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# Capital gains overhang and irrelevant value characteristics of Brazilian companies

## *Ganancias de capital no realizadas y características de valor irrelevantes de las empresas Brasileñas*

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**Abstract**

This study, based on Ahmed's (2017) work for the US market, examines whether the prices of shares traded on the stock market of a developing country, such as Brazil, can also be influenced by noise traders who make their decisions based on irrelevant information. Using data from the Brazilian stock market between Jan/2003 and Sep/2018 we show that irrelevant firm characteristics are associated with variations in capital gains overhang (CGO), a proxy for the disposition effect bias. Our results are quite similar to those found by Ahmed (2017) for the US. However, the two markets show different results for the relationship between CGO and market liquidity and systematic risk for the entire sample period. Also, we find that there is an inverse relationship between investor sentiment and CGO at times of market upward movement. Overall, the influence of variables considered irrelevant was confirmed in robustness checks. These results may imply that noise traders evaluate stocks and companies based on their irrelevant characteristics, and this behavior, which is not compensated for by rational investors, temporarily influences the market by generating price distortions like the disposition effect.

*JEL Code:* G14, G15, G40, C33
*Keywords:* capital gains overhang; disposition effect; prospect theory; mental accounting; investor sentiment

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**Resumen**

Este estudio, basado en el trabajo de Ahmed (2017) para el mercado estadounidense, examina si los precios de las acciones negociadas en la bolsa de valores de un país en desarrollo, como Brasil, también pueden verse influenciados por noise traders que toman sus decisiones con base en información irrelevante. Utilizando datos de la bolsa de valores de Brasil entre enero de 2003 y septiembre de 2018, mostramos que las características irrelevantes de las empresas están asociadas con variaciones en las ganancias (o perdidas) de capital no realizadas (CGO), un proxy del sesgo del efecto disposición. Nuestros resultados son bastante similares a los encontrados por Ahmed (2017) para el mercado estadounidense. Sin embargo, los dos mercados muestran resultados diferentes para la relación entre CGO y liquidez de mercado y riesgo sistemático para todo el período de muestra. Además, encontramos que existe una relación inversa entre el sentimiento de los inversores y el CGO en momentos de movimiento alcista del mercado. En general, la influencia de las variables consideradas irrelevantes fue significativa en las comprobaciones de robustez. Estos resultados pueden implicar que los noise traders evalúan acciones y empresas en función de sus características irrelevantes, y este comportamiento, que no es compensado por inversores racionales, influye temporalmente en el mercado generando distorsiones de precios como el efecto disposición.

*Código JEL:* G14, G15, G40, C33
*Palabras clave:* ganancias de capital no realizadas; efecto disposición; teoría de prospectos; contabilidad mental; sentimiento del inversor

## Introduction

The disposition effect refers to the tendency of investors to realize gains quickly with the sale of assets and, at the same time, be reluctant to realize losses. These gains and losses are accounted for based on a reference price which, in general, is the purchase price of the asset in question. This bias suggests that certain investors' selling decisions may be affected by unrealized capital gains or losses.

Grinblatt and Han (2005) have shown that the combination of prospect theory and mental accounting (PT/MA) can generate the disposition effect described above. To this end, they developed a method to estimate the reference price and thus calculate the unrealized capital gains and losses that they called capital gains overhang (CGO).

Grinblatt and Han (2005) pointed out that, if the demand from uninformed investors exceeds the supply of rational investors, this would imply the departure of current stock prices in relation to their fundamental values. This behavior can be measured using the CGO variable, which measures the percentage of deviation between the reference price, at which the investor purchased a certain stock, and its current price. The CGO serves as a proxy for the mispricing of shares and, consequently, for the disposition effect at the aggregate market level.

Thus, when the CGO is positive (current price higher than the reference price), according to Grinblatt and Han (2005), there will be greater pressure to sell the winning shares from uninformed

investors. This will undervalue the current prices of these stocks leading to lower current prices and higher expected returns when future prices return to their fundamental values. And when the CGO is negative (current price lower than the reference price), there will be less selling pressure from these uninformed investors, indicating that these investors will carry the losing stocks, leading to higher current prices and lower expected returns.

The behavior described above is consistent with investors who suffer from the disposition effect and is explained by the combination of PT/MA. In this respect, the further the CGO level moves away from zero, the greater the role of uninformed investors in the stock market.

Furthermore, according to Anginer et al. (2011); Shefrin and Statman (1994, 1995); Clarke and Statman (1994), behaviorally biased investors mistakenly believe that "good stocks are stocks of good companies", and that “good companies” are large and have low book-to-price ratio. This belief in the growth-value and small-large scales is widespread in the stock selection process, despite the lack of a more robust theoretical foundation.

Thus, based on Ahmed's (2017) work for the US market, we tested in the Brazilian stock market whether uninformed investors also prefer to buy stocks of "good companies". To this end, we selected a series of characteristics of "good companies" (described in the following section) and gauged whether these characteristics have an important influence on CGO, that is, we verified how attractive these characteristics are for uninformed investors.

Likewise, the finance literature, since the seminal paper by Baker and Wurgler (2006), has provided important evidence suggesting that investor sentiment affects stock prices. In this context, investor sentiment can be defined as whether an individual feels excessively optimistic or pessimistic about a situation (Antoniou et al., 2013).

Investor sentiment has been linked to post-earnings announcement drift (Livnat & Petrovits, 2011), initial public offerings (Cornelli et al., 2006), distortions in the mean-variance relationship (Yu & Yuan, 2011), and momentum strategies (Antoniou et al., 2013), among other stock market anomalies. Thus, within this framework, our study also aims to analyze whether sentiment is a potential variable that can affect the decision making of uninformed investors and play a role in the relationship between CGO and the variables associated with "good companies".

Given the above framework, our goal in this paper is to analyze whether variables associated with the characteristics of "good companies" attract uninformed investors who, in turn, can influence CGO, generating distortions in asset prices.

To achieve this goal, we strove to answer the following questions: (i) Is there a disposition effect, estimated through CGO, in the Brazilian stock market? (ii) Could the characteristics of “good companies”, such as those reported in Clarke and Statman (1994) as irrelevant characteristics, affect

CGO? (iii) Does investor sentiment affect CGO? (iv) How can different market conditions, such as stock liquidity, company size, and market trends affect the CGO variable?

This study is the first in Brazil so far to apply the Grinblatt and Han (2005) model for estimating the aggregate disposition effect via CGO. Moreover, based on Ahmed (2017) for the US, it is the first to test in Brazil the hypothesis that there is a relationship between irrelevant value characteristics of a company (e.g., profitability, leverage, corporate liquidity, growth opportunities, and company size) and CGO, in addition to analyzing the relationship between CGO and investor sentiment.

Most studies to date have addressed the impact of irrational supply-side behaviors, while demand, the personal preferences of uninformed investors, has not yet been covered. It is hoped that this study can help to provide a better understanding of the behavior of these uninformed investors by identifying their buying and selling preferences and their possible impact on prices, detecting the characteristics of companies that may attract their attention and affect stock prices.

To conduct this study, we analyze data from all registered preferred shares, which are generally the most liquid shares on the Brazilian stock exchange (B3), and in their absence, we employ registered common shares. These data were collected through the Economatica database and represent all Brazilian companies listed on B3, for the period from January 2000 to June 2018. We also employ investor sentiment data, collected from Ipeadata, a database of economic and financial data maintained by the Institute for Applied Economic Research (IPEA) of the Brazilian federal government. Considering the survivorship bias in collecting these data, they were winsorized between 2% and 98% to reduce outlier effects. At the end, we apply a regression with unbalanced panel data with gaps, using the fixed effects and standard error model with clustering by firms. CGO is the dependent variable and the variables representing irrelevant characteristics are the independent variables.

