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WOMEN'S PRESENCE ON THE BOARD OF DIRECTORS AND STOCK RETURNS: AN EVENT STUDY IN THE BRAZILIAN MARKET

VITOR FONSECA MACHADO BELING DIAS[1]
Universidade Federal de Uberlândia
https://orcid.org/0000-0001-6084-5599
vitorfonsecabeling@gmail.com

RODRIGO FERNANDES MALAQUIAS
Universidade Federal de Uberlândia
https://orcid.org/0000-0002-7126-1051
rodrigofmalaquias@yahoo.com.br

JOSÉ EDUARDO FERREIRA LOPES
Universidade Federal de Uberlândia
https://orcid.org/0000-0001-5504-3321
jeflopes@ufu.br

ABSTRACT

Using an event study, the main purpose of this paper was to analyze whether the presence of women on the Board of Directors (BoD) of companies impacts the return of their shares. We collected data on the composition of the BoD on the website of the Brazilian Securities and Exchange Commission (CVM), and financial data were collected from the Economática Database. Considering the events as a whole, no significant effect of disclosure on stock returns was observed (for the individualized analysis, by stock, a significant effect was observed only in some cases in the event window). The paper is relevant in contributing to the literature on gender diversity in Finance, specifically concerning studies addressing the presence of women in the BoD. This research also highlights the semi-strong aspect of the Brazilian stock market, considering the theory of market efficiency.

Keywords: Women Presence. Board of Directors. Event Study. Stock Returns. Market Efficiency Hypothesis.

1 INTRODUCTION

In contemporary times, aspects related to gender diversity have been discussed in various fields of study. In Finance, this topic is addressed in Corporate Governance studies, mainly through the study of the presence of women on the Board of Directors (BoD) of companies (Kirsch, 2018).

Part of the literature uses the presence of women in the BoD as a proxy for gender diversity in companies (Kirsch, 2018; Tahir et al., 2020). This proxy can be measured in different ways.

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[1] **Correspondence address:** Avenida João Naves de Ávila, 2121 | Santa Mônica | 38408-100 | Uberlândia/MG | Brazil.

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Two widely used forms are dummy variables with value 1 in case the company has at least one woman in the BoD in the period the work was done and zero if there is not (Brahma et al., 2021; Loukil et al., 2019; Jizi & Nehme, 2017), and also the percentage of women in the BoD (Mustafa et al., 2020; Tahir et al., 2020; Nadeem et al., 2019). Some studies measure this variable in the two ways mentioned above (Dobija et al., 2022; Dani et al., 2019; Nadeem et al., 2019).

Regarding the studies analyzing the effects of the presence of women in the BoD, in general, there are two different views: (i) part of the studies indicate that men and women lead similarly (Gipson et al., 2017) and that the gender of a new member of the BoD will have an irrelevant effect on stock returns (Wolfers, 2006; Chapple & Humphrey, 2014); (ii) another part of the literature, according to Sanford and Tremblay-Boire (2019), shows that there is a prejudice against women in leadership positions, and this remains an obstacle to effective participation in the BoD (Sanford & Tremblay-Boire, 2019; Eagly & Karau, 2002).

The implications of studies analyzing the impact of the presence of women in the BoD are divergent. Some studies have found a positive impact of this aspect relative to the organization's performance (Khan & Vieito, 2013; Rossi et al., 2017; Dani et al., 2019). Others have shown a negative relationship (Lee & James, 2007; Darmadi, 2013), while others have not found statistical significance (Wolfers, 2006; Chapple & Humphrey, 2014).

In research in Finance, the event study methodology contributes to investigating possible effects related to market expectations regarding certain events in stocks or the return of companies (Lin et al., 2016). Previous studies have shown, through the event study, that the disclosure of relevant information can interfere with stock returns. For example, the news of possible involvement in corruption can affect stock returns negatively (Dias & Malaquias, 2021). The Brazilian stock market may react concerning the change in the companies' dividend policy (Moreiras et al., 2012). In addition to that, Sanford and Tremblay-Boire (2019) showed that, after the period a woman joins the BoD, the investor's reaction is negative and statistically significant (in the two days following the disclosure of the information, and this effect dissipates over longer periods; in this case in a window greater than 30 days).

