INVESTING IN MARKET ANOMALIES: PEAD AND GROWTH/VALUE AS FUNDAMENTAL ANALYSIS TOOLS IN THE BRAZILIAN STOCK MARKET

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ABSTRACT

This study investigated whether combining the market anomalies PEAD (Post-Earnings Announcement Drift) and growth/value, based on fundamental criteria, can increase portfolio profitability in the Brazilian stock market. A theoretical-methodological approach rooted in the market anomalies and fundamental analysis literature was adopted, analyzing quarterly data from companies listed on B3 between 1994 and 2021. The methodology included panel regression models and mean return tests to validate the strategies. Results showed that combining these anomalies with fundamentalist criteria yields superior and consistent returns, despite the lack of statistical significance in some econometric coefficients. It is concluded that the strategy contributes to investment practices by enhancing portfolio performance in the Brazilian capital market, underscoring the relevance of market anomaly-based approaches.

Keywords: Fundamental Analysis. Growth and Value Stocks. Unexpected Earnings Surprise.

INVESTINDO NAS ANOMALIAS DE MERCADO: PEAD E CRESCIMENTO/VALOR COMO FERRAMENTAS DE ANÁLISE FUNDAMENTALISTA NO MERCADO ACIONÁRIO BRASILEIRO

RESUMO

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Este estudo investigou se a combinação das anomalias de mercado PEAD (Post-Earnings Announcement Drift) e crescimento/valor, com base em critérios fundamentalistas, pode aumentar a rentabilidade de portfólios no mercado acionário brasileiro. Adotou-se uma abordagem teórico-metodológica fundamentada na literatura de anomalias de mercado e análise fundamentalista, analisando dados trimestrais de empresas listadas na B3 entre 1994 e 2021. A metodologia incluiu a aplicação de modelos de regressão em painel e testes de médias dos retornos para validar as estratégias. Os resultados demonstraram que a conjugação das anomalias, considerando critérios fundamentalistas, proporciona retornos superiores e consistentes, mesmo frente à ausência de significância estatística em alguns coeficientes econométricos. Conclui-se que a estratégia contribui para a prática de investimento ao ampliar a eficácia de portfólios no mercado de capitais brasileiro, validando a relevância de abordagens fundamentadas em anomalias de mercado.

Palavras-Chave: Análise Fundamentalista. Ações de Crescimento e Valor. Surpresa Inesperada dos Lucros.

1 INTRODUCTION

The Efficient Market Hypothesis (EMH), as established by Fama (1998), in its strong form, assumes that stock prices reflect all public and private information. Therefore, market participants would not be able to exploit market inefficiencies or insider information to achieve abnormal returns, and if such returns were to occur, it would be merely by chance or luck. However, several studies have been able to catalog market inefficiencies or anomalies within the EMH, as expressed by Shleifer (2000).

This article seeks to verify whether the combination of two anomalies, which, according to the literature, are capable of generating abnormal returns, can enhance the profitability of a portfolio through buy and sell strategies. The two anomalies, widely documented in the literature, are the post-earnings announcement drift (PEAD), also referred to as the unexpected earnings surprise (Ball & Brown, 1968; Rendleman, Jones & Latané, 1987; Bernard & Thomas, 1989; Freeman & Tse, 1989; Chordia *et al*., 2009; Battalio & Mendenhall, 2011; Altanlar, Guo & Holmes, 2019), and the growth versus value stock dilemma (Basu, 1983; Fama & French, 1992; Lakonishok, Shleifer & Vishny, 1994; La Porta, 1996; La Porta *et al*., 1997; Piotroski, 2000; Mohanram, 2005; Yan & Zhao, 2011; Galdi & Lima, 2016). According to Fink (2021), PEAD refers to situations where stock prices tend to rise (fall) after the release of quarterly earnings that are above (below) market expectations. As scholars explored this theme, several reasons were proposed to explain PEAD: the size effect (Rendleman, Jones & Latané, 1987), delayed response (Bernard & Thomas, 1989), earnings reassessment (Freeman & Tse, 1989), transaction costs/liquidity (Battalio & Mendenhall, 2011; Chordia *et al*., 2009), and cognitive dissonance (Altanlar, Guo & Holmes, 2019).

On the other hand, the growth/value dilemma refers to the consistency with which the returns of value stocks (book value higher than market value) systematically outperform the returns of growth stocks (book value lower than market value), as explained by Fink (2021). The reasons for the occurrence of this

anomaly are more clearly defined, divided between the higher risk of value companies (Fama & French, 1992) and the erroneous expectations of investors and analysts regarding the future price of the asset (La Porta, 1996; La Porta *et al*., 1997).

However, much of the literature on PEAD and the growth/value dilemma evaluates these anomalies separately, meaning that few scholars have focused on assessing PEAD in conjunction with the growth/value dilemma. Moreover, many researchers have not, in their findings, classified growth and value companies according to fundamental indicators, a theme initiated by Piotroski (2000) and Mohanram (2005).

This study is justified by the context of emerging countries, which have markets with low capitalization relative to Gross Domestic Product (GDP) and characteristics that amplify the PEAD anomaly (Santana, Black & Lima, 2022). Additionally, to the best of our knowledge, the intersection between the PEAD and growth/value anomalies has only been explored by Sun and Wen (2023), Galdi and Lima (2016), and Yan and Zhao (2011). Therefore, it is necessary to retest the strategy highlighted by these studies, updating the data and verifying whether the inclusion of a longer historical series would alter the results (Colquitt & Zapata-Phelan, 2007).

For investors, in particular, the findings of this research may or may not confirm the so-called "Golden Opportunity." Rostagno, Soares, and Soares (2005) explain that this refers to the strategy of investing in assets with higher returns and lower risks, especially in the short term. Thus, the adoption of a selection practice for companies with desired/undesired fundamental indicators and desired/undesired PEAD may be useful for stock market application and maximizing returns for market participants.

This study uses the Standardized Unexpected Earnings and Market-to-Book variables to estimate the PEAD and growth/value anomalies, respectively. Additionally, growth and value stocks were segmented according to fundamental signals, referred to as *BrG_Score* and *BrF_Score*, respectively. In total, 309 publicly traded companies comprised the sample.