The remainder of this paper is structured as follows. The next section presents the theoretical background and develops our testable hypotheses. Section 3 describes the data and methodology. Session 4 presents and discusses the results, and Session 5 concludes the work.

## Theoretical background and hypotheses development

According to Shefrin and Statman (1985); Barberis et al. (2001); Grinblatt and Han (2005); Barberis et al. (2006); Frazzini (2006), prospect theory and mental accounting can play an important role in explaining asset price dynamics and the cross-section of stock returns and, consequently, explain the disposition effect. This term, which was coined by Shefrin and Statman (1985), refers to the tendency to sell winning stocks quickly and hold losing stocks longer.

Grinblatt and Han (2005) proposed a model to estimate the disposition effect in aggregate

market terms when some investors suffer from biases caused by mental accounting and prospect theory. If the disposition effect is prevalent among capital market investors, winning stocks will suffer selling pressure from their holders and their price will decrease. Since the disposition effect is a purely behavioral effect, it influences the future value of a stock, and a low price means that the stock is undervalued, out of equilibrium. On the other hand, for a losing stock, its price may be high because of the lack of selling pressure, suggesting that it is overvalued. In the long run, this mispricing will eventually disappear and return to equilibrium. Therefore, for a winning (losing) stock that is undervalued (overvalued), its price will gradually rise (fall) to the correct equilibrium level (Li, 2016).

Guo et al. (2022) show that prospect theory and mental accounting are among the most important drivers to explain the momentum anomaly and use capital gains overhang as a proxy for capital gains and losses to capture the effect of PT/MA. Also, Chelikani et al. (2021) investigating how past stock returns affect lottery demand for the US financial market provide evidence that capital gains overhang has a positive and significant relationship with expected returns.

The key variable in the model proposed by Grinblatt and Han (2005) that is used as a proxy for the disposition effect is what they called capital gains overhang (CGO), which will be explained in the following sections.

## *Estimation of unrealized capital gains and losses (capital gains overhang)*

According to Grinblatt and Han (2005) and Bhootra and Hur (2012), based on the assumption that the relevant reference price (RP) for PT/MA investors is the market's aggregate cost basis incurred by investors when buying a certain share, the measure of unrealized capital gains and losses (CGO) is the percentage deviation between this reference price (RP) and current stock prices $P_t$, as shown in Equation (1):

$$CGO_t = \frac{P_t - RP_t}{P_t} \tag{1}$$

where $CGO_t$ is the unrealized capital gains and losses (capital gains overhang) at the end of quarter t; $P_t$ is the price at the end of quarter t; and $RP_t$ is the reference price at the end of quarter t.

The estimation of the reference price ($RP_t$), using the past three years (12 quarters), is shown in Equation (2):

$$RP_t = \frac{1}{k}\sum_{n=1}^{12}\left(R_{t-n}\prod_{\tau=1}^{n-1}[1 - R_{t-n+\tau}]\right)P_{t-n} \quad (2)$$

where $R_{t-n}$ is the turnover at date t–n; $P_{t-n}$ is the closing price at t–n; and k is a constant that makes the sum of the weights equal to one.

## *Irrelevant characteristics of "good" companies*

Shefrin and Statman (1994, 1995) showed that behaviorally biased investors mistakenly believe that "good stocks are stocks of good companies" and that this finding is old, already discussed in Bernstein (1956). This type of investor generally tends to overvalue growth stocks (those with low book-to-market ratios) and undervalue value stocks (those with high book-to-market ratios), as found by Lakonishok et al. (1994). Thus, Shefrin and Statman (1995) showed that companies with high market value and low book-to-market ratios are likely to be viewed as "good" companies by these investors. Consequently, these uninformed investors will cause excessive buying pressure that rational investors may have difficulty arbitraging. Therefore, an increase in the amount of these stocks in the portfolio (from uninformed investors) also increases the CGO, leading to a positive relationship between CGO and variables associated with good companies.

Furthermore, in a competitive market with rational investors, stock prices must already incorporate all relevant information and, thus, there would be no need to use these quality characteristics of good companies in the development of investment strategies. What should determine the value of a company in an efficient market is its future profitability and the systematic risk incurred in obtaining it.

Thus, in order for our results to be comparable to Ahmed's (2017) results in the US market, the present study used the following constructs of quality of a good company (proxies): Earnings per share (EPS), as a proxy for corporate profitability; total debt ratio, as a proxy for leverage (L); cash flow to price ratio (CF/P), as a proxy for corporate liquidity; market-to-book ratio (G), as a proxy for growth opportunities, and the natural log of market capitalization (S), as a proxy for company size. These quality constructs are the explanatory variables of capital gains overhang (CGO) used to determine whether these firm characteristics influence asset prices.

With regard to these quality characteristics of companies, we will refer to irrelevant characteristics of companies or characteristics of good companies, because they can attract uninformed investors, who believe that good stocks are stocks of good companies. With this, Hypothesis 1 is formulated:

H1. If the supply and demand of uninformed investors suffering from the disposition effect is

high and is not offset by the supply and demand of rational investors, then the capital gains overhang (CGO) will relate directly to the variables associated with the characteristics of good firms, namely profitability (EPS), leverage (L), corporate liquidity (CF/P), growth opportunities (G), and size (S).

## *Systematic risk and market liquidity*

The disposition effect is a prevalent anomaly in several stock markets, from the U.S. stock market (Odean, 1998) to stock markets such as the Portuguese (Cerqueira Leal et al., 2010) and the Brazilian (Prates et al., 2019). Given this fact, according to Ahmed (2017), the higher the market liquidity (V) of a given stock, the more likely it is that a part of this liquidity is due to uninformed investors who are realizing capital gains and, consequently, generating lower unrealized capital gains. On the other hand, the lower the volume of stock trading, the more likely it is to be associated with the tendency of uninformed investors not realizing losses, leading to lower realized capital gains and consequently higher unrealized capital gains. This fact has also been observed in the US by Lakonishok and Smidt (1986), who showed that market liquidity (V) is higher for winning stocks than for losing stocks.

In addition, stocks with high systematic risk (B) tend to have both higher gains and higher losses, that is, they are more sensitive in relation to market variations. At the same time, uninformed investors react asymmetrically by selling winning stocks, generating lower unrealized capital gains, and holding losing stocks, generating higher unrealized capital gains. Taking all of these aspects into account, the relationship between capital gains overhang (CGO), systematic risk (B) and market liquidity (V) is investigated, formulating Hypothesis 2, which can be stated as follows:

H2. If the supply and demand of uninformed investors suffering from the disposition effect is high and is not offset by the supply and demand of rational investors, then capital gains overhang (CGO) will be inversely related to market liquidity (V) and systematic risk (B).

## *Investor sentiment*

The theoretical assumption of a positive trade-off between risk and return is fundamental in many areas of finance, for example, in Markowitz's portfolio theory and risk analysis (Aslanidis et al., 2016). However, the empirical proof that this relationship is in fact positive is controversial in the related literature. While some studies have confirmed this positive relationship, such as Merton (1980); Bali and Peng (2006); Ghysels et al. (2005), others have identified a negative relationship (Aslanidis et al., 2016; Bekaert & Wu, 2000; Glosten et al., 1993; Q. Li et al., 2005; Nelson, 1991; Piccoli et al., 2018).