Considering that the dissemination of relevant news can significantly impact stock returns (Moreiras et al., 2012; Lin et al ., 2016; Dias & Malachias; 2021), and also considering divergent results from previous studies related to the presence of women in the BoD, which can have a positive impact on performance (Khan & Vieito, 2013; Rossi et al., 2017; Dani et al., 2019) negative (Lee & James, 2007; Darmadi, 2013) or neutral (Wolfers, 2006; Chapple & Humphrey, 2014), and the possibility of appointing women to the BoD having statistical significance in the stock returns (Sanford & Tremblay-Boire, 2019), the research question that guides this study is the following: what is the impact of the disclosure of information on the presence of women on the Board of Directors in the stock returns of Brazilian companies? Thus, the study aims to investigate the effect of the disclosure of information on the presence of women in the BoD on the stock returns of Brazilian companies.

This study used data related to the returns of Brazilian stocks traded on the Brazilian stock exchange (B3), and the methodological procedure used to achieve the proposed objective was the event study, followed by a robustness test also involving the volatility of stock returns. Data on the composition of the BoD was collected on the Brazilian Securities and Exchange Commission (CVM) website, and the quotations of the stocks were collected from the Economática Database.

This study advances the literature by adopting a new perspective of analysis to identify the impact of one of the aspects of gender diversity in the BoD, considering that it considers the effect of disclosure on stock prices. The article also shows that the presence of women in the BoD proved to be an expected event in the market (or at least already priced previously), and according to EMH, this event generally did not impact the price of stock within the terms evaluated in this research.

2 THEORETICAL BACKGROUND

2.1 Gender Diversity

Studies on gender diversity have gained great relevance in Corporate Governance and Corporate Finance studies. Several countries, mainly in Europe (e.g., France, Finland, Italy, Spain, Norway, and the Netherlands), have implemented quotas for women's participation in the BoD. In contrast, other nations have adopted voluntary recommendations and guidelines to promote a greater presence of women in higher hierarchy positions in companies (Chapple & Humphrey, 2014).

Studies that involve analyzing the gender impact of a new member of the Board of Directors (BoD), in general, address two different views. Part of the literature states that men and women lead similarly and tend to be comparatively effective so that the gender of a new member of the BoD will have an irrelevant effect on the stock returns so that a possible "shock" of the information of presenting a new board member is the same (Sanford & Tremblay-Boire, 2019). On the other hand, according to Sanford and Tremblay-Boire (2019), part of the literature indicates that prejudice towards women in leadership positions remains an obstacle and that, in some cases, they are "penalized" for these perceptions.

In Finance, leadership effectiveness is usually measured through variables related to the company's financial performance. That means good managers can show good indicators to the market, such as return on assets (ROA) and return on equity (ROE), Tobin's Q, and stock returns (Gipson et al., 2017; Hoobler et al., 2018).

Studies that seek to identify the gender impact of the *Chief Executive Officer* (CEO) on the company's performance have shown mixed results, depending on the measures and methodology used (Hoobler et al., 2018). Wolfers (2006), for example, found no differences in stock returns for women-headed companies in the United States. The work of Lee and James (2007) prepared an event study and identified a negative relationship between the appointment of women to the CEO position in US companies and the stock returns.

Other studies use variables in addition to stock returns to portray the company's performance. In the US, Khan and Vieito (2013) showed that having a female CEO is associated with a higher ROA. Rossi et al. (2017) showed that the presence of women in the BoD was associated with better operational performance (EBITDA) of Italian companies. In Brazil, Dani et al. (2019) showed that in a diversified BoD, in terms of gender, the monitoring of managers can be more effective, and the performance (measured by ROA and ROE) of these companies can be positively impacted.

Post and Byron (2015) analyzed results from 140 studies. They showed that the female presence in the BoD is positively related to the accounting returns of companies, and this relationship is stronger in countries with greater shareholder protections. Terjensen et al. (2016) prepared a study that considered 47 countries (including Brazil) and more than three thousand publicly-traded companies. They identified that the presence of women on the board of directors contributed to the increase in the performance of companies, and they measured performance using ROA and Tobin's Q (Terjensen et al., 2019).