Among the main results and contributions, it can be stated that the combination of PEAD with growth/value delivers comparatively high and statistically significant returns, a finding consistent with Galdi and Lima (2016). However, the random-effects panel regression model was not robust enough, and all inferences here were made through mean return tests.

This introduction is followed by Section 2, which refers to the theoretical framework. Subsequently, the methodology is presented in Section 3, the results and discussions in Section 4, and the conclusions in Section 5.

2 THEORETICAL FRAMEWORK

2.1 PEAD and the growth-value dilemma

The Efficient Market Hypothesis (EMH), popularized by Eugene Fama in the 1970s, is widely used in the world of finance. According to Fama (1970), assets fully

reflect all available information, implying perfect competition in the stock market, so no agent can take advantage of asymmetries.

According to Shleifer (2000), the EMH is supported by three central arguments. First, it assumes that investors are rational and price securities rationally. Second, even if some agents are irrational, their trades are presumed to be random and cancel each other out. Finally, even if many individuals act irrationally, market arbitrageurs will eliminate their influence on asset prices. However, the author argues that the term "anomaly" was coined by EMH theorists to describe certain empirical regularities they struggle to explain. Over the decades, new discoveries have pointed to contradictions with market efficiency, such as PEAD and the growth-value dilemma.

PEAD is an anomaly that has been repeatedly confirmed (Fama, 1998), directly challenging the semi-strong form of the EMH. Initially documented by Ball and Brown (1968), it reflects the time lag between the release of earnings information by companies and the subsequent adjustment in stock prices. Since then, a series of researchers have contributed to its understanding.

Rendleman, Jones, and Latané (1987) were pioneers in introducing the Standardized Unexpected Earnings (SUE) metric, a crucial tool for assessing market reactions to earnings announcements. By investigating the size effect, they pointed out that larger companies may face distinct challenges in quickly incorporating information into their market prices, contributing to the PEAD anomaly.

Bernard and Thomas (1989) proposed delayed decision-making as a relevant factor for PEAD, while Freeman and Tse (1989) highlighted earnings reassessment as an alternative explanation for the observed discrepancies. Chordia *et al*. (2009) and Battalio and Mendenhall (2011) explored transaction costs and liquidity as influential variables, demonstrating how these factors can affect the absorption of information in financial markets. Additionally, in more recent studies, Altanlar, Guo, and Holmes (2019) introduced cognitive dissonance as a possible explanation, emphasizing the psychological and behavioral aspects in the interpretation of financial information, while Beaver, McNichols, and Wang (2019) highlighted that PEAD is intensified by the greater quantity and quality of information released on announcement dates.

Regarding the growth-value dilemma, Basu (1983), while comparing returns with the size effect, discovered that smaller companies tend to achieve higher returns compared to larger ones. In the following decade, Fama and French (1992) noted the consistency with which the returns of value companies outperform those of growth companies, arguing that this relationship is due to the higher risk of value stocks, which are often marked by poor forecasts and elevated risks.

Initially, the analysis by Fama and French (1992) seemed to dismiss the growth-value dilemma as an anomaly, as the risk of value companies would be considerably higher. However, Lakonishok, Shleifer, and Vishny (1994) found that value firms have low prices because they are ignored or underestimated by investors (behavior termed suboptimal or irrational), rather than the more traditional explanation at the time, which focused on the risk-return relationship.

In addition to the contributions of Lakonishok, Shleifer, and Vishny (1994), La Porta (1996) and La Porta *et al*. (1997) showed that investors underestimate value companies and overestimate growth companies, respectively. These analyses, focused on investor behavior, went beyond what traditional financial data could explain.

In the 2000s, new research became important for exploring the growth-value dilemma, among which the contributions of Piotroski (2000) and Mohanram (2005) stand out. Both authors segmented value and growth companies into strata, classifying them according to fundamental criteria and adopting scores that separated companies with good and poor fundamentals. In this analysis, the returns of companies with good fundamentals consistently outperformed those with poor fundamentals.

There were also scholars, such as Yan and Zhao (2011) and Galdi and Lima (2016), who combined the growth-value dilemma with PEAD, showing that the combination of the two anomalies promotes consistent returns. Galdi and Lima (2016) found that PEAD, combined with fundamental analysis (*BrG_Score* and *BrF_Score*), can amplify investor returns, and that, at the same time, value stocks are more impacted by PEAD than growth stocks. However, transaction costs could hinder the strategy focused on value companies. Meanwhile, Yan and Zhao (2011) concluded that value stocks showed milder market reactions to earnings surprises, as they were more resilient in both positive and negative contexts compared to growth stocks.

More recently, Sun and Wen (2023) intertwine SUE with other variables, such as book-to-market, and show that abnormal returns are more persistent in value companies than in growth companies, which is due to the fact that value companies face greater market inefficiency.

3 METHODOLOGICAL PROCEDURES

3.1 Sample

Data were collected through the Economatica platform for 580 companies (34,917 observations) listed on B3 (both active and inactive) between January 1994 and December 2021, on a quarterly frequency. Firms with negative equity and those lacking at least the SUE and quarterly return (1st and 2nd quarter) information were removed from the sample. Financial institutions were also excluded due to their potential for high leverage (Colla, Ippolito & Li, 2013), which could interfere with the classification of growth or value. Thus, 309 companies (3,750 observations) remained as the final sample. The choice of the year 1994 is due to the beginning of the Plano Real.

Regarding outliers, the decision was made not to remove them from the sample and to use the median as a comparative basis to the mean, primarily because the SUE measures "investors' reaction to the company's financial results." By winsorizing this data (or applying another outlier treatment method), the researcher could inadvertently bias this behavioral analysis, which is the focus of this study.

In the section on the main variables employed, the unexpected earnings of companies, also known as PEAD, were measured using the SUE (Standardized Unexpected Earnings), as expressed by Chordia *et al*. (2009):

$$SUE_{it} = \frac{L_{it} - L_{it-4}}{\sigma_{it}} \quad (1)$$

The SUE formula, which captures the unexpected earnings surprise of companies, considers the most recent quarterly earnings (L_{it}) minus the quarterly earnings from four preceding periods (L_{it-4}). Additionally, the result is divided by the standard deviation of the previous eight quarters (σ_{it}). In other words, the purpose of the formula is to assess earnings variability by comparing quarterly earnings with expected earnings. Using the SUE of each company, the stocks were classified into deciles for each period, as follows: positive SUE (deciles 8, 9, and 10), neutral SUE (deciles 4, 5, 6, and 7), and negative SUE (deciles 1, 2, and 3). Each decile represents 10% of the collected sample, with the first decile and the tenth decile corresponding to the companies with the lowest and highest SUE, respectively. The practice of separating SUE into strata is widely used in the literature, as many authors, such as Chordia *et al*. (2009) and Galdi and Lima (2016), employ deciles for this purpose.