Yu and Yuan (2011) proposed a model based on investor sentiment (C) to attempt to explain

this distortion in the mean-variance relationship. They showed, for the US market, that there is a significant and positive relationship between mean and variance (proxy used for risk) when investor sentiment is low (pessimism), but little or no relationship when investor sentiment is high (optimism). These results are robust even when different models are used to estimate variance. According to these authors, this result is consistent with higher market participation by uninformed investors (sentiment-driven investors, according to Yu and Yuan (2011) when there is optimism and investor sentiment is high, shifting prices away from their equilibrium level that would otherwise reflect a positive mean-variance trade-off.

Wang et al. (2017), estimating risk in various ways (volatility of returns, CAPM-beta, volatility of cash flows, among others) found that the risk-return relationship was positive (negative) among stocks with high (low) capital gains overhang (CGO), and that this effect can be attributed to reference-dependent preference (RDP). This RDP hypothesis suggests that the risk behavior of investors in the loss region is different from their behavior in the gain region, as supported by prospect theory.

It is worth noting that Grinblatt and Han (2005) identified a positive correlation between CGO and expected stock returns. On the other hand, Baker and Wurgler 2006), for the US market, and Piccoli et al. (2018), for the Brazilian market, showed that low (high) expected returns are related to high (low) investor sentiment.

Thus, from the relationships described above between CGO, investor sentiment, return and risk, the third hypothesis to be tested, not yet explored in the literature, may be stated as follows:

H3. If the supply and demand of uninformed investors suffering from the disposition effect is high and is not offset by the supply and demand of rational investors, there will be a negative relationship between capital gains overhang (CGO) and investor sentiment (C).

## Data and methodology

### *Data collection*

In this paper, the closing prices of all stocks traded on the Brazilian stock exchange (B3) were collected. From these, the most traded stock of each company was selected, if a company had more than one traded stock, as is common in Brazil. The period that was covered was from January 2003 to September 2018, on a quarterly basis, covering 748 company stocks, and with 56,848 observations, collected from the Economatica® database.

To estimate capital gains overhang, some assumption had to be made about the investors' reference price (cost basis) at a given point in time. Grinblatt and Han (2005) used five-year historical

series of prices and turnovers to estimate the aggregate reference price (RP), but noted that the estimates were robust if three to seven years of past data were used. Thus, to avoid trading problems with low liquidity stocks, we chose to use quarterly prices and turnovers and estimate the aggregate reference price with a three-year past horizon (weighting for each of the 12 quarters), discarding all stocks with fewer than 12 observations (12 quarters). Finally, the remaining data were winzorized at 2% and 98% for the purpose of treating possible outliers. Thus, 227 stocks and 6,792 observations remained for our study.

To avoid survivorship bias, the sample included all the shares of companies active and inactive in the Brazilian capital market during the period in question.

The proxy used for the level of investor sentiment was the Consumer Confidence Index calculated by the Trade Federation of Rio de Janeiro, in accordance with Piccoli et al. (2018). These authors argue that there is no data available in Brazil to compute the investor sentiment index proposed by Baker and Wurgler (2006). Furthermore, the Consumer Confidence Index follows the same methodology as the Michigan Consumer Sentiment Index, widely adopted by the financial literature. It is also noteworthy that the use of surveys as proxies for investor sentiment is well established in the literature (Chau et al., 2016; Coulton et al., 2016; Fisher & Statman, 2003; Kurov, 2008). More details on the description of the variables are found in Table 1.

Table 1
Description of the variables
This table presents the definitions of the variables and the respective proxies used in this study.

| Variable | Proxy | Abbreviation | Definition |
|---|---|---|---|
| Mispricing | Capital gains overhang | CGO | The percentage difference between current prices and the reference price: $\mathrm{CGO_t} = \frac{\mathrm{P_t} - \mathrm{RP_t}}{\mathrm{P_t}}$ |
| Market liquidity | Turnover | V | Volume of shares traded divided by shares outstanding (in thousands, quarterly periods) |
| Systematic risk | Company beta | B | Measure of systematic risk: CAPM-beta, estimated over the previous two years with monthly data using the Ibovespa index |
| Company profitability | Earnings per share | EPS | Computed as a result of the division between the company's net income and the number of shares outstanding. Sum of the most recent 12 months (trailing 12 months) |
| Leverage | Total debt ratio | L | Company's short and long-term debt divided by total assets |
| Corporate liquidity | Cash flow-to-price ratio | CF/P | Ratio of the cash flow per share to price |
| Growth opportunities | market-to- book ratio (%) | G | Ratio of the market value per share to book value per share |

| | | | |
|---|---|---|---|
| Company size | Market capitalization | S | The natural log of market capitalization at the end of each quarter (in thousands) |
| Investor sentiment | Consumer confidence index (CCI) | C | Monthly measurements of the degree of confidence that the population has in the general situation of the country and in the present and future conditions of their families. Computed as the quarterly average. |

Source: http://www.ipeadata.gov.br

## *Data description*

Table 2 presents summary statistics for the dependent variable and the eight independent variables and covers the period of January 2003 to September 2018. The mean capital gains overhang is –0.320, which means that, in general, investors are experiencing unrealized capital losses.

We can observe that in Brazil the capital gains overhang, in the analyzed period, is lower than in the US market. Frazzini (2006) found CGO = –0.15 for mutual funds during the period of Jan/1980 to Dec/2002, Grinblatt and Han (2005) found CGO = 0.056 for NYSE and AMEX stocks for Jul/1963 to Dec/1996, and Ahmed (2017) found CGO = –0.0935 for stocks listed in the Russell 3000 index for Jan/1995 to Dec/2015.

Furthermore, for capital gains overhang, the standard deviation of 1.319 and asymmetry of –6.997 were more pronounced than those reported by Frazzini (2006), which were of 0.52 and –2.3, respectively, while Ahmed (2017) reported 0.547 and –2.394.

Table 2
Descriptive statistics after 2% and 98% winzorization

| Variables | Observations | Mean | Std. D. | Min. | Max. | Asymmetry | Kurtosis |
|---|---|---|---|---|---|---|---|
| CGO | 11,054 | -0.320 | 1.319 | -21.315 | 0.829 | -6.997 | 76.293 |
| V (in thousands) | 11,159 | 0.045 | 0.073 | 0.000 | 0.625 | 2.859 | 13.642 |
| B | 9,335 | 0.710 | 0.568 | -0.829 | 3.069 | 0.658 | 3.891 |
| EPS | 10,923 | -3.074 | 30.625 | -417.888 | 308.581 | -5.174 | 72.426 |
| L | 10,859 | 88.196 | 168.478 | -1,447.846 | 3,742.592 | 3.507 | 42.738 |
| CF/P | 8,166 | 0.016 | 0.749 | -5.747 | 11.765 | 6.353 | 95.901 |
| G | 10,989 | 1.975 | 2.927 | -6.004 | 42.630 | 4.423 | 35.301 |
| S (in thousands) | 11,521 | 14.258 | 2.133 | 6.621 | 18.767 | -0.417 | 2.702 |
| C | 14,553 | 129.158 | 22.054 | 84.913 | 164.310 | -0.075 | 1.954 |

This table reports summary statistics, after winzorization of 2% and 98% of the observations, for the variables of the study. CGO is the capital gains overhang, calculated in accordance with Grinblatt and Han (2005), a proxy for mispricing; V is the volume of shares traded quarterly divided by shares outstanding, a proxy for market liquidity; B is the value of the firm's beta coefficient determined by the CAPM for the previous two years using the Ibovespa index, a proxy for systematic risk; EPS is the result of the division between the company's net income and the number of shares outstanding, sum of the most recent 12 months (trailing 12 months), a proxy for company profitability; L is the company's short and long-term debt divided by the total assets, a proxy for leverage; CF/P is the ratio of cash flow per share to price, a proxy for corporate liquidity; G is the market-to-book ratio, a proxy for growth opportunities; S is the natural log of the market capitalization at the end of each quarter, a proxy for firm size; C measures the degree of confidence that the population has in the general situation of the country and in the present and future conditions of their family, collected from Ipeadata <www.ipeadata.gov.br>, a proxy for investor sentiment.