Dobija et al. (2022) analyzed facilitators that allow women to add more value to monitoring activities regarding affirmative actions to promote women in the BoD in companies in Poland. The authors showed that the increased participation of women in the BoD is positively associated with improved financial reporting quality, punctuality of reports, results management, and auditors' opinions.

For Mexican companies, Quintero et al. (2018) showed in their study that the presence of women in the BoD had a negative impact on corporate indebtedness. The authors did not show statistical significance regarding profitability, measured at work by ROA. In a study of Indonesian companies, Darmadi (2013) found a negative effect of female representation on accounting

performance and the market. This result can be explained in part by the country's culture, which is less gender-equal. Chapple and Humphrey (2014) used the CAPM methodology. They analyzed the three hundred most traded companies on the Australian stock exchange and did not show statistical significance between gender diversity in the BoD and company returns. Table 1 below summarizes the main information of some of the studies mentioned on the topic.

Table 1

Summary of previous studies

Authors	Country where the study was conducted	Database	Method	How gender diversity was measured	Variable Dependent	Main Result
Chapple & Humphrey (2014)	Australia	S&P/ASX 300	CAPM	Number of women in the BoD	Stock returns (CAPM)	They did not find statistical significance between the presence of women in the BoD and performance.
Dani et al. (2019)	Brazil	Non-financial companies of IBX-100 (B3), Economática, and CVM.	Panel Data Regression	Dummy variable - [With value 1 if the company has at least one woman in the BoD, and zero otherwise. Percentage of women in the BoD.	Economic performance (ROA and ROE). Financial Performance (Return on sales, indebtedness, return on dividends, market to book, and Tobin's Q).	A positive and statistically significant relationship was identified regarding the mediation of gender diversity and Corporate Governance indicators relative to the economic and financial performance of the companies analyzed.
Damardi (2013)	Indonesia	Indonesia Stock Exchange	Cross-section regression	Proxies of gender diversity – the percentage of women in the BoD, presence of women in the BoD (dummy), gender heterogeneity index (Blau index)	ROA and Tobin's Q	Negative and statistically significant relationship of gender diversity (dummy) relative to ROA (Proportion of women and Blau index without significance). Concerning Tobin's Q, the three gender diversity proxies were negative and statistically significant.
Dobija et al. (2022)	Poland	Financial data of the WSE (Polish Stock Exchange) and data on the BoD at Notoria Service (database with current and historical data on members of the board of directors and supervision)	Linear regression with fixed effects and data in unbalanced panel and GMM model.	Dummy variable - [With value 1 if the company has at least one woman in the BoD, and zero otherwise. Percentage of women in the BOD.	Financial reporting quality (FRQ) – the authors used the end of the company's fiscal year and the end date of the audit opinion to perform this proxy, based on the companies' financial statements	They showed that the increased participation of women in BoDs is associated with improved quality of financial reports, presenting, for example, greater punctuality of reports, better earnings management and better opinions of auditors.
Khan & Vieito (2013)	United States	Standard and Poor's ExecuComp	Panel Data Regression (unbalanced)	Dummy variable (with value 1 if CEO is female, and zero otherwise).	LN (Total Compensation) – Directors' bonus; adjusted ROA; LN (BS Volatility) – standard deviation of returns	Companies with female CEOs showed better performance compared to companies run by male CEOs.
Lee & James (2007)	United States	Announcements of executives in leadership positions (CEO, CFO, COO, president, and vice-president)	Study of events	Dummy variable (with value 1 for women in the aforementioned positions, and	Stock returns	Announcements of female CEO appointments generate more negative reactions (relative to stock returns) than