It is worth noting that, at this initial stage, the stocks are not yet separated into growth and value, an aspect that belongs to the next stage of data processing.

3.2 Definition of Growth and Value Actions

The quarterly M/B (Market-to-Book) ratio of the firms was calculated to analyze and classify the universe of growth and value stocks (Fama, 2018). This ratio incorporates quarterly data on the market price of the stock and the book value of each company.

$$M/B = \frac{Market\ value}{Booking\ value} \quad (2)$$

Next, the stocks were sorted into quintiles (a classification divided into five equal parts, each representing 20% of the sample) based on the M/B ratio. The first quintile refers to value companies. Conversely, the fourth and fifth quintiles correspond to growth companies. As for the remaining quintiles, two and three, they are in a neutral position and cannot be classified as either growth or value. It is worth mentioning that this classification was based on Yan and Zhao (2011).

Once classified as value or growth, we incorporated fundamental criteria into both asset types, referred to as *BrF_Score* and *BrG_Score*, respectively. Based on Mohanram (2005) and Galdi and Lima (2016), the quarterly fundamental signals for growth stocks, called *BrG_Score*, were established. To calculate *BrG_Score*, seven binary classification fundamental signals (dummy variables) were summed to determine the fundamental strength of the companies: weak *BrG_Score* (sum of 0 to 2); neutral *BrG_Score* (sum of 3 or 4); strong *BrG_Score* (sum of 5 to 7).

Additionally, we used the criteria from Piotroski (2000) and Galdi and Lima (2016) to classify value stocks, as follows: weak *BrF_Score* (sum of 0 to 2); neutral *BrF_Score* (sum of 3 to 6); strong *BrF_Score* (sum of 7 to 9).

After determining the *BrG_Score* and *BrF_Score* for growth and value stocks, respectively, it was possible to compare the performance of the upper and lower strata, as shown in Tables 1 and 2:

Table 1
BrG_Score Signals - Growth Stocks (Quarterly)

Signals	Description	How to Interpret	Foundation
First Signal (G1)	ROA	Equals 1 if the company's ROA is higher than the median ROA of all companies in the same sector and period, equals 0 otherwise.	See Table 2.
Second Signal (G2)	ROA Cashflow	Equals 1 if the company's ROA Cashflow is higher than the median ROA Cashflow of all companies in the same sector and period, equals 0 otherwise.	See Table 2.
Third Signal (G3)	Accrual	Equals 1 if operating cash flow is greater than net income, equals 0 otherwise.	See Table 2.
Fourth Signal (G4)	Net Income	Equals 1 if the standard deviation of net income is lower than the median sectoral standard deviation, equals 0 otherwise.	Represents the actual profit after all deductions.
Fifth Signal (G5)	Sales	Equals 1 if the standard deviation of sales growth is lower than the median sectoral standard deviation, equals 0 otherwise.	Assesses commercial performance.
Sixth Signal (G6)	Investment (Fixed Assets)	Equals 1 if fixed assets divided by the previous total assets are higher than the sectoral median of fixed assets divided by the previous total assets, equals 0 otherwise.	Indicates the company's productive capacity.
Seventh Signal (G7)	Advertising (Selling Expenses)	Equals 1 if selling expenses divided by the previous total assets are higher than the sectoral median of selling expenses divided by the previous total assets, equals 0 otherwise.	Reflects the company's visibility and market reach.

Source: Prepared by the authors based on Mohanram (2005) and Galdi & Lima (2016).

Table 2
BrF_Score Signals - Value Stocks (Quarterly)

Signals	Description	How to Interpret	Foundation
First Signal (F1)	Return on Assets (ROA)	Equals 1 if ROA is positive, equals 0 otherwise.	Indicates changes in the company's ability to generate profits relative to assets over time.
Second Signal (F2)	ROA Cashflow	Equals 1 if ROA Cashflow is positive, equals 0 otherwise.	A broader perspective on financial performance.
Third Signal (F3)	ROA Variation	Equals 1 if the variation is positive, equals 0 otherwise.	Changes in the company's ability to generate profits relative to assets over time.
Fourth Signal (F4)	Accrual	Equals 1 if Accrual is negative, equals 0 otherwise.	Recognition of revenues or expenses that have not yet been paid or received in cash.

Fifth Signal (F5)	Long-Term Debt Variation	Equals 1 if the variation is negative, equals 0 otherwise.	Changes in the company's indebtedness, affecting its capital structure and repayment capacity.
Sixth Signal (F6)	Current Liquidity Ratio Variation	Equals 1 if the variation is positive, equals 0 otherwise.	Changes in the company's ability to meet short-term obligations.
Seventh Signal (F7)	Stock Issuance	Equals 1 if the company has issued shares, equals 0 if no issuance occurred.	Volume of shares issued, affecting the company's ownership structure and capital.
Eighth Signal (F8)	Gross Margin Variation	Equals 1 if the margin increases, equals 0 otherwise.	Operational efficiency, indicating sales profitability.
Ninth Signal (F9)	Inventory Turnover Variation	Equals 1 if turnover is positive, equals 0 otherwise.	Operational efficiency, indicating the speed of product turnover.

Source: Prepared by the authors based on Piotroski (2000) and Galdi & Lima (2016).

Based on the variables presented, we employed three investment strategies. The first strategy involves buying and selling value and growth stocks, respectively, based on SUE. The second strategy entails buying and selling *BrG_Score* or *BrF_Score* stocks with strong and weak fundamental signals, respectively. On the other hand, the final strategy combines positive SUE and strong *BrG_Score* or *BrF_Score* in a long position, with negative SUE and weak *BrG_Score* or *BrF_Score* in a short position.