## *Econometric model employed*

In our model represented by Equation (3), based on Ahmed (2017), several explanatory variables were included that are considered proxies of "good" companies by uninformed investors, i.e., who mistakenly believe that they are variables indicative of a firm's successful investments.

Thus, when the relative strength of uninformed investors exceeds the relative strength of rational investors, there will be higher capital gains overhang (CGO) which, in light of PT/MA, may indicate the existence of the disposition effect. Hence, variables associated with "good firms" by uninformed investors are expected to be positively associated with CGO. Furthermore, to analyze the effects of systematic risk, market liquidity, and investor sentiment on CGO, we added to equation (1), as independent variables, market liquidity (V), systematic risk (B), estimated by the basic CAPM model, and investor sentiment (C). In order to study the behavior of the combined data (cross-section and time series) on CGO, a panel regression was used. To guarantee the validity of our regression, we confirmed the stationarity of our data to prevent spurious results (Brooks, 2008). Since our sample is unbalanced, we utilized Fisher-type tests based on the Dickey-Fuller and Im–Pesaran–Shin (IPS) tests. The null hypothesis for both tests is that all panels contain unit roots.

Table 3
Unit-root tests

| Variables | IPS | | | | Fisher-type unit-root test | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | intercept | | intercept and trend | | Inverse chi-sqared | | Inverse normal | | Inverse logit | | Modified inv. chisquared | |
| | W-t-bar | p-value | W-t-bar | p-value | Statistic | p-value | Statistic | p-value | Statistic | p-value | Statistic | p-value |
| CGO | -18.9939 | 0.0000 | -14.1000 | 0.0000 | 2230.4928 | 0.0000 | -33.7334 | 0.0000 | -40.0825 | 0.0000 | 58.1791 | 0.0000 |
| V | -64.2230 | 0.0000 | -60.4938 | 0.0000 | 3683.5544 | 0.0000 | -47.8914 | 0.0000 | -66.5918 | 0.0000 | 105.9814 | 0.0000 |
| B | -9.7372 | 0.0000 | -7.9899 | 0.0000 | 1321.2772 | 0.0000 | -22.2986 | 0.0000 | -22.8106 | 0.0000 | 28.2681 | 0.0000 |
| EPS | -15.9793 | 0.0000 | -11.9053 | 0.0000 | 2118.6940 | 0.0000 | -29.7226 | 0.0000 | -37.2491 | 0.0000 | 54.5012 | 0.0000 |
| L | -18.7740 | 0.0000 | -16.6209 | 0.0000 | 2569.5241 | 0.0000 | -34.6900 | 0.0000 | -45.4259 | 0.0000 | 69.3325 | 0.0000 |
| CF/P | -23.7610 | 0.0000 | -20.0738 | 0.0000 | 2765.7830 | 0.0000 | -38.5670 | 0.0000 | -49.3499 | 0.0000 | 75.7889 | 0.0000 |
| G | -13.3327 | 0.0000 | -11.7949 | 0.0000 | 3078.1857 | 0.0000 | -37.8901 | 0.0000 | -54.6157 | 0.0000 | 86.0662 | 0.0000 |
| S | -8.3441 | 0.0000 | -5.4930 | 0.0000 | 1686.6478 | 0.0000 | -25.7843 | 0.0000 | -29.1448 | 0.0000 | 40.2880 | 0.0000 |
| C | -12.2347 | 0.0000 | -10.3731 | 0.0000 | 1160.6205 | 0.0000 | -21.2441 | 0.0000 | -20.3508 | 0.0000 | 22.9829 | 0.0000 |

This table reports the results of panel unit root tests for the variables included in the regression equation (3). Specifically, the Im, Pesaran, and Shin (2003) test for heterogeneous panels based on the mean of individual unit root statistics (IPS) and the Fisher-type unit-root test (Choi, 2001) for unbalanced panel data are applied. These tests evaluate the null hypothesis that all panels contain a unit root, providing insights into the stationarity properties of the variables under investigation.; CGO is the capital gains overhang, calculated in accordance with Grinblatt and Han (2005), a proxy for mispricing; V is the volume of shares traded quarterly divided by shares outstanding, a proxy for market liquidity; B is the value of the firm's beta coefficient determined by the CAPM for the previous two years using the Ibovespa index, a proxy for systematic risk; EPS is the result of the division between the company's net income and the number of shares outstanding, sum of the most recent 12 months (trailing 12 months), a proxy for company profitability; L is the company's short and long-term debt divided by the total assets, a proxy for leverage; CF/P is the ratio of cash flow per share to price, a proxy for corporate liquidity; G is the market-to-book ratio, a proxy for growth opportunities; S is the natural log of the market capitalization at the end of each quarter, a proxy for firm size; C measures the degree of confidence that the population has in the general situation of the country and in the present and future conditions of their family, collected from Ipeadata <www.ipeadata.gov.br>, a proxy for investor sentiment.

According to Table 3, all variables were stationary at a significance level of 1% in both unit root tests. In order to validate the relationship between the variables, robustness tests were performed to determine whether the data could effectively explain the relationship between the variables. Five test steps were performed, which are described below, and the results presented in Table 4.

First, a Hausman test was performed (which tests whether the unique errors are correlated with the regressors, the null hypothesis being that they are not). Since the p-value was significant at 1%, fixed effects were chosen rather than random effects since the unique errors are correlated with the regressors.

Second, the Chow test was applied to identify which model is more suitable between pooled or fixed effects, which has the null hypothesis that the model is pooled against the alternative hypothesis that the model is fixed effects. This test indicated, at the 1% significance level, that the more robust model is the fixed effects model.

Third, the Wald heteroscedasticity test was performed, also suggested by Greene (2003), whose null hypothesis indicates homoscedasticity (constant variance), and the alternative hypothesis indicates heteroscedasticity (different variance). The error process may be homoscedastic within cross-section units, but its variance may be different across units; this is what is called group heteroscedasticity. The Wald test calculates group heteroscedasticity in the residuals of fixed-effects panel models. In the case of this test, the hypothesis tested is that: $\sigma_i^2 = \sigma^2$ for $i = 1, \ldots, N_g$, where $N_g$ is the number of cross-sectional units. This test, at the 1% significance level, indicated that the data exhibit heteroscedasticity.

Fourth, to check whether there is dependence between cross-section data, the test often used in the literature, Pesaran's test (2004), was computed, which has as its null hypothesis that the data are cross-section weakly dependent (there is no serial correlation), and, as an alternative hypothesis, the data are cross-section strongly dependent (there is serial correlation). If there is cross-section dependence, it is an indication that the stocks of different companies exhibit serial correlation. In our data, this test indicated the null hypothesis was not rejected (p-value=0.297), so the data do not exhibit cross-section dependence.