		published in media outlets. Financial data (stock returns) were obtained from the Center for Research in Securities Prices (CRSP)		zero otherwise).		male CEO appointments.
Quintero et al. (2018)	Mexico	They built a database, through the accounting reports of the publicly-held companies of the Mexican Stock Exchange	Logit regression and unbalanced panel data with fixed effects	Dummy variable - [With value 1 if the company has at least one woman in the BoD, and zero otherwise. Percentage of women in the BoD.	Indebtedness (total liabilities/total assets) and performance (ROA)	They found a negative effect between the presence of at least one woman in the BoD and indebtedness (total liabilities/total assets). For performance (ROA) there was no statistical significance
Rossi, Galasso, & Capasso (2017)	Italy	They built a dataset from a random sample of 154 companies listed on the Italian Stock Exchange	Cross-section regression	Percentage of women in the BoD.	ROE, Price book Value, EBITDA	Positive and significant relationship between the presence of women in leadership and performance positions and the position held also impacts this relationship.
Sanford & Tremblay-Boire (2019)	United States	Wharton Research Data Services (WRDS), BoardEx, Center for Research in Security Prices (CRSP)	Study of events	Entry of a woman in the BoD (considering this event as a zero date)	Stock returns (CAPM)	Immediately after the women join a BoD (5-day event window, in the two days after the zero date), investors' reaction is negative and statistically significant, a statistical relationship that was not evidenced in relation to the disclosure of new men in the BoD. However, the differences dissipate for a window of events with a longer term (more than 30 days).
Terjensen et al. (2016)	47 countries		GMM model	Percentage of women in the BOD.	Tobin's Q and ROA	A positive and significant relationship between the number of women in the BoD and performance
Wolfers (2006)	United States	S&P 1500 (Execucomp data showing women in CEO positions). Stock returns - CRSP	Relationship between the presence of women and performance: Cross-section regression; Stock returns: Fama and French Three-Factor Model	Percentage of companies with women CEOs in the month	Stock returns	They did not show statistical significance among women in the CEO position and return of companies' stocks.

Source: Prepared by the authors.

2.2 Event Study, Market Efficiency, and Corporate Governance

EMH considers that market participants price assets based on all available information on events with the potential to influence the return of the asset in question. Based on market behavior, the theory classifies the three forms of efficiency: Weak, Semi-strong, and Strong (Fama, 1970).

In Finance, the event study methodology contributes to analyzing possible implications related to market expectations regarding certain events in stocks or the return of companies (Lin et al., 2016).

The methodology of an event study is usually linked to EMH. According to this theory, trading stocks in the financial market based on public information may not bring greater benefits than its costs (Fama, 1970; 1991), as this information would already be priced.

The weak form of efficiency argues that securities traded in the market reflect all past information related to that asset. The semi-strong form shows that prices reflect past behavior and can also absorb information to be published according to market expectations. Finally, the strong efficiency form states that asset prices reflect public and private information, which can be obtained through privileged information (Fama, 1970; Mussa et al., 2008).

According to EMH, in asset trading in the financial market, given the competition between the various participants in any period, the actual prices of the securities already reflect the effects of information both of events that have already occurred and events that the market expects to occur (Fama, 1965; 1970). Thus, it would not be possible to obtain abnormal returns by observing the occurrence of certain events, as asset prices would follow a random walk so that the information would already be reflected in the current stock price (Fama, 1965).

Duarte and Pérez-Iñigo (2014) identified that in Brazil, EMH in the weak form increased in recent years, mainly from 2007 onwards. Duarte et al. (2015) conducted a study comparing the randomness of markets for Brazil, Mexico, and the United States and, based on EMH, identified that market efficiency in Brazil and Mexico increased from 2000 onwards, opposing the idea that emerging markets tend to be less efficient. Duarte et al. (2015) also showed that, in Mexico and Brazil, the randomness of the main indices of the respective stock exchanges has increased in recent years, aided, among several factors, by the greater liquidity of these markets.

Previous studies investigated applications of EMH concerning Corporate Governance in Brazil. Medeiros (2016) indicated that the return required by the Brazilian stock market relative to companies at special levels of Corporate Governance earns a negative risk premium. The author showed that the stock market positively prices the differentiated levels of Corporate Governance, for example, reducing the cost of capital, which would be a sign of market efficiency applied to this market in the semi-strong form.