Through these strategies, we tested x possibilities: buying and selling value and growth stocks, respectively, with positive SUE (1st and 2nd quarters); buying and selling value and growth stocks, respectively, with negative SUE (1st and 2nd quarters); buying strong *BrG_Score* and selling weak *BrG_Score* (1st and 2nd quarters); buying weak *BrG_Score* and selling all *BrG_Score* scores (1st and 2nd quarters); buying strong *BrG_Score* and selling all *BrG_Score* scores (1st and 2nd quarters); buying strong *BrF_Score* and selling weak *BrF_Score* (1st and 2nd quarters); buying weak *BrF_Score* and selling all *BrF_Score* scores (1st and 2nd quarters); buying strong *BrF_Score* and selling all *BrF_Score* scores (1st and 2nd quarters); buying positive SUE with weak *BrG_Score* and selling negative SUE with weak *BrG_Score* (1st and 2nd quarters); buying positive SUE with neutral *BrG_Score* and selling negative SUE with neutral *BrG_Score* (1st and 2nd quarters); buying positive SUE with strong *BrG_Score* and selling negative SUE with strong *BrG_Score* (1st and 2nd quarters); buying positive SUE with strong *BrG_Score* and selling negative SUE with weak *BrG_Score* (1st and 2nd quarters); buying positive SUE with weak *BrF_Score* and selling negative SUE with weak *BrF_Score* (1st and 2nd quarters); buying positive SUE with neutral *BrF_Score* and selling negative SUE with neutral *BrF_Score* (1st and 2nd quarters); buying positive SUE with strong *BrF_Score* and selling negative SUE with strong *BrF_Score* (1st and 2nd quarters); buying positive SUE with strong *BrF_Score* and selling negative SUE with weak *BrF_Score* (1st and 2nd quarters).

3.3 Calculation of Quarterly Returns and Construction of Models

Using the variables SUE, M/B, *BrF_Score*, and *BrG_Score*, the performance of the portfolios was evaluated with the help of Quarterly Returns. To calculate the Quarterly Return, the reference dates proposed by Galdi and Lima (2016) were used: first quarter (May 15 of the reference year); second quarter (August 15 of the reference year); third quarter (November 15 of the reference year); fourth quarter (March 31 of the year following the reference year). The choice of these dates is based on the premise of the moment when investors have access to the accounting and financial information of the respective quarter. Therefore, SUE is estimated starting from the mentioned dates, considering one and two quarters ahead of the standardized dates.

The calculation of the quarterly return was performed as seen in Chordia *et al*. (2009), where $Price_{t+n}$ represents the closing price of the stock recorded in year *t+n* of the sample, and $Price_n$ indicates the price recorded in year *n*. With this formula, it is possible to capture the effect of PEAD (Post-Earnings Announcement Drift) for one and two quarters after the earnings announcement of a given entity. The formula can be seen below:

$$Quarterly\ Return = \left(\frac{Price_{t+n}}{Price_n} - 1\right) x\ 100 \quad (3)$$

We emphasize that all the returns mentioned here were calculated individually for each stock in the sample. Consequently, these results were grouped into equally weighted portfolios, representing the average return of the buy and sell strategies (based on SUE, M/B, *BrF_Score*, and *BrG_Score*). Further details about the buy and sell strategies will be presented in the following section, totaling eighteen strategies, each of which is tested using the *Student's t* for mean differences (see Tables 3 to 9).

As a research method, both panel regression and tests of the mean quarterly returns were employed. Initially, through the application of regression, the relationship between PEAD and the returns of growth and value stocks was estimated:

$$R_{i,t+r\ (growth)} = \beta_O + \beta_1(q_{sue}) + \beta_2\left(q_{BrG\_Score}\right) + \beta_3\left(q_{sue}\ x\ q_{BrG\_Score}\right) + \varepsilon_{i,t} \quad (4)$$

$$R_{i,t+r\ (value)} = \beta_O + \beta_1(q_{sue}) + \beta_2\left(q_{BrF\_Score}\right) + \beta_3\left(q_{sue}\ x\ q_{BrF\_Score}\right) + \varepsilon_{i,t} \quad (5)$$

These models are justified by the accumulated knowledge from studies by Piotroski (2000), Mohanram (2005), Yan and Zhao (2011), Galdi and Lima (2016), and Sun and Weng (2023), as we observe the connection between growth and value stocks with SUE (the variable that estimates PEAD), in addition to the fundamental indicators of the respective stocks. In this framework, $R_{i,t+r}$ (dependent variable) represents the quarterly stock return for the first and second quarters. Regarding the independent variables, q_{sue} expresses the SUE deciles, while q_{BrG_Score} and q_{BrF_Score} are variables that classify growth and value stocks,

respectively, according to fundamental criteria. Furthermore, $q_{sue}\ x\ q_{BrG\_Score}$ and $q_{sue}\ x\ q_{BrF\_Score}$ are multiplicative interaction variables of the model.

This study used panel data, with three main models being employed: Pooled (Chow Test), Fixed (Breusch-Pagan Test), and Random (Hausman Test). Through tests described in Gujarati and Porter (2011), the most recommended model was the Random Effects model, considered the most robust among the three (already corrected for autocorrelation and heteroscedasticity issues in the error term). Another statistical test used to obtain the results was the mean difference test, called the *Student's t*, which aimed to test whether the samples had equal or different means, considering two independent groups.

4 ANALYSIS AND DISCUSSION OF RESULTS

4.1 Buy and Sell Strategies

The results presented in Section 4 are based on the assumption that there is a buying strategy and a selling strategy, tested using the *Student's t*. As an example, the Strong-Weak strategy assumes that the investor acquires companies with strong fundamental criteria and sells companies with weak fundamental criteria. Therefore, the difference between the bought and sold portfolios is reflected in the average return.

In Table 3, the strategy combining earnings surprise (measured by SUE) with the selection of value and growth stocks was examined.