Fifth, Wooldridge's test for serial correlation was applied, because serial correlation is usually harmful only for panel data with long time series (around 20 to 30 time observations). It is not usually a problem in micro-panels (with few time series), because serial correlation makes the standard errors of the coefficients smaller than they really are and generates higher R-squared. This test has the null hypothesis that there is no serial correlation and the alternative hypothesis that there is serial correlation. It differs from the Pesaran cross-section dependence test in that it considers serial autocorrelation after pooled regression (ordinary least squares - MQO) is estimated in first difference and predicts the residuals, then regresses the lagged residuals in lag (1) and tests the coefficients against the lagged residuals. Thus, it does not focus only on the cross-section dependence of the data. In the present study, Wooldridge's test indicates at the 1% significance level that there is serial correlation.

Table 4
Panel data robustness tests

| Tests | P-value | Null hypothesis (H0) | Decision |
|---|---|---|---|
| Hausman | 0.0000 | Difference in coefficients not systematic | Reject H0 |
| Chow | 0.0000 | Model is restricted | Reject H0 |
| Wald heteroscedasticity | 0.0000 | Sigma(i)^2 equal sigma^2 for all i | Reject H0 |
| Pesaran | 0.2970 | Errors are weakly cross-sectional dependent. | Accept H0 |
| Wooldridge | 0.0000 | No first-order autocorrelation | Reject H0 |

This table reports the results of five robustness tests for a panel data regression model. The data consists of a panel of N= 748 company stocks over a period from January 2003 to September 2018, on a quarterly basis. The dependent variable CGO is the capital gains overhang, calculated in accordance with Grinblatt and Han (2005), a proxy for mispricing; the independent variables are as follows: V is the volume of shares traded quarterly divided by shares outstanding, a proxy for market liquidity; B is the value of the firm's beta coefficient determined by the CAPM for the previous two years using the Ibovespa index, a proxy for systematic risk; EPS is the result of the division between the company's net income and the number of shares outstanding, sum of the most recent 12 months (trailing 12 months), a proxy for company profitability; L is the company's short and long-term debt divided by the total assets, a proxy for leverage; CF/P is the ratio of cash flow per share to price, a proxy for corporate liquidity; G is the market-to-book ratio, a proxy for growth opportunities; S is the natural log of the market capitalization at the end of each quarter, a proxy for firm size; C measures the degree of confidence that the population has in the general situation of the country and in the present and future conditions of their family, collected from Ipeadata <www.ipeadata.gov.br>, a proxy for investor sentiment.

To correct the detected problems of serial correlation and heteroscedasticity, the corrective measure suggested by Wooldridge (2015) of standard error with clustering by shares (firms) was used, which can make the standard errors robust in fixed effects panels, whether the panel model is balanced or not. In this sense, the test results indicate that the most appropriate model is the fixed effects panel, also known as the least squares model with dummy variables. The optimal model was followed by the inclusion of dummy variables for each time period and the use of standard error with clustering by shares. The same approach was previously used by Ahmed (2017) and, according to Petersen (2009), is frequently employed in the literature. Thus, the specified model is as follows:

$$CGO_{it} = \beta_0 + \beta_1 V_{it} + \beta_2 B_{it} + \beta_3 EPS_{it} + \beta_4 L_{it} + \beta_5 CF/P_{it} + \beta_6 G + \beta_7 S_{it} + \beta_8 C_t + \mu_{it} \quad (3)$$

where $\mathrm{CGO_{it}}$ is the capital gains overhang, a proxy for mispricing, calculated in accordance with Equation (1); $\mathrm{V_{it}}$ is the turnover, a proxy for market liquidity, calculated as the volume of shares traded divided by shares outstanding (in thousands of reais, quarterly periods); $\mathrm{B_{it}}$ is the company's CAPM-beta,

a proxy for systematic risk, estimated over the previous two years with monthly data using the Ibovespa index; $EPS_{it}$ is earnings per share in reais, a proxy for company profitability; $L_{it}$ is the total debt ratio, a proxy for leverage, estimated by company's short and long-term debt divided by the total assets, in percentage form; $CF/P_{it}$ is the cash flow to price ratio, a proxy for corporate liquidity; $G_{it}$ is the market-to-book ratio, a proxy for growth opportunities; $S_{it}$ is the natural log of the market capitalization at the end of each quarter (in thousands of reais), a proxy for company size; $C_t$ is the consumer confidence index (CCI), a proxy for investor sentiment, computed as the quarterly average of the CCI found in the Ipeadata database; and $\mu_{it}$ is the error term.

Finally, the behavior of the dependent variable, CGO, was analyzed under various conditions (robustness checks), which are described in the next section, using the same framework described above.

In the following section, the regression results are presented, and their implications for the Brazilian financial market and their contributions to the behavioral finance literature are discussed.

## Results and discussion

In this section, we discuss the results in light of the formulated hypotheses, applying the model of Eq.1 to our full sample. We then discuss the results obtained from various subsamples and market conditions, constituting the robustness analysis of the results.

### *General results according to each hypothesis*

### *Analysis according to Hypothesis 1:*

Based on Table 5, we found strong evidence that supports the relationship between CGO and four of the five characteristics of "good" companies, our hypothesis 1. Thus, during the period in question, uninformed investors influenced the market by taking into account the irrelevant characteristics of companies in their investment strategies.

Thus, as expected, there was a directly proportional relationship between capital gains overhang and the variables profitability (EPS), growth opportunities (G) and size (S). Corporate liquidity (CF/P) showed statistical significance ($p < 0.05$), but with an opposite sign than expected, and the leverage variable (L) was not significant for the total period analyzed. This suggests that the higher the profitability (EPS), growth opportunities (G), and size (S), the greater the pressure from uninformed investors acting in the market by buying stocks that rational investors cannot compensate for, pushing stock prices above their fundamental values.

Ahmed (2017) found similar results for the US market (Russell 3000 index stocks). He, in a similar way to our analysis, also detected an inverse relationship between CGO and corporate liquidity (CF/P). One possible explanation for this is that, according to Lakonishok et al. (1994), uninformed investors tend to overprice stocks with low book-to-market ratios, which are the growth stocks, and underprice stocks with high book-to-market ratios, which are the value stocks. Note that in the corporate liquidity variable (CF/P), the denominator, the stock price, is a market variable. Thus, the lower the CF/P ratio of a stock, the higher the demand for this stock which makes its price and CGO increase, inducing a negative relationship between CGO and CF/P.

Our result, consistent with Guo et al. (2022) also suggests the existence of the momentum anomaly in the Brazilian financial market, since CGO, through the disposition effect, would be able to generate momentum.

## *Analysis according to Hypothesis 2:*

Regarding the second hypothesis, it was not confirmed for the full sample. It was found at the significance level of 1% and 5%, respectively, that the market liquidity (V) and systematic risk (B) variables have a positive relationship with CGO and not negative as expected. In other words, it seems that periods of higher (lower) market liquidity are associated with lower (higher) realization of capital gains, generating higher (lower) CGO. This result is in agreement with Goh et al. (2022), who argue that the disposition effect is caused by selling pressure from investors with capital gains overhang, which implies that liquidity providers are affected by the disposition effect mainly when they are on the selling side, this is because investors or liquidity providers are less willing to sell stocks (or provide liquidity) when the CGO is low. Although, is the opposite of that found by Ahmed (2017) for the total period of his sample, where he found an inverse relationship between the market liquidity (V) and systematic risk (B) variables with CGO for the stocks of the Russell 3000 index. However, when dividing the period analyzed into annual sub-periods, Ahmed (2017) identified an unstable relationship between CGO and systematic risk, attributing this result to a non-linear relationship between these variables. We will discuss this point in our robustness analysis.