In line with the semi-strong form of the market for the Brazilian context, Batista et al. (2018) aimed to analyze whether the presidential impeachment occurred in Brazil in 2016 in three different periods and provided an expected reaction from the stock market at B3. Given three distinct dates on three events considered important that culminated in impeachment, the authors did not reject the study hypothesis that abnormal returns and cumulative abnormal returns were equal to zero, which, according to the researchers, was evidence that the markets were well-informed about the events, and that, according to the EMH in its semi-strong form, the markets had a reaction that was expected.

Oliveira Neto et al. (2012) indicated that a better level of Corporate Governance in Brazilian companies reduces the costs associated with incorporating new information into asset prices. Thus, companies with a higher level of Corporate Governance would have a higher speed of information incorporation than companies in the traditional market. The authors also mentioned that the results obtained did not indicate a violation concerning EMH since, possibly, by adopting clearer rules, companies with a higher level of Corporate Governance enable more efficient monitoring by analysts regarding the implications of relevant facts.

In Brazil and other countries, previous studies have already identified aspects of EMH related to Governance issues (Duarte and Pérez-Iñigo, 2014; Duarte et al., 2015; Medeiros, 2016). Another point much explored in the literature is the impact of the disclosure of relevant information on stock prices and returns, for example, the impact of the disclosure of the change in the dividend policy (Moreiras et al., 2012); possible involvement of the company in cases of corruption (Dias and Malachy, 2021); and the presence of women in the BoD (Sanford & Tremblay-Boire, 2019).

2.3 Disclosure of Information and Impact on Prices

The study by Savor (2012) showed that investors react little to news about the company's fundamentals and overreact to shocks that move stock prices, stating, for example, that price changes based on the information are more strongly correlated with news that surprises relative to future profits compared to price changes in relation to the prospect of future profits without the disclosure of information.

Sanford and Tremblay-Boire (2019) showed that, after the period a woman joins the BoD, the investor's reaction is negative and statistically significant in relation to the five-day event window. In this case, in the two days following the disclosure of this information, which does not occur when a new man joins the BoD. However, this evident difference dissipates for a longer event window (30 days and 90 days, according to the authors).

Some events in the stock market that concern issues related to Corporate Governance may impact the stock returns, and studies that used event studies have already shown aspects in this regard for Brazil. Dias and Malaquias (2021) showed, through an event study, that the disclosure of news of potential involvement in corruption cases by Brazilian companies traded on B3 had a negative impact on their return.

Moreiras et al. (2012) showed that the Brazilian stock market reacts more strongly relative to changes in the dividend policy of the traditional market compared to companies listed in the New market segment, which led to the conclusion that in these cases (traditional market companies) the information asymmetry is greater in relation to those of the New market.

Considering the different results among gender diversity in the BoD (Lee & James, 2007; Khan & Vieito, 2013; Chapple & Humphrey, 2014; Rossi et al., 2017), and that the disclosure of information related to Corporate Governance can impact stock prices (Epstein & Schneider, 2008; Moreiras et al., 2012; Savor, 2012; Dias & Malaquias, 2021), the hypothesis that guides this study is as follows:

H1: The disclosure of information regarding the presence of women in the BoD has a statistically significant impact on the stock returns of Brazilian companies.

Thus, through an event study, this research seeks to analyze whether the presence of women on the Board of Directors of Brazilian companies impacts the stock returns, measured by the difference between abnormal and normal returns, as will be detailed in the methodology. The presence of women was evaluated based on a *dummy* variable and, in robustness analysis, based on the percentage of women who are part of the BoD. The next section details the methodology and criteria used to perform the H1 test.

3 METHODOLOGY

The event study methodology allows comparing the effective stock returns and the expected return, evidencing if there was any abnormal return that can be related to the occurrence of any relevant event. If any significant abnormal return is observed, it is possible to conclude that such events were important for stock returns (Miari et al., 2015; Matsumoto et al., 2018). The event study considers an objective hypothesis to analyze whether any event impacted a certain stock at a certain time in a period close to the occurrence of the event studied (Camargos & Barbosa, 2003).