Table 3
Statistics of Results (SUE x M/B Quintile)

SUE Classification		M/B Quintile				
		Value	Neutral			Growth
		1	2	3	4	5
Negative SUE	Cumulative Return of the 1st Quarter(%)	5.615	3.238	2.891	3.736	-1.726
	Cumulative Return up to the 2nd Quarter(%)	2.652	-0.388	2.621	6.836	-0.024
	Observations	199	290	258	218	175
Neutral SUE	Cumulative Return of the 1st Quarter(%)	15.660	8.211	5.205	5.509	1.125
	Cumulative Return up to the 2nd Quarter(%)	20.915	15.986	15.249	15.862	13.726
	Observations	259	275	288	293	278
Positive SUE	Cumulative Return of the 1st Quarter(%)	13.053	14.519	9.985	8.977	10.273
	Cumulative Return up to the 2nd Quarter (%)	29.845	22.830	22.521	23.423	20.753
	Observations	200	222	298	308	189

Student's t (Cumulative Return of the 1st Quarter, Negative SUE, Value x Growth)	
Mean (%)	3.0950
T-statistic	0.937
p-value	0.349
Student's t (Cumulative Return up to the 2nd Quarter, Negative SUE, Value x Growth)	
Mean (%)	3.115
T-statistic	0.718
p-value	0.473
Student's t (Cumulative Return of the 1st Quarter, Positive SUE, Value x Growth)	
Mean (%)	2.329
T-statistic	0.762
p-value	0.449
Student's t (Cumulative Return up to the 2nd Quarter, Positive SUE, Value x Growth)	
Mean (%)	7.311
T-statistic	0.883
p-value	0.378

Notes: The results presented in Table 3 illustrate the cumulative returns of stocks for the first and second quarters, meaning that the second quarter's return takes into account the values accumulated over the first and second quarters.
Source: Research results.

In the horizontal analysis of Table 3, according to the data presented, when impacted by good news, value stocks outperform growth stocks in terms of return by 6.30% (13.05% - 10.27%) in the first quarter and 9.09% (29.84% - 20.75%) in the second quarter. Additionally, in the case of negative news, value companies also performed better, both in the first quarter, 7.33% (5.61% + 1.72%), and in the second quarter, 2.67% (2.65% + 0.02%). However, there is a scenario where value stocks underperform growth stocks. Comparing the fourth quintile with the first quintile in negative SUE, value stocks show a performance of -4.18% (2.65% - 6.83%) in the average return for the second quarter.

From a vertical analysis, it is noted that almost all the portfolios listed, whether value, neutral, or growth, tend to increase returns as investors gain access to better news. In other words, building a strategy that buys on positive surprises and sells on negative surprises yields significant returns, both for value and growth stocks. In numerical terms, the mentioned operations would generate a return of 24.22% (25.17% - 0.95%) and 20.89% (30.19% - 9.30%) over two quarters for value and growth stocks, respectively.

The superior performance of value stocks compared to growth stocks aligns with other empirical evidence, as seen in Galdi and Lima (2016) and Yan and Zhao (2011). For investment purposes, these results suggest that to maximize portfolio returns, investors should maintain a long position in value stocks and a short position in growth stocks, although the lack of statistical significance may cast doubt on the model. In this case, in the Fama and French (1992) analysis, value firms have higher returns because they are riskier. The portfolios listed here show that this risk is associated with high returns. In other words, the investor would allocate their

capital to a very risky investment with a higher probability of return, although these stocks are typically from companies with financial problems, low profitability, and poor prospects. Furthermore, the evidence from Sun and Wen (2023) shows that including M/B as a way to control SUE maximizes PEAD, especially in value companies, which is also observed in this study, as shown in Table 3. However, the mere division of portfolios into value and growth stocks may bias the analysis. For this reason, Piotroski (2000) and Mohanram (2005) proposed the adoption of fundamental criteria for growth and value stocks. This stems from the fact that there are companies with good financial indicators, regardless of whether they are classified as growth or value. Therefore, it is necessary to analyze the influence of fundamental variables, as seen in Tables 4 and 5.

Table 4
Return of Growth Stocks with Fundamental Criteria (*BrG_Score*)

BrG_Score	Mean Cumul. Return of the 1st Quarter (in %)	Mean Cumul. Return of the 2st Quarter (in %)	Median Cumul. Return of the 1st Quarter (in %)	Median Cumul. Return of the 2st Quarter (in %)	SD on of the 1st Quarter (in %)	SD on of the 2st Quarter (in %)	Total Obs.
0	7.339	10.431	5.789	12.919	33.622	45.956	15
1	0.809	11.594	-3.297	-3.356	50.217	80.476	52
2	1.107	5.754	-3.354	0.148	32.124	45.965	167
3	3.669	14.479	0.0000	4.160	30.369	52.816	315
4	4.702	13.009	2.985	6.599	26.769	44.504	310
5	7.272	19.573	3.937	9.599	29.775	54.233	277
6	9.946	22.183	5.718	13.138	20.088	41.127	121
7	7.171	8.436	4.048	8.077	20.903	23.481	24
Weak BrG_Score (0 to 2)	1.412	7.628	-3.175	-0.359	37.864	57.262	291
Neutral BrG_Score (3 and 4)	4.218	13.699	1.451	5.641	28.499	48.551	697
Strong BrG_Score (5 to 7)	8.024	19.700	4.473	10.605	26.914	49.586	473
BrG_Score Total	4.891	14.433	1.738	6.339	30.198	50.876	1461
Student's t (Strong-Weak)							
Mean (%)	6.613	12.072					
T-statistic	2.602	2.975					
p-value	0.009	0.003					
Student's t (Weak-All)							
Mean (%)	-3.479	-6.804					
T-statistic	-1.477	-1.884					
p-value	0.141	0.060					
Student's t (Strong-All)							
Mean (%)	3.133	5.267					
T-statistic	2.134	1.995					
p-value	0.033	0.046					

Source: Prepared by the authors.

Considering the data in Table 4, the higher the score of growth stocks, the greater the return tends to be. For comparison purposes, observing growth stocks

with a Strong *BrG_Score* (5 to 7) and a Weak *BrG_Score* (0 to 2), if the investor adopted a buying (selling) strategy for stocks with good (poor) fundamental criteria, respectively, they would accumulate a gain of 6.61% (8.02% - 1.41%) in the first quarter and 12.08% (19.70% - 7.62%) in the second quarter. Comparing the average of strong and weak score stocks, there is sufficient evidence to assert that there is a significant difference in the average returns between the weak and strong groups, given the p-values of 0.96% and 0.31%, both with 95% significance, for the first and second quarters, respectively.

A possible explanation for the higher aggregate return of stocks with strong fundamental criteria compared to weak ones, as confirmed by the Student's t, may be the selection of companies with good accounting and financial indicators, increasing the chances of higher portfolio returns, as empirically shown by Mohanram (2005). This is because buying and selling growth portfolios with good and poor fundamental signals, respectively, increases portfolio returns.