## *Analysis according to Hypothesis 3:*

Regarding the third hypothesis, Table 5 shows that investor sentiment (C), despite the negative coefficient, was not significant in explaining CGO.

Tabla 5
Panel regression results for the full sample for the period of Jan/2003 to Sep/2018

| Independent Variables | Coefficients | |
|---|---|---|
| | βi | t |
| Intercept | -14.3203 | -9.80*** |
| | (1.4605) | |
| V | 2.6981 | 3.76*** |
| | (0.7176) | |
| B | 0.3215 | 2.35** |
| | (0.1366) | |
| EPS | 0.0058 | 4.47*** |
| | (0.0013) | |
| L | -0.0004 | -0.90 |
| | (0.0004) | |
| CF/P | -0.2127 | -2.35** |
| | (0.0906) | |
| G | 0.0342 | 2.20** |
| | (0.0156) | |
| S | 0.9337 | 9.89*** |
| | (0.0945) | |
| C | -0.0008 | -0.87 |
| | (0.0009) | |
| Within $R^2$ | 0.3094 | |
| F-statistics | 43.75 | |
| P-value | 0.0000 | |
| Observations | 6792 | |
| Groups | 227 | |

This table reports the results from the estimation of the following equation: $CGO_{it} = \beta_0 + \beta_1 V_{it} + \beta_2 B_{it} + \beta_3 EPS_{it} + \beta_4 L_{it} + \beta_5 CFP_{it} + \beta_6 G + \beta_7 S_{it} + \beta_8 C_t + \mu_{it}$, where: CGO is the capital gains overhang, calculated in accordance with Grinblatt and Han (2005), a proxy for mispricing; V is the volume of shares traded quarterly divided by shares outstanding, a proxy for market liquidity; B is the value of the firm's beta coefficient determined by the CAPM for the previous two years using the Ibovespa index, a proxy for systematic risk; EPS is the result of the division between the company's net income and the number of shares outstanding, sum of the most recent 12 months (trailing 12 months), a proxy for company profitability; L is the company's short and long-term debt divided by the total assets, a proxy for leverage; CF/P is the ratio of cash flow per share to price, a proxy for corporate liquidity; G is the market-to-book ratio, a proxy for growth opportunities; S is the natural log of the market capitalization at the end of each quarter, a proxy for firm size; C measures the degree of confidence that the population has in the general situation of the country and in the present and future conditions of their family, collected from Ipeadata <www.ipeadata.gov.br>, a proxy for investor sentiment. Standard errors, in parentheses, are heteroskedasticity robust and clustered at the firm level. ***, **, *, respectively, indicate the statistical significance at the 1%, 5%, and 10% levels.

## *Robustness checks*

To gauge whether the overall results found in our study hold up under various market conditions, or whether a particular market condition influences the overall results, we conducted a robustness analysis.

For this purpose, we recalculated all the previous coefficients in Equation (3) under various

market conditions: upward and downward trend, liquidity and firm size.

### *Up and down-market trends*

This analysis has to do with the behavior of CGO under uptrends and downtrends of the market. The uptrend (downtrend) occurs when the value of the Ibovespa index in a given quarter is above (below) the moving average of the previous four quarters. Thus, we determined the new coefficients of the panel regression model (Eq.3) for these two trends.

### *Analysis regarding Hypothesis 1:*

Table 6, which separates the market fluctuations into upward and downward trends, shows that the coefficients and significances of the five variables that characterize "good companies" change little compared to those in Table 5. Only the corporate liquidity (CF/P) variable becomes significant ($p < 0.01$) in the down-market condition, and the growth opportunities variable (G) is significant ($p < 0.01$) only in the up-market condition. Thus, it can be affirmed that uninformed investors are misled by irrelevant characteristics of companies in both bullish and bearish market conditions. It can also be seen that, in the upward market condition, the size variable (S) has less influence on CGO than in the downward condition ($\beta_7 = 0.2730$ for upward and $\beta_7 = 1.2754$ for downward). This may demonstrate that uninformed investors attribute less importance to firm size in a bullish market condition.

### *Analysis regarding Hypothesis 2:*

Based on Table 6, it is possible to observe that the market liquidity (V) and systematic risk (B) variables remained significant ($p < 0.01$) in these two conditions and in the same direction regarding their influence on CGO, continuing to contradict what was established in Hypothesis 1.

### *Analysis regarding hypothesis 3:*

As for the investor sentiment variable (C), it was found to be significant ($p < 0.01$) only for a bullish market condition. In this condition, this variable shows a negative relationship with CGO, corroborating Hypothesis 3. This negative relationship suggests that uninformed investors tend to act more in the market in an uptrend (optimism). This result contradicts the findings of Chau et al. (2016); Karlsson et al. (2011);

Stambaugh et al. (2012). However, it is in keeping with the result of Yu and Yuan (2011) for the US market, and Piccoli et al. (2018), for the Brazilian market, who reported that the higher the sentiment of investors (optimism), the more they tend to act in the financial market to induce an inverse relationship between risk and return.

Table 6
Panel regression results for the downtrend and uptrend subsamples for the period of Jan/2003 to Sep/2018

| Independent Variables | Downtrend Market | | Uptrend Market | |
|---|---|---|---|---|
| | βi | t | βi | t |
| Intercept | -19.5683 | -9.96*** | -3.8183 | -6.67*** |
| | (1.9643) | | (0.5720) | |
| V | 3.1917 | 2.75*** | 1.0509 | 3.19*** |
| | (1.1610) | | (0.3297) | |
| B | 0.5193 | 3.07*** | 0.1423 | 3.52*** |
| | (0.1690) | | (0.0405) | |
| EPS | 0.0039 | 3.11*** | 0.0037 | 4.01*** |
| | (0.0013) | | (0.0009) | |
| L | -0.0001 | -0.14 | -0.0004 | -1.59 |
| | (0.0005) | | (0.0003) | |
| CF/P | 0.0043 | 8.66*** | 0.0006 | 0.04 |
| | (0.0005) | | (0.0145) | |
| G | 0.0300 | 1.03 | 0.0515 | 3.97*** |
| | (0.0291) | | (0.0130) | |
| S | 1.2747 | 10.02*** | 0.2730 | 6.91*** |
| | (0.1272) | | (0.0395) | |
| C | -0.0006 | -0.50 | -0.0041 | -5.75*** |
| | (0.0012) | | (0.0007) | |
| Within $R^2$ | 0.3759 | | 0.1973 | |
| F-statistics | 73.43 | | 23.67 | |
| P-value | 0.0000 | | 0.0000 | |

