old each investor is in a certain year. Because we received information on the age of the individual investors in 2007 but had no access to their birth date, we assume all investors age by one year in January of every year. We also investigate whether the disposition effect (*Dispos*) has any association with the amount invested. For this purpose, *balance* is the sum of all the positions of every asset during a certain month. Some portfolios include negative (short) positions. In such cases, we subtract these values from the total sum. We also calculate the number of assets contained in each portfolio by simply counting these positive and negative positions. *Ntrades* refers to the inferred number of trades each investor made during each month. Because we had no access to actual trades, we calculate this number according to the following: if the return in a certain asset in the portfolio is higher or lower than the return of the asset itself, then we consider this as evidence of trading activity for each asset. Then, we count all the trading evidence for all the assets in the portfolio and normalize this measure.

In the general specifications, fixed income is the omitted asset class and January is the omitted month; therefore, we conduct all of our analyses relative to these two categories.

3.3 Investor sophistication

We divide portfolio investments into four asset classes, namely, fixed income, real estate, multi-market funds and stocks. Fixed income refers to corporate bonds and interest rate investment funds, multi-market refers to multi-market funds with low and high volatility, real estate refers to real estate funds and certificates of real estate receivables (*Certificado de Recebíveis Imobiliários*) and stocks refers to equity funds and stocks. When the investor

portfolio includes assets in at least three of these categories, we classify the portfolio as diversified (assets_div).

3.4 Market conditions

To analyse market conditions, we follow [Leal, Armada, and Duque \(2010\)](#). If market capitalization increases in comparison to the previous month, we classify it as a bull market. If market capitalization decreases, we classify it as a bear market. Then, if at least two of the three months in a quarter were bull (bear), we consider the quarter a bull (bear) period.

4. Data

Our sample contains information on the monthly portfolios of 189 investors from June 2007 to February 2017, as well as information on 124 different assets, investor demographic characteristics (gender, age and whether the investor has higher education) and total portfolio size. We excluded 8 assets and 51 investors due to missing information and our final sample contains information on 138 investors and 116 assets.

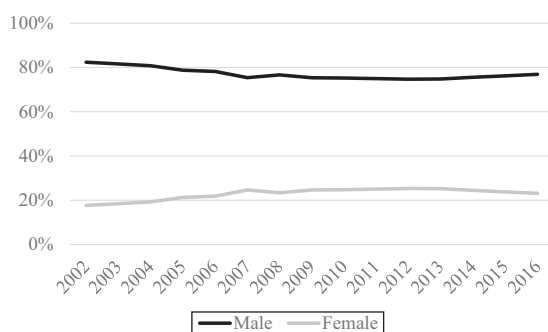
In our sample, 66% of the investors are male and 90% of them have a higher education. The average age is 68 years ([Table 1](#), Panel A) and each investor made four monthly trades on average. When comparing our data with the household investor profile in the Brazilian Stock Exchange (B³), we verify that our sample is more balanced in terms of gender because the average proportion of male investors in B³ during the period 2002 to 2016 was 77% ([Figure 3](#)). Also, the investors in our sample are relatively older than those in B³ because the majority of investors in B³ (54%) are more than 60 years old ([Figure 4](#)).

The average asset position is R\$107,590.00 ([Table 1](#), Panel B). The investors' portfolios are largely concentrated in multi-market funds with low volatility and in real estate funds, and 90% of the assets are real estate investment funds, although the largest positions are in multi-market funds. [Lakonishok and Smidt \(1986\)](#) argue that individual investors who do not hold market portfolios are more likely to incur the disposition effect.

Variable	Count	Mean	St. dev.	Min	Max
<i>Panel A: Main variables</i>					
Age	4,095	68.330	17.535	36	129
Gender	4,095	0.661	0.473	0	1
Educ	4,095	0.908	0.287	0	1
Profile	4,078	2.341	0.650	1	4
Balance	4,393	554,790	780,892.5	4.55e-13	1.38e + 07
Ntrades	4,502	4.2774	2.8548	0	25
Dispos	4,502	0.219	0.413	0	1
<i>Panel B: Asset allocation</i>					
Fixed income	4,502	79,992.86	193,852.2	-28,159.56	1,983,054
Multi-market	4,502	202,010.4	548,793.4	-1,273.865	1.18e + 07
Real estate	4,502	208,077.5	313,766.4	-46,299	2,733,399
Stocks	4,502	42,791.31	152,757.4	-1.60e-10	1,351,147