This study considered observations for the period between 2017 and 2022. Data collection on the composition of the BoD was conducted on the CVM website in the area of automated receipt of documents (RAD) from listed companies. Item 12 (Meeting and Management) and sub-item 12.5/6 (Composition and professional experience of management and the Fiscal Council) of the

companies' reference report were considered for analysis, in addition to the report's publication date. For resubmitted reports, the most current date was considered. The subsequent tabulation of the data was done with the aid of the *Phyton* programming language, which allowed to automate the filling of the spreadsheets with greater agility and precision compared to a fully manual collection of a high volume of data for analysis. The financial data of the stock price and the Ibovespa price collected in the Economática Database were used. After the union of the two databases through the code of stocks, the software used for conducting the event study was *Stata* version 14.1.

3.1 Event Study

Campbell et al. (1997) described the procedures for an event study, which are in this order: (i) Definition of the event, (ii) Definition of the criteria for selecting the events, calculation of normal and abnormal returns, (iii) Procedures for estimating abnormal returns, (iv) Test procedures, (v) Analysis of empirical results.

Following this methodology, the event of interest of this study was defined as the disclosure of the reference reports by the companies to CVM, in which the companies disclose information relevant to the market, among them the members of the BoD. In cases where the companies sent more than one report per year, only the most recent report was considered. This methodological choice considers formal reports and information mandatory but also has limitations since information on the board's composition (or change in composition) may have been disclosed in the market through another communication channel. There is also other information about BoD members, such as academic background, professional experience, and date of birth; this research focuses on the presence of women in the BoD. The use of the most recent report date also represents a limitation of the study, as the information may have been brought to market earlier. Using other sources to identify the date of the first publication of the report could bring other limitations to the study, so it was decided to use the date that was available at the time of collection (i.e., the date of the last report sent).

The study classified as *dummy* variables the companies that had at least one woman in the BoD, being "value one" for companies with at least one woman in the BoD and "zero" value for companies without women in the BoD in the year analyzed, particularly on the analyzed date. This classification was made to analyze whether the disclosure of the reference report had any significant effect on companies with some degree of gender diversity in the BoD. Using a *dummy* variable to identify whether the company has at least one woman in the BoD and its application as a gender diversity *proxy* is supported in the Finance literature (Ahmed & Atif, 2021; Dobija et al., 2022). A robustness analysis also considered the percentage of women who are part of the BoD.

Next, it was evaluated whether there was an "abnormal" return on the report's publication date (as well as in the event window). Finally, the abnormal return of events in companies with women on the board was compared with the abnormal return of events in other cases. The event window is the period that includes a period before and after the analyzed event to make it possible to compare the stock returns relative to the dates of the events (Sanford & Tremblay-Boire, 2019). This study considered as "zero date" the day the company submitted the reference report to the CVM website (or the date of the most recent report, as previously explained). The event window was two days (two trading sessions) before and after the report's release (five days total). The estimation window used was thirty trading sessions (-30 to -60, that is, 60 trading sessions started before the event and 30 trading sessions finished before the event date) before the event (Dias & Malaquias, 2021).

An abnormal return measure is required to identify the impact of events on the price of the analyzed papers (Campbel et al., 1997). Abnormal asset return is measured by the difference between the actual and expected returns of assets during the event window (Campbell et al., 1997; Sanford & Tremblay-Boire, 2019). Next, it will be presented how the calculation of the abnormal

stock returns of the company *i* on an event date *t* was performed (Campbel et al., 1997; Sanford & Tremblay-Boire, 2019):

$$AR_{it} = R_{it} - E\left(\frac{R_{it}}{X_t}\right),$$

where AR_{it} represents the abnormal return, R_{it} the observed return, and $E\ (R_{it}/X_t)$ the expected return of asset *i* for period *t* based on the informationX_t.