| | | |
|---|---|---|
| Observations | 2615 | 2647 |
| Groups | 175 | 174 |

This table reports the results of the CGO behavior for two market trends: upward and downward. The uptrend (downtrend) is present when the value of the Ibovespa index in a given quarter is above (below) the moving average of the previous four quarters. For each of the trends the following equation was estimated: 〖CGO〗_it=β_0+β_1 V_it+β_2 B_it+β_3 〖EPS〗_it+β_4 L_it+β_5 〖CFP〗_it+β_6 G+β_7 S_it+β_8 C_t+μ_it, where: CGO is the capital gains overhang, calculated in accordance with Grinblatt and Han (2005), a proxy for mispricing; V is the volume of shares traded quarterly divided by shares outstanding, a proxy for market liquidity; B is the value of the firm's beta coefficient determined by the CAPM for the previous two years using the Ibovespa index, a proxy for systematic risk; EPS is the result of the division between the company's net income and the number of shares outstanding, sum of the most recent 12 months (trailing 12 months), a proxy for company profitability; L is the company's short and long-term debt divided by the total asset, a proxy for leverage; CF/P is the ratio of cash flow per share to price, a proxy for corporate liquidity; G is the market-to-book ratio, a proxy for growth opportunities; S is the natural log of the market capitalization at the end of each quarter, a proxy for firm size; C measures the degree of confidence that the population has in the general situation of the country and in the present and future conditions of their family, collected from Ipeadata <www.ipeadata.gov.br>, a proxy for investor sentiment. Standard errors, in parentheses, are heteroskedasticity robust and clustered at the firm level. ***, **, *, respectively, indicate the statistical significance at the 1%, 5%, and 10% levels.

## *Low, medium and high market liquidity*

In this subsection, as shown in Table 7, we analyze the behavior of the CGO variable for three different levels of market liquidity, considering as "low" liquidity the 10% of stocks with the lowest market liquidity in our sample, "high" liquidity the 10% of stocks with the highest market liquidity and "medium" liquidity the remaining stocks in the sample.

## *Analysis regarding Hypothesis 1:*

Table 7 shows that uninformed investors are apparently more active during periods of low market liquidity. This is because, of the five variables analyzed, three have significant coefficients (note that in Table 5, four were significant). Meanwhile, in medium and high liquidity conditions, only two and one variable were significant, respectively. It should be observed that only the size variable (S) proved to be significant in all three liquidity conditions, and is therefore a relevant variable for uninformed investors for any of the three liquidity levels under study. Furthermore, the relationship between leverage (L) and CGO is negative in the low liquidity condition. This may indicate that uninformed investors give preference to less leveraged companies in this market condition.

## *Analysis regarding Hypothesis 2:*

As shown in Table 7, the market liquidity variable (V) is not significant in any of the three market liquidity conditions. Systematic risk (B), however, continues to have a positive and significant relationship in the high liquidity condition ($p < 0.01$) and is less significant in the medium liquidity condition ($p < 0.05$). It seems that in low liquidity conditions these two variables are not taken into account in the decisions of uninformed investors.

## *Analysis regarding Hypothesis 3:*

Regarding investor sentiment (C), Table 7 shows that there is a negative relationship between CGO and sentiment, as expected, but with a low significance level ($p < 0.10$) only in the medium market liquidity condition.

Table 7
Results of the panel regression subsample low, medium, and high liquidity for the period of Jan/2003 to Sep/2018

| Independent Variables | Low Liquidity | | Medium Liquidity | | High Liquidity | |
|---|---|---|---|---|---|---|
| | βi | t | βi | t | βi | t |
| Intercept | -4.3988 | -2.08** | -17.0276 | -9.48*** | -13.8756 | -4.51*** |
| | (2.1167) | | (1.7970) | | (3.0766) | |
| V | 5,506.5140 | 1.35 | 1.4136 | 1.01 | 0.6157 | 1.53 |
| | (4,087.6720) | | (1.4013) | | (0.4020) | |
| B | -0.0558 | -0.59 | 0.2687 | 2.06** | 0.4123 | 2.76*** |
| | (0.0943) | | (0.1305) | | (0.1493) | |
| EPS | 0.0061 | 0.92 | 0.0039 | 2.10** | -0.0081 | -0.18 |
| | (0.0067) | | (0.0018) | | (0.0456) | |
| L | -0.0009 | -7.05*** | -0.0001 | -0.21 | -0.0022 | -1.18 |
| | (0.0001) | | (0.0003) | | (0.0019) | |
| CF/P | -0.0467 | -0.35 | -0.0044 | -0.59 | -0.3301 | -1.17 |
| | (0.1331) | | (0.0074) | | (0.2831) | |

| | | | | | | |
|---|---|---|---|---|---|---|
| G | 0.0833 | 4.32*** | 0.0235 | 1.37 | 0.0199 | 0.61 |
| | (0.0193) | | (0.0171) | | (0.0328) | |
| S | 0.2752 | 1.89* | 1.1428 | 9.37*** | 0.8652 | 4.35*** |
| | (0.1457) | | (0.1219) | | (0.1988) | |
| C | -0.0005 | -0.29 | -0.0018 | -1.68* | -0.0014 | -0.46 |
| | (0.0017) | | (0.0011) | | (0.0030) | |
| Within $R^2$ | 0.3801 | | 0.3481 | | 0.4859 | |
| F-statistics | 194.36 | | 30.53 | | 4.18 | |
| P-value | 0.0000 | | 0.0000 | | 0.0012 | |
| Observations | 211 | | 5743 | | 578 | |
| Groups | 23 | | 217 | | 38 | |

This table presents the results of the CGO behavior for three levels of liquidity, considering as "low" companies with 10% lower liquidity, "high" for 10% higher liquidity, and "medium" for all the others. For each of the levels, the following equation was estimated: $CGO_{it} = \beta_0 + \beta_1 V_{it} + \beta_2 B_{it} + \beta_3 EPS_{it} + \beta_4 L_{it} + \beta_5 CFP_{it} + \beta_6 G + \beta_7 S_{it} + \beta_8 C_t + \mu_{it}$, where: CGO is the capital gains overhang, calculated in accordance with Grinblatt and Han (2005), a proxy for mispricing; V is the volume of shares traded quarterly divided by shares outstanding, a proxy for market liquidity; B is the value of the firm's beta coefficient determined by the CAPM for the previous two years using the Ibovespa index, a proxy for systematic risk; EPS is the result of the division between the company's net income and the number of shares outstanding, sum of the most recent 12 months (trailing 12 months), a proxy for company profitability; L is the company's short and long-term debt divided by the total assets, a proxy for leverage; CF/P is the ratio of cash flow per share to price, a proxy for corporate liquidity; G is the market-to-book ratio, a proxy for growth opportunities; S is the natural log of the market capitalization at the end of each quarter, a proxy for firm size; C measures the degree of confidence that the population has in the general situation of the country and in the present and future conditions of their family, collected from Ipeadata <www.ipeadata.gov.br>, a proxy for investor sentiment. Standard errors, in parentheses, are heteroskedasticity robust and clustered at the firm level. ***, **, *, respectively, indicate the statistical significance at the 1%, 5%, and 10% levels.

## *Small, medium and large size*

Here CGO is analyzed for three levels of company size, considering as "small" the shares of companies with market capitalization among the smallest 10%, as "large" those with market capitalization among the largest 10%, and as "medium" the remaining shares.

### *Analysis regarding Hypothesis 1:*

Observing the relationship between the variables for the three levels of company size in Table 8, the same trends of relationship of these variables with CGO observed in Table 5 with the full sample can be seen. What can be observed is that among the larger firms, more variables are significant and that, therefore, there is greater activity of uninformed investors. In this situation, the leverage (L) variable becomes inversely related ($p < 0.10$) to CGO. It might be that, because they are stocks of large companies, uninformed investors wish to invest in stocks of less leveraged companies, a situation opposite to that found in Ahmed (2017).