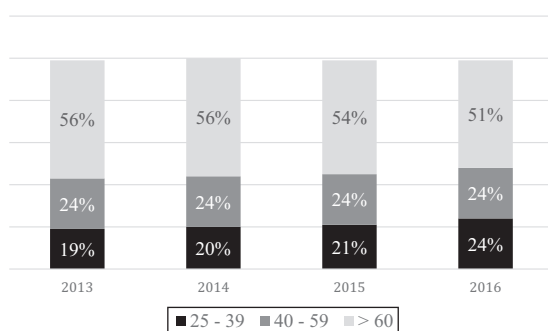
Notes: Gender is a dummy variable that equals 1 if the investor is male and zero if the investor is female. Higher education is a dummy that indicates whether investors have a higher education. Profile equals 1 if the investor is conservative, 2 if she is moderate without volatility, 3 if she is moderate with volatility and 4 if she is aggressive. Balance indicates the monthly amount invested by investors through the asset management firm and ntrades indicates the number of monthly trades by investors. Panel B indicates asset allocation considering four asset classes. All values are in Brazilian reais

Table 1.
Investor profile:
descriptive statistics



Source: B3

Figure 3.
Gender participation
in the Brazilian Stock
Exchange (B3)



Source: B3

Figure 4.
Individual investors
in the Brazilian Stock
Exchange by age
group

Of the 5,092 portfolio transactions, we identify, investors incur gains or losses in 4,502. The disposition effect occurs in 10% of those transactions. The average PGR is 13.1%, while the average PLR is 3.5%, which suggests a tendency to sell winners and hold on to losers. This finding is inconsistent with that of [Chang et al. \(2016\)](#) and [Bashall, Willows, and West \(2018\)](#), who demonstrate that investors holding delegated asset classes are less likely to incur such a bias.

Female investors have a higher average monthly return ([Table 2](#), 0.70% vs 0.41%), higher allocations in real estate (48.45% vs 41.15%) and lower allocations in stocks (1.31%

Gender	Monthly average return (%)	Fixed income (%)	Real estate (%)	Multi-market funds (%)	Stocks (%)
Male	0.4177	0.3845	0.3642	0.3390	0.2830
Female	0.7060	0.6314	0.7966	0.4611	0.3787

Notes: This table depicts the differences in portfolio allocation and portfolio returns between male and female investors. The first column reports the monthly average returns and the remaining columns report the average return for each gender in each asset class

Table 2.
Monthly average
return by gender

vs 4.91%), which is consistent with [Barber and Odean \(2001\)](#) and [Talpsepp \(2010\)](#). In accordance with most of the international literature about gender and risk aversion, the proportion of female risk takers is lower and statistically significant (27.881% vs 47.432%, $t = -12.266$), which is also consistent with [Byrnes et al. \(1999\)](#). The opposite holds true for cognitive biases because while 24.783% of the female investors exhibit the disposition effect, only 22.016% of the male investors exhibit this effect ($t = 1.99$). Indeed, when we compare the PGR for both genders, we observe that female investors tend to realize more gains than their male counterparts ([Figure 5](#)).

4.1 Limitations

Most of the assets in investors' portfolios are related to the real estate sector because of the core activities of the asset management firm that provided us the data. This issue is not a major concern for computing the disposition effect because the methodology deals with asset prices and is not asset-type dependent. To address this sample characteristic, we also perform our regression analysis for each asset class.

Some of the limitations of the study include the fact that paper gains and losses are based on the highest and lowest prices of the month and not on the price at the moment the sale occurred. This limitation should not be a major concern given the exploratory perspective of the study. Secondly, we had access only to end-of-month information and not to actual daily trading records, which is a common practice in the literature. However, we find evidence of the disposition effect even when observing monthly data, which suggests that the effect could be stronger if we used daily trading records. Thirdly, because the data set relates to individual investors who trade investment funds, we cannot determine whether firm size is associated with the disposition effect as [Ranguelova \(2001\)](#) suggests.