Regarding the Strong-All model, maintaining long positions in companies with strong fundamentals yields returns 3.13% (8.02% - 4.89%) and 5.27% (19.70% - 14.43%) higher than the market average for the first and second quarters, respectively. As for statistical validation, the p-value indicates that, indeed, the average returns are different from zero, confirming the adoption of the strategy.

Table 5
Return of Value Stocks with Fundamental Criteria (*BrF_Score)*

BrF_Score	Mean Cumulative Return of the 1st Quarter (in %)	Mean Cumulative Return of the 2st Quarter (in %)	Median Cumulative Return of the 1st Quarter (in %)	Median Cumulative Return of the 2st Quarter (in %)	Standard Deviation of the 1st Quarter (in %)	Standard Deviation of the 2st Quarter (in %)	Total Observations
0	10.597	20.149	-7.681	2.156	68.909	79.617	18
1	2.535	-0.347	1.994	-1.822	34.477	44.309	44
2	10.818	13.628	3.618	-3.704	66.128	87.638	91
3	11.439	27.150	2.529	9.011	40.846	133.116	136
4	15.922	15.711	4.752	3.968	49.152	59.237	139
5	5.381	15.698	4.000	8.116	30.695	55.618	89
6	17.004	24.062	14.812	14.406	39.467	61.198	80
7	12.763	17.155	2.839	7.077	45.069	50.203	45
8	19.476	22.152	13.629	14.882	27.117	33.464	15
9	22.703	23.514	22.703	23.514	NA	NA	1
Weak BrF_Score (0 to 2)	8.410	10.376	2.778	-3.021	58.912	76.569	153
Neutral BrF_Score (3 to 6)	12.631	20.717	4.677	7.709	41.759	88.335	444
Strong BrF_Score (7 to 9)	14.577	18.488	7.576	11.577	40.874	45.985	61

BrF_Score Total	11.829	18.106	4.199	6.051	46.208	82.641	658
Student's t (Strong-Weak)							
Mean (%)	6.167	8.112					
T-statistic	0.871	0.949					
p-value	0.385	0.344					
Student's t (Weak-All)							
Mean (%)	-3.4196	-7.729					
T-statistic	-0.671	-1.108					
p-value	0.503	0.269					
Student's t (Strong-All)							
Mean (%)	2.747	0.382					
T-statistic	0.496	0.0569					
p-value	0.621	0.955					

Source: Prepared by the authors.

Based on the data in Table 5, in comparative terms, adopting a buying and selling strategy for value stocks with strong fundamental criteria (*BrF_Score* Strong (7 to 9)) and weak fundamental criteria (*BrF_Score* Weak (0 to 2)), respectively, would accumulate a gain of 6.16% (14.57% - 8.41%) in the first quarter and 8.11% (18.48% - 10.37%) in the second quarter. This strategy was confirmed by Piotroski (2000), as the author also noted consistent returns in the strategy of selling and buying value stocks with poor and strong fundamental criteria, respectively.

To correlate PEAD with growth stocks (considering the signals from fundamental analysis – *BrG_Score*), Tables 6 and 7 were developed:

Table 6
SUE x *BrG_Score* (Cumulative Return of the 1st Quarter)

			BrG_Score Classification		
SUE Classification		All companies	Weak (0 to 2)	Neutral (3 and 4)	Strong (5 to 7)
Negative SUE	Observations	393	94	188	111
	Mean (%)	1.304	-2.114	1.809	3.354
	Median (%)	-1.447	-4.665	-0.066	2.504
	Standard Deviation (%)	28.001	34.287	28.583	19.918
Neutral SUE	Observations	571	113	283	175
	Mean (%)	3.375	-0.381	2.247	7.623
	Median (%)	0.000	-4.842	-0.319	2.857
	Standard Deviation (%)	34.019	45.399	30.484	30.482
Positive SUE	Observations	497	84	226	187
	Mean (%)	9.470	7.768	8.694	11.172

	Median (%)	5.734	-0.312	5.599	7.733
	Standard Deviation (%)	26.472	29.178	25.274	26.667
Student's t (Positive and Negative SUE)	Mean (%)	8.167	9.881	6.893	7.818
	T-statistic	6.191	0.636	3.907	6.484
	p-value	7.76E-07	0.525	0.000	2.25e-10
Student's t (Positive SUE and Strong *BrG_Score* with Negative SUE and weak *BrG_Score*)	Mean (%)	13.286			
	T-statistic	3.289			
	p-value	0.001			

Source: Prepared by the authors.

Table 7
SUE x *BrG_Score* (Cumulative Return of the 2st Quarter)

			BrG_Score Classification		
SUE Classification		All Companies	Weak (0 to 2)	Neutral (3 and 4)	Strong (5 to 7)
Negative SUE	Observations	393	94	188	111
	Mean (%)	3.781	-2.327	3.616	9.237
	Median (%)	-0.571	-7.337	-1.535	3.485
	Standard Deviation (%)	40.362	46.483	40.487	33.615
Neutral SUE	Observations	571	113	283	175
	Mean (%)	14.822	7.034	14.768	19.939
	Median (%)	4.274	-1.012	4.316	9.675
	Standard Deviation (%)	58.981	71.415	53.933	57.734
Positive SUE	Observations	497	84	226	187
	Mean (%)	22.408	19.578	20.748	25.688
	Median (%)	13.559	11.785	12.289	15.780
	Standard Deviation (%)	46.689	43.547	46.339	48.493
Student's t (Positive and Negative SUE)	Mean (%)				
	T-statistic	10.843	2.273	7.449	8.641
	p-value	2.2e-16	0.024	2.79E-10	2.2e-16
Student's t (Positive SUE and Strong *BrG_Score* with Negative SUE and Weak *BrG_Score*)	Mean (%)	28.016			
	T-statistic	4.698			
	p-value	4.97e-06			

Source: Prepared by the authors.

Tables 6 and 7 shows the three types of SUE separated by the portfolio of growth companies based on *BrG_Score*. The strategy of buying positive SUE and

selling negative SUE yields returns above zero in any scenario: full sample (8.16%), weak score (9.88%), neutral score (6.89%), and strong score (7.81%). Therefore, initially, the most profitable strategy is to buy positive SUE stocks and sell negative SUE stocks, particularly for growth stocks classified as weak. Regarding the second quarter, the returns were also satisfactory: full sample (10.84%), weak score (2.27%), neutral score (7.44%), and strong score (8.64%).