Normal return would be the expected return on assets if no specific event occurred in the period (Camargos & Barbosa, 2003; Sanford & Tremblay-Boire, 2019). Normal returns were estimated based on the risk-adjusted model (Campbel et al., 1997; Sanford & Tremblay-Boire, 2019). The α_i and β_i coefficients were estimated using a simple factor model (Takamatsu et al., 2008). This model accepts that abnormal returns are shown by the difference of individual returns (R_{it}) in relation to the return of the market portfolio (R_{mt}) (Takamatsu et al., 2008). The estimation of normal returns was performed as follows:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_i$$

The definition of an estimation window and the event window are essential to operationalize the simple factor model (Campbel et al., 1997; Sanford & Tremblay-Boire, 2019). The event window is the period that includes a period before and after the analyzed event to make it possible to compare the stock returns relative to the dates of the events (Campbel et al., 1997; Sanford & Tremblay-Boire, 2019). This study considered a "zero date" the day the company submitted the reference report to the CVM website (or the date of the most recent report, as previously explained). The event window considered was two days (two trading sessions) before and after the report's release (five days in total).

The estimation window used was 30 trading sessions, starting 60 trading sessions before the event and ending 30 trading sessions before the event was announced (Princeton University, 2020; Dias & Malaquias, 2021). In a subsequent robustness analysis, another event window was considered starting 60 trading sessions before and ending 10 trading sessions before the event (50 trading sessions window).

After calculating the returns, the sum of the abnormal returns in the period after the event was made to improve its analysis (Sanford & Tremblay-Boire, 2019). Thus, abnormal returns are cumulative in the trading sessions after the event to analyze the behavior of prices throughout the event window (Camargos & Barbosa, 2003). Therefore, the accumulation of abnormal returns was calculated as follows (Camargos & Barbosa, 2003; Sanford & Tremblay-Boire, 2019):

$$CAR_{t1,t2} = \sum_{t=t_1}^{t2} AR_{it}$$

In the formula above, $CAR_{t1,t2}$ expresses the sum of the cumulative abnormal return and t_1 and t_2) are the periods of accumulation of the abnormal returns between the event windows (Sanford & Tremblay-Boire, 2019), in this case, between $t_1$and t_2.

The event analyzed in this study was the sending of the reference report to the CVM by the companies, which also has information on the presence or not of women in the BoD. To investigate the hypothesis that the disclosure of these reports, which inform the presence or not of women in the BoD, affected the price of stocks, the comparison of the cumulative abnormal return relative to the "zero date" was prepared through the mean difference test. Simple regression analysis was also performed to evaluate this difference since, by regression analysis, it is also possible to employ robust standard errors (Princeton University, 2020), and this analysis resembles the application of

the *t*-test but allows the use of robust standard errors (Dias & Malaquias, 2021), which mitigates any limitations resulting from heteroscedasticity.

In a second round of robustness tests, the effect of information disclosure on the conditional volatility of stock returns was analyzed. Therefore, based on Yaffee and McGee (2000) and Poon (2005), it was considered an ARMA model (that is, an autoregressive model including parameters for moving averages) with a GARCH model (*Generalized Auto Regressive Conditional Heteroscedasticity*). In this case, for this robustness analysis, a parsimonious ARMA(1,1)-GARCH(1,1) model was used, including the *dummy* related to the publication of information as a possible variable explaining the volatility of returns. The model was estimated for each of the stocks. For this robustness test, only companies with at least one woman in the BoD were considered; thus, the conditional volatility of the stock on the day of the event was compared with the conditional volatility of the other days.

4 RESULTS ANALYSIS

The study sample consisted of 277 observations (stocks/year). Two hundred fifty-two observations (stocks/year) of companies with at least one woman in the BoD were verified. The following Table 2 summarizes this information.

Table 2

Total stocks and total companies/events with at least one woman on the board

Year	No. of Stocks (Total)	No. of Stocks (Women in the BOD)	No. of events (Total)	No. of events (Women in the BOD)
2017	32	27	32	27
2018	29	24	29	24
2019	25	24	24	23
2020	55	49	50	44
2021	81	76	66	61
2022	55	52	55	52
Total	277	252	256	231

Source: Prepared by the authors.

In the analyzed period, there were 256 events, which are reports disclosed by the companies to the CVM. Some of these reports refer to companies that have more than one stock in the database, which justifies the total number of stocks equal to 277. Regarding the object of study also in the analyzed period, there were 231 specific events, that is, a report released by the companies to CVM that included at least one woman on the board. Table 3 shows additional information about the composition of the sample.