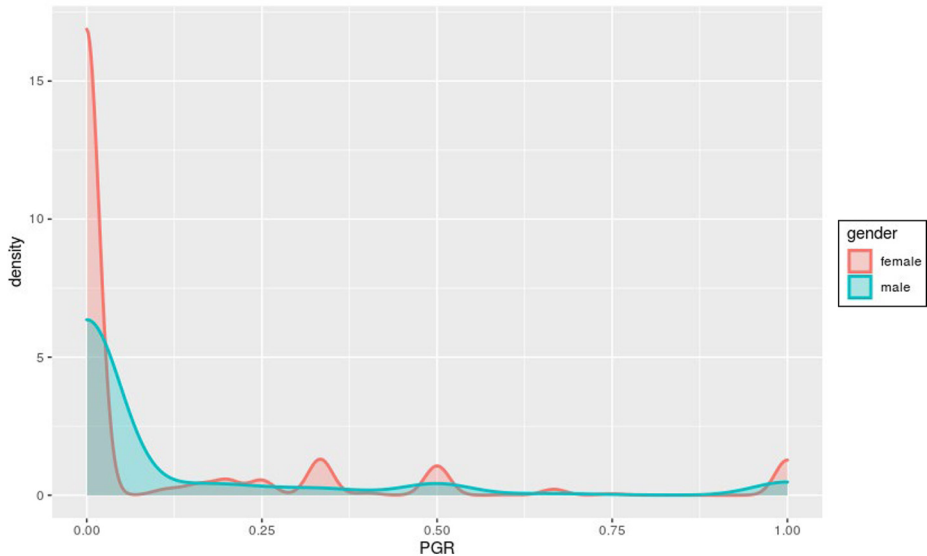


Figure 5.
Proportion of gains realized by gender

Source: Elaborated by authors

5. Results

We present our regression results in [Table 3](#). The first column reports our general results, which include controls for risk taking, portfolio size and age in natural logarithm form, as well as gender and the normalized number of monthly trades. Column (1) does not include the education variable. Column (2) reports the general results, including fixed effects for each month and for each asset type. Column (3) includes general controls, month and asset controls and the education variable. Column (4) includes the asset diversification variable and Column (5) reports the results considering only bull markets.

In all of our specifications, risk-averse individuals are more prone to the disposition effect. We also observe that investors who trade frequently are generally more prone to incur such a bias ([Dhar & Zhu, 2006](#); [Tizziani et al., 2010](#)) and find that male investors are less prone to the disposition effect ([Cheng, Lee, & Lin, 2013](#); [Rau, 2014](#); [Frino, Lepone, & Wright, 2015](#)). Except for investors who trade multi-market funds, age is not associated with this cognitive bias, which is inconsistent with [Talpsepp \(2010\)](#). Because age may not necessarily represent investor experience ([Menkhoff, Schmeling, & Schmidt, 2013](#)), this finding suggests that cognitive biases are not necessarily associated with generational preferences.

Individuals with large portfolios are more prone to the disposition effect, which is inconsistent with [Seasholes and Feng \(2005\)](#), [Dhar and Zhu \(2006\)](#), [Brown et al. \(2007\)](#), [da Costa et al. \(2013\)](#) and [Leal, Loureiro, and Armada \(2018\)](#). Our results also demonstrate that investors with higher education are less likely to incur such a cognitive bias ([Calvet, Campbell, & Sodini, 2009](#)) and indicate that more sophisticated investors are more likely to incur the disposition effect, which is inconsistent with [Calvet, Campbell and Sodini \(2009\)](#) and [Leal, Loureiro, & Armada \(2018\)](#). However, we note that measures of sophistication do not follow a single definition in the literature, and the concept is often substituted by investor experience in Brazilian studies ([da Costa, Macedo, Zindel, & Arruda, 2007](#); [da Costa et al., 2013](#); [Prates, da Costa, & Santos, 2019](#)).

We highlight that this is the first study concerning the disposition effect on Brazilian investors to use real data at the individual level. The results demonstrate that demographic characteristics are associated with the disposition effect for Brazilian investors in delegated asset classes, which is inconsistent with [Bogea and Barros \(2008\)](#).

5.1 Disposition effect and market conditions

In general, investors are less prone to the disposition effect during bull markets ([Figure 6](#)). Moreover, the effect is persistent for all asset classes except for corporate bonds (although the number of observations is too low for this asset class for us to generalize the findings). In our sample, the tendency to incur the disposition effect decreases during bull markets but increases during bear markets, which is consistent with [Rangelova \(2001\)](#) and [Cheng, Lee, and Lin \(2013\)](#) but in contrast to [Leal, Armada, and Duque \(2010\)](#). To our knowledge, we present the first evidence about the behaviour of Brazilian individual investors depending on market conditions and using real data.