To correlate PEAD with value stocks (considering the signals from fundamental analysis – *BrF_Score*), Tables 8 and 9 were developed:

Table 8
SUE x *BrF_Score* (Cumulative Return of the 1st Quarter)

			BrF_Score Classification		
SUE Classification		All Companies	Weak (0 to 2)	Neutral (3 to 6)	Strong (7 to 9)
Negative SUE	Observations	199	64	124	11
	Mean	5.615	6.863	4.922	6.177
	Median	1.007	1.133	0.749	6.407
	Standard Deviation	40.869	50.329	36.575	25.354
Neutral SUE	Observations	259	60	182	17
	Mean	15.660	12.944	15.852	23.194
	Median	6.806	3.818	7.134	7.219
	Standard Deviation	52.842	75.337	43.258	53.288
Positive SUE	Observations	200	29	138	33
	Mean	13.053	2.445	15.309	12.937
	Median	4.899	-2.500	5.089	7.717
	Standard Deviation	41.329	33.094	43.488	38.019
Student's t (Positive and Negative SUE)	Retorno Médio (%)	7.437	-4.418	10.388	6.760
	T-statistic	6.567	1.766	6.373	2.785
	p-value	1.04E-07	0.079	4.65E-07	0.0071
Student's t (Positive SUE and Strong *BrF_Score* with Negative SUE and Weak *BrF_Score*)	Mean (%)	6.074			
	T-statistic	0.665			
	p-value	0.508			

Source: Prepared by the authors.

Table 9
SUE x *BrF_Score* (Cumulative Return of the 2st Quarter)

		BrF_Score Classification

SUE Classification		All Companies	Weak (0 to 2)	Neutral (3 to 6)	Strong (7 to 9)
Negative SUE	Observations	199	64	124	11
	Mean	2.652	1.776	2.912	4.813
	Median	-3.704	-11.400	-1.349	-15.608
	Standard Deviation	52.938	64.157	47.229	45.929
Neutral SUE	Observations	259	60	182	17
	Mean	20.915	21.422	19.335	21.067
	Median	7.692	10.854	-1.827	5.375
	Standard Deviation	68.749	59.058	96.952	45.658
Positive SUE	Observations	200	29	138	33
	Mean	29.845	10.822	35.786	21.718
	Median	12.644	2.381	12.087	16.046
	Standard Deviation	1150.825	49.176	1345.546	46.742
Student's t (Positive and Negative SUE)	Mean (%)	27.194	9.045	32.874	16.905
	T-statistic	5.620	1.676	4.942	3.140
	p-value	2.82E-05	0.096	1.1e-06	0.003
Student's t (Positive SUE and Strong *BrF_Score* with Negative SUE and Weak *BrF_Score*)	Mean (%)	19.942			
	T-statistic	1.745			
	p-value	0.084			

Source: Prepared by the authors.

Continuing with the results of this section, Tables 8 and 9 again group the three types of SUE, this time segmented by the portfolio of value companies, represented by *BrF_Score*. In the first quarter, buying positive SUE and selling negative SUE, respectively, does not always yield a return greater than zero: full sample (7.43%), weak score (-4.41%), neutral score (10.38%), and strong score (6.76%). Therefore, the strategy in question may not be profitable if applied to companies with a weak score, while the neutral score delivers the highest profitability. Regarding the second quarter, all returns were greater than zero: full sample (5.62%), weak score (9.04%), neutral score (32.87%), and strong score (16.90%).

As occurred in Tables 6 and 7, only the weak score had a p-value above 5%, indicating that there is insufficient evidence to reject the null hypothesis. For the remaining scores and the full sample, the p-value was below 5%, and consequently, there is sufficient evidence to infer, with 95% confidence, that the portfolio return is different from zero.

Regarding the strategy of buying companies with positive SUE/strong score and selling negative SUE/weak score, the returns were 6.07% in the first quarter and 19.94% in the second quarter, respectively. However, the p-value was above 5% in Tables 8 and 9, lacking robustness to assert that the returns of the comparisons are different from zero.

Considering the results presented, the winning strategy for the first quarter was "Buy Positive SUE and Strong *BrG_Score*" and "Sell Negative SUE and Weak *BrG_Score*," with a return of 13.28%, surpassing any other returns in the same category. For the second quarter, the strategy "Buy Positive SUE - *BrF_Score* (Neutral)" and "Sell Negative SUE - *BrF_Score* (Neutral)" delivered a return of 32.87%, the highest in the respective quarter and among all the tactics tested in this study.

Overall, the results presented show that the strategies in Tables 3 to 5 are not worthwhile, as the strategies in Tables 6 to 9 result in considerably higher returns and, in many cases, with sufficient statistical significance to validate them. These results demonstrate that the inclusion of the *BrG_Score* and *BrF_Score* indicators is important for maximizing portfolio returns. On one hand, Sun and Wen (2023) and Yan and Zhao (2011) succeeded in showing that PEAD intensifies when controlled by the M/B ratio. On the other hand, the addition of fundamental indicators to growth and value stocks, as proposed by Piotroski (2000) and Mohanram (2005), also delivers higher returns. However, the combination of SUE with the M/B ratio, the latter incorporating the fundamental signals *BrG_Score* and *BrF_Score*, delivers the highest return, as seen in Galdi and Lima (2016).

In this research, the fundamental criteria added to growth and value stocks, tested alongside SUE, were crucial for maximizing portfolio returns. Therefore, based on these results, it is not worthwhile to apply the PEAD and growth/value dilemmas separately, as their combination yields much better returns for participants in the Brazilian capital market. Furthermore, PEAD is a good complementary fundamental indicator for composing portfolios with growth and value stocks, as verified in Tables 3 to 5.

4.2 Panel Regression

In this section, the results for the panel regression models are presented. The results are presented sequentially for growth firms (1st and 2nd quarter) and value firms (1st and 2nd quarter).

Regarding the tests used to define the best model (Pooled, Fixed, or Random), for both value and growth stocks, the Random model was the most appropriate within the panel data methodology. Although autocorrelation of the error term was not evidenced, it was identified that the errors were not homoscedastic. Therefore, it was decided to treat the Random models (1st and 2nd quarter) based on robust covariance matrices. The regression results can be seen in Tables 10, 11, 12, and 13.