Table 3

Number of observations per sector of activity

Economática Sector	Qty. Obs.	Qty. Obs.(%)	% Mean Women in the BoD
Agro and Fishing	4	1.4%	8.2%
Food and Beverages	19	6.9%	15.3%
Trade	30	10.8%	19.7%
Construction	20	7.2%	9.1%
Electronics	2	0.7%	11.2%
Electricity	30	10.8%	16.7%
Finance and Insurance	40	14.4%	12.6%
Industrial Machinery	5	1.8%	4.8%
Mining	4	1.4%	15.8%
Other	50	18.1%	11.7%

Pulp and Paper	2	0.7%	8.7%
Oil and Gas	17	6.1%	10.7%
Steelmaking and Metallurgy	2	0.7%	17.7%
Software and Data	9	3.2%	15.8%
Telecommunications	5	1.8%	19.1%
Textile	5	1.8%	18.2%
Transportation Services	22	7.9%	11.0%
Vehicles and parts	11	4.0%	13.0%
Total	277	100.0%	13.5%

Source: Prepared by the authors.

According to information in Table 3, most of the sample consists of stocks of companies in the following sectors: Trade (10.8%), Electricity (10.8%), Finance and Insurance (14.4%), and the Others sector (18.1%). Table 3 also shows that the three sectors with stocks of companies with the highest average percentage of women in the BoD are: Trade, Telecommunications, and Textiles. Table 4 presents the descriptive statistics for the estimated abnormal returns.

Concerning the study of events, for the test involving the 277 stocks, the main results indicated that, on average, based on the mean difference test, the mean abnormal return was not statistically significant on any of the dates (neither on "date zero", nor on the dates before and after releasing the reports). The same result was also observed in the analysis of the cumulative abnormal return in the event window, considering 30 trading sessions (estimation window -30 to -60). This analysis was also made considering only the 252 stocks for which there was at least one woman in the BoD, and the results were equivalent (for all dates of the event window and the cumulative abnormal return in the window). These results suggest that the disclosure of the reports, on the date of disclosure that was collected, with information that there was at least one woman in the BoD, did not have a statistically significant effect on the prices of this set of stocks.

Table 4

Descriptive analysis - abnormal return

Date (Event)	No. Obs.	Mean	Std.Dev.	Minimum	Median	Maximum
-2	277	0.0947	2.2885	-7.5397	0.0418	8.1053
-1	277	-0.1551	2.2087	-8.8993	-0.1794	8.4706
0	277	0.1501	2.3835	-10.3813	0.0736	11.3099
1	277	-0.0124	2.5319	-9.2932	-0.2013	12.3103
2	277	-0.1314	2.4179	-6.8393	-0.1295	15.1173

Source: Prepared by the authors.

It should be noted that in the individualized analysis by assets: for the 277 stocks, in 20 cases, the abnormal return in the event window was negative and significant at 10%, and in 16 cases, it was positive and significant at 10%; for the 252 stocks of companies with at least one woman in the BoD, in 19 cases the abnormal return in the event window was negative and significant at 10%, being positive and significant in 12 cases.

The results were also explored through regression analysis with robust standard errors, replacing the mean difference test. In this case, first, it was evaluated whether the disclosure of reports with at least one woman on the board (*dummy* variable) affected the estimated abnormal return. The results indicated that the *dummy* variable for the presence of women on the board had no statistically significant effect on the abnormal return at date zero nor the cumulative abnormal return in the event window. The *dummy* variable was then replaced by a scalar variable, which indicates the percentage of women on the board relative to the total number of members. The results were equivalent, indicating that the percentage of women on the board did not have a

statistically significant effect on the estimated abnormal return at date zero and the cumulative abnormal return in the event window. These results were in line with the overall results of the event study.

Robustness tests were performed to complement the analysis. In this case, a larger estimation window (-10 to -60) was considered, and the general results were similar. A highlight of these tests was that in 21 stocks, the abnormal return in the event window was negative and significant at 10%, and in 14 stocks, it was positive and significant at 10%. Therefore, they are quantities of stocks with abnormal returns close to what was obtained in the test performed initially.

Regarding the additional analysis considering the effect of the disclosure on conditional volatility, the parameters of an ARMA(1,1)-GARCH(