5.2 Robustness checks

Columns (6)–(9) in [Table 3](#) depict the results for the asset classes fixed income, multi-market funds, real estate and stocks, respectively. We do not find any association between the demographic variables and the investments in real estate assets. For all asset classes, however, the number of trades is positively associated with the disposition effect, which means that investors that trade frequently are generally more likely to incur such a cognitive bias ([Tizziani et al., 2010](#)). Gender is negatively associated with the disposition

Table 3.
Logistic regressions

Variables	1	2	3	4	5	6	7	8	9
<i>risk_taker</i>	-0.318*** (0.0797)	-0.293*** (0.0919)	-0.314*** (0.0922)	-0.231** (0.0936)	-0.335*** (0.122)	-0.297** (0.149)	-0.303** (0.119)	-0.304*** (0.1000)	-0.991*** (0.233)
<i>ln_balance</i>	0.0376* (0.0147)	0.0422*** (0.0146)	0.0394*** (0.0144)	0.0419** (0.0145)	0.0296* (0.0212)	0.0764** (0.0306)	0.0587** (0.0238)	0.231*** (0.0640)	-0.0396 (0.0426)
<i>ln_age</i>	0.0164 (0.155)	0.136 (0.175)	0.0473 (0.178)	0.0560 (0.177)	0.263 (0.234)	0.0729 (0.255)	0.178 (0.249)	-0.544*** (0.202)	-0.0248 (0.568)
<i>gender</i>	-0.131 (0.0796)	-0.184 (0.0897)	-0.178** (0.0897)	-0.195** (0.0905)	-0.0702 (0.120)	0.114 (0.133)	0.298** (0.121)	-0.0188 (0.0995)	-0.891*** (0.225)
<i>ntrades_norm</i>	0.223*** (0.0379)	0.265*** (0.0481)	0.266*** (0.0483)	0.185*** (0.0511)	0.373*** (0.0621)	0.171*** (0.0645)	0.121* (0.0636)	0.299*** (0.0579)	0.345*** (0.0785)
<i>educ</i>			-0.519*** (0.137)	-0.487*** (0.138)	-0.478*** (0.177)	-0.0159 (0.190)	-0.552*** (0.182)	-0.480*** (0.160)	-0.155 (0.324)
<i>assets_div</i>				0.898*** (0.128)					
Constant	-1.565** (0.669)	-3.170*** (0.779)	-2.307*** (0.814)			-2.753** (1.180)	-2.823** (1.155)	-2.301** (1.153)	-0.182 (2.552)
Observations	4,055	4,055	4,055			1,608	2,228	3,071	819
Only bull markets	N	N	N	N	Y	N	N	N	N
Month control	N	Y	Y	Y	Y	Y	Y	Y	Y
Asset control	N	Y	Y	Y	Y	N	N	N	N

Notes: In this table, *disp* is the dependent categorical variable, which equals 1 if the investor incurs in the disposition effect (that is if the proportion of gains realized is higher than the proportion of losses realized). Controls include the following: *risk_taker*, which equals 1 if investors are classified as moderate with volatility or aggressive and zero if they are classified as conservatives or moderate without volatility (according to the suitability questionnaire), portfolio size (*ln_balance*), age (*ln_age*), gender (which equals 1 if the investor is male and zero if she is female) and the number of monthly trades (*ntrades_norm*). We also control for diversified portfolios (*assets_div*), which is a categorical variable that equals 1 if the investor portfolio includes assets in at least three of the four asset classes for a certain month. Columns (6)–(9) depict the results considering each asset class separately: fixed income, multi-market funds, real estate and stocks, respectively. Standard-errors for all models are shown in parentheses. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$