Table 10
Random Effects Coefficient (Sample of Growth Stocks, 1st Quarter)

	Coefficient	Standard Error	t	p-value
Intercept	0,162	0,039	0,419	0,675
SUE	0,028	0,012	2,310	0,021
BrG_Score	0,008	0,005	1,544	0,123
SUE: BrG_Score	0,000	0,003	-0,156	0,876

Source: Prepared by the authors.

Table 11
Random Effects Coefficient (Sample of Growth Stocks, 2st Quarter)

	Coefficient	Standard Error	t	p-value
Intercept	0,101	0,069	1,449	0,147
SUE	0,040	0,019	2,105	0,035
BrG_Score	0,014	0,008	1,6	0,101
SUE:BrG_Score	0,002	0,004	0,456	0,649

Source: Prepared by the authors.

Analyzing the data, which includes only the sample of growth stocks (for one and two accumulated quarters), the *SUE* strategy delivers the highest return coefficient (2.84%), as expressed in Table 10, being the only one with statistical significance. A peculiarity of this result relates to the negative return of the interactive variable (*SUE:BrG_Score*). At first glance, this result could be used to infer that the combination of the PEAD strategy and growth is not profitable. However, *SUE:BrG_Score* (87.61%) does not have statistical significance, given that its p-value is greater than 5%.

Based solely on the sample relevant to value firms, Tables 12 and 13 were prepared:

Table 12
Random Effects Coefficient (Sample of Value Stocks, 1st Quarter)

	Coefficient	Standard Error	t	p-value
Intercept	0,181	0,098	1,858	0,064
SUE	0,8130	0,049	1,661	0,097
BrF_Score	-0,005	0,014	-0,371	0,711
SUE:BrF_Score	-4,10E-03	0,009	-0,450	0,653

Source: Prepared by the authors.

Table 13
Random Effects Coefficient (Sample of Value Stocks, 2st Quarter)

	Coefficient	Standard Error	t	p-value
Intercept	0,018	0,097	1,858	0,064
SUE	0,081	0,049	1,661	0,097
BrF_Score	-0,005	0,014	-0,37	0,711
SUE:BrF_Score	-4,10E-03	0,009	-0,450	0,653

Source: Prepared by the authors.

Based on the information in Tables 12 and 13, none of the variables showed statistical significance. In general terms, these results indicate that there is no evidence, at the 5% significance level, to infer that the return coefficients are different from zero. Additionally, no statistical evidence was found that PEAD or even the use of the fundamental indicator *BrF_Score* would amplify the accumulated returns over two quarters, considering the context of value stocks.

Although these results did not corroborate the robustness of the tested model, the lack of statistical significance of the regression coefficients contrasts with the findings of Galdi and Lima (2016) for the Brazilian market. The authors also only found significant evidence in the mean return tests. Furthermore, it is worth noting that the model's failure does not invalidate the strategy, as the mean return tests indicated that many strategies showed statistical significance. Therefore, from an empirical perspective, the strategy delivers good performance.

5 CONCLUSIONS

This study aimed to verify whether combining fundamental criteria (related to growth and value stocks) with unexpected earnings surprises (PEAD) can enhance the profitability of a portfolio, covering the period from the first quarter of 1994 to the fourth quarter of 2021 for companies listed or previously listed on B3. To achieve this, the methodologies proposed by Piotroski (2000), Mohanram (2005), Chordia *et al*. (2009), Yan and Zhao (2011), and Galdi and Lima (2016) were used. Additionally, the final sample of this study included 309 companies and 3,750 observations. Initially, it was necessary to estimate the SUE, a variable representing the PEAD anomaly, and the M/B ratio, used to classify companies as growth or value.

In this context, it was found that the combination of the two anomalies (PEAD and growth/value, using fundamental signals) delivered the highest returns tested in this study, both for the first quarter and the cumulative returns up to the second quarter, validated by the mean test. This contribution highlights the importance of estimating the effect of PEAD while controlling for other variables, as seen in Yan and Zhao (2011) and Sun and Wen (2023). Furthermore, this work complements that of Galdi and Lima (2016), particularly by demonstrating the relevance of fundamental indicators in combining PEAD with the M/B ratio.

As this study aimed to be useful to financial market participants, it is believed that the results presented here are important in highlighting the relevance of PEAD combined with growth/value, especially for long-term investors seeking a systematic approach based on accounting data to structure their portfolios and plan periodic investments over time through the application of "filters" that facilitate the selection of the best stocks to buy/sell. However, it must be acknowledged that not all investors have access to databases with the necessary variables to calculate the fundamental signals for growth and value stocks, as well as the other variables mentioned here. Nevertheless, this limitation does not invalidate the strategy's effectiveness.

The first strategy tested, involving buying positive SUE and selling negative SUE, proved profitable and significant at a 95% confidence level, both for the first and second quarters. However, the second strategy, based on acquiring negative/positive SUE for value stocks and selling negative/positive SUE for growth stocks, did not achieve statistical significance, even though the returns were positive.

In the third strategy, a portfolio was constructed by buying stocks with good fundamental criteria and selling those with poor fundamental criteria, both for *BrG_Score* and *BrF_Score*. In this scenario, the tactic proved profitable and

statistically robust at a 95% confidence level. Regarding the fourth and final strategy, which combines BRG and BRF with SUE, it was also fruitful in 75% of cases.

While the results of the combined strategy were mostly statistically significant, the same cannot be said for the significance of the panel regression econometric model. Even when the bias of heteroscedasticity was mitigated by robust covariance matrices, no variable proved statistically robust. This result was also evidenced by Galdi and Lima (2016).

Another limitation of this research was the disregard for transaction costs in the return calculation, something other researchers have also done, as seen in Yan and Zhao (2011) and Galdi and Lima (2016), as well as the absence of control variables for economic/pandemic crises. For future work, it should be noted that this study is only the second to analyze the combination of PEAD and growth/value anomalies in the Brazilian capital market. In this context, new investigations in other emerging markets (especially in Latin America and Asia) can be conceived, along with extending the time horizon and addressing the limitations (such as the absence of transaction costs and variables measuring the impact of crises on returns) present in this study.

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