### *Analysis regarding Hypothesis 2:*

As shown in Table 8, except in the conditions of the portfolio formed by large companies for the market liquidity variable and the portfolio formed by small companies in the case of systematic risk, all other relationships between market liquidity and systematic risk with the CGO variable were significant and positive. This shows that for large companies, market liquidity becomes less relevant, and in the case of small companies, it is the systematic risk that becomes less relevant for stock buying and selling decisions by uninformed investors.

## *Analysis regarding Hypothesis 3:*

It can be seen in Table 8 that investor sentiment was not significant in influencing CGO in any of the conditions relating to firm size.

Table 8
Panel regression results for small, medium and large subsamples sizes for the period of Jan/2003 to Sep/2018

| Independent Variables | Small | | Medium | | Large | |
|---|---|---|---|---|---|---|
| | βi | t | Bi | t | βi | t |
| Intercept | -10.8280 | -3.78*** | -14.8276 | -9.17*** | -5.8830 | -4.33*** |
| | (2.8666) | | (1.6165) | | (1.3581) | |
| V | 15.6652 | 4.11*** | 1.8914 | 3.22*** | 0.3752 | 0.94 |
| | (3.8133) | | (0.5875) | | (0.3996) | |
| B | 0.8421 | 1.38 | 0.1684 | 2.45** | 0.1767 | 2.99*** |

| | | | | | | |
|---|---|---|---|---|---|---|
| | (0.6102) | | (0.0688) | | (0.0591) | |
| EPS | 0.0059 | 2.25** | 0.0063 | 3.84*** | 0.0126 | 1.75* |
| | (0.0026) | | (0.0016) | | (0.0072) | |
| L | 0.0002 | 0.76 | -0.0002 | -0.54 | -0.0006 | -1.74* |
| | (0.0003) | | (0.0003) | | (0.0004) | |
| CF/P | -0.0541 | -1.68* | -0.0044 | -0.60 | 0.0087 | 0.05 |
| | (0.0322) | | (0.0073) | | (0.1835) | |
| G | -0.0744 | -0.85 | 0.0311 | 2.41** | 0.0365 | 2.82*** |
| | (0.0876) | | (0.0129) | | (0.0130) | |
| S | 0.7926 | 2.60*** | 0.9829 | 8.88*** | 0.3181 | 4.06*** |
| | (0.3046) | | (0.1107) | | (0.0784) | |
| C | 0.0025 | 0.31 | -0.0008 | -0.78 | 0.0001 | 0.11 |
| | (0.0081) | | (0.0010) | | (0.0010) | |
| Within $R^2$ | 0.2685 | | 0.3375 | | 0.3425 | |
| F-statistics | 7.75 | | 30.52 | | 15.66 | |
| P-value | 0.0000 | | 0.0000 | | 0.0000 | |
| Observations | 494 | | 5432 | | 737 | |
| Groups | 26 | | 207 | | 28 | |

This table presents the results of the CGO behavior for three levels of company size, considering as "small" companies with market capitalization 10% smaller, "large" for market capitalization 10% higher, and "medium" the remaining companies. For each of the levels, the following equation was estimated: $CGO_{it} = \beta_0 + \beta_1 V_{it} + \beta_2 B_{it} + \beta_3 EPS_{it} + \beta_4 L_{it} + \beta_5 CFP_{it} + \beta_6 G + \beta_7 S_{it} + \beta_8 C_t + \mu_{it}$, where: CGO is the capital gains overhang, calculated in accordance with Grinblatt and Han (2005), a proxy for mispricing; V is the volume of shares traded quarterly divided by shares outstanding, a proxy for market liquidity; B is the value of the firm's beta coefficient determined by the CAPM for the previous two years using the Ibovespa index, a proxy for systematic risk; EPS is the result of the division between the company's net income and the number of shares outstanding, sum of the most recent 12 months (trailing 12 months), a proxy for company profitability; L is the company's short and long-term debt divided by the total assets, a proxy for leverage; CF/P is the ratio of cash flow per share to price, a proxy for corporate liquidity; G is the market-to-book ratio, a proxy for growth opportunities; S is the natural log of the market capitalization at the end of each quarter, a proxy for firm size; C measures the degree of confidence that the population has in the general situation of the country and in the present and future conditions of their family, collected from Ipeadata <www.ipeadata.gov.br>, a proxy for investor sentiment. Standard errors, in parentheses, are heteroskedasticity robust and clustered at the firm level. ***, **, *, respectively, indicate the statistical significance at the 1%, 5%, and 10% levels.

## Conclusions

In this study, the objective was to analyze, with data from the Brazilian capital market during the period of 2003 to 2018, whether certain firm characteristics considered irrelevant from the point of view of an

efficient market can attract the attention of uninformed investors. More importantly, the study also looked to see if the trading strategies of these uninformed investors can create distortions in stock prices. To achieve this goal, we followed the methodology proposed by Grinblatt and Han (2005) to estimate the capital gains overhang (CGO) variable, which serves as a proxy for the disposition effect bias in aggregate market terms.

Through this model, via panel regression, we tested the influence on CGO of the following five variables considered irrelevant from the point of view of an efficient market: company profitability (EPS), leverage (L), corporate liquidity (CF/P), growth opportunities (G), and size (S). We also included as variables in the regression market liquidity (V), systematic risk (B) and investor sentiment (C).

Based on the overall results shown in Table 5, our first hypothesis is partially confirmed. So much so that four of the five variables are significant and positive (EPS, CF/P, G, S). Whereas, the second hypothesis is rejected, as systematic risk (B) and market liquidity (V) show positive rather than negative relationship. Finally, the third hypothesis is not confirmed, indicating that investor sentiment is not able to explain the disposition effect. Most robustness tests confirm these results for all three hypotheses. We do, however, find an inverse relationship between investor sentiment and CGO in times of upward market movement (Table 6), corroborating, in this specific market condition, our third hypothesis.

The main conclusion found in this work is that uninformed investors evaluate companies through irrelevant characteristics and static indicators that are not able to identify successful stocks, corroborating Clarke and Statman (1994) and Ahmed (2017), who argue that uninformed investors tend to believe that "good stocks are always stocks of good companies". Especially, the variables that support this argument are profitability (L), growth opportunities (G) and size (S).

As a practical implication, given the existence of uninformed investors, who mistakenly believe that good stocks are stocks of good companies, better-informed investors, aware of uninformed investors' biases, should capitalize on them by investing as "contrarians", favoring stocks of companies despised by uninformed investors. This strategy seems to be possible, because it was found that even adjusting for risk, the expected returns of stocks from companies despised (by uninformed investors) exceed the expected returns of the most admired stocks by these investors. And this incomplete arbitrage has happened both in the US stock market (Ahmed, 2017) and in the Brazilian stock market, where Prates et al. (2019) showed that individual investors (a proxy for uninformed investors) suffer from the disposition effect while institutional investors do not.

Among the main limitations of this work is the fact that we did not deal with other cognitive biases that may have affected price behavior, such as: framing effect, overconfidence, conservatism, among other important biases that can affect stock market investors. Although our results are quite similar to those obtained by Ahmed (2017) in the US market, one cannot generalize the results to other markets,

as the period and frequency of the data analyzed were different. Finally, this work can be used to better understand the stock market in developing countries and encourage future research to use other characteristics of companies that may impact investor behavior, such as managerial efficiency, product quality, innovation, and social responsibility.

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