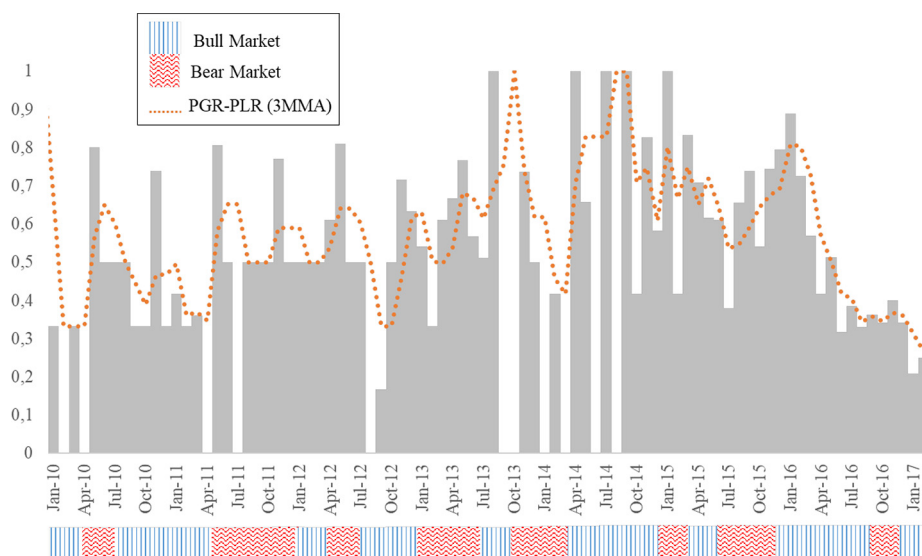


Figure 6.
Average PGR – PLR
and market sentiment

Source: Elaborated by authors

effect for individual investors who trade stocks and the coefficient is even stronger than the one in our general specification. This finding suggests that men that trade stocks are less likely to sell winning assets and hold on to losing ones.

We also find that risk-taking male investors are more prone to the disposition effect when investing in multi-market funds (results not reported), even when using month controls. Our results also demonstrate that older investors that trade multi-market funds are more prone to the disposition effect; that is age is positively associated with the disposition effect for delegated asset classes. This result is inconsistent with what we observe in our general findings and is in line with [Menkhoff, Schmeling, and Schmidt \(2013\)](#). Altogether, these findings demonstrate that demographic characteristics may have a different association with the disposition effect for delegated asset classes.

Another issue that might explain our findings concerns the nature of the assets in the portfolio. [Rangelova \(2001\)](#) argues that risk-seeking behaviour varies strongly with firm size. We analysed information on 96 investor-period observations (21% of the total); however, we did not find evidence supporting the author's hypothesis.

Finally, we also analyse the association between the magnitude of returns and the disposition effect ([Kaustia, 2010](#)) as an additional robustness check (results not reported). In our sample, the correlation between the disposition effect and the categorical variable for small positive returns is -6.76% . To determine whether the magnitude of returns explains the trading decision of individual investors in delegated asset classes, we calculated the monthly average return for each investor and classified these returns into four categories using the 5% cut-off value, namely, small positive, small negative, large positive and large negative. We discard asset returns that were higher than 50% or smaller than -50% . Then, we ran the same regressions presented in [Table 3](#) and include dummies for each of these magnitudes (large negative is the omitted category). In the general specification, small negative returns exhibit positive and significant returns; however, this is no longer the case

when we include month and asset controls. The coefficients for risk taking, gender and number of trades are similar to those in our main regressions.

6. Concluding remarks

This study uses a unique data set provided by one of the largest asset management firms in Brazil to investigate the association of the disposition effect with demographic characteristics, market conditions and risk taking. We use monthly data from June 2007 to February 2017, and investors' portfolios containing 124 different types of assets and apply the methodology proposed by Odean (1998) to calculate the disposition effect. Our empirical strategy consists of logistic regression analyses that include fixed effects for assets and months. We also run logistic regressions by asset type as robustness checks. To our knowledge, this is the first study to analyse the role of demographics and risk taking to explain the disposition effect using individual-level data from Brazilian investors. It is also the first to analyse the intensity of cognitive biases depending on market conditions (bull or bear markets).

In our sample, the difference between the PGR and the PLR is statistically significant, which means that individual investors sell more winning assets and hold on to more losing ones. We find evidence that risk averse investors and investors with a higher number of trades are more prone to the disposition effect and demonstrate that male subjects are less prone to this cognitive bias and that age is not associated with the disposition effect. Compared with empirical findings in the literature, we observe that individuals with large portfolios and sophisticated investors are more prone to selling winning assets and holding on to losing assets. Finally, we observe that the tendency to incur the disposition effect decreases during bull markets but increases during bear markets. These findings indicate that market conditions can impact the willingness to engage in risk exposure in the Brazilian economy.

Our results demonstrate that the disposition effect is prevalent even among wealthier and more educated investors with diversified portfolios. In this sense, the study also highlights the necessity of promoting educational programmes to avoid detrimental portfolio losses for people with a limited investment capacity.

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Corresponding author

Mariana Oreng can be contacted at: mariana.oreng@gmail.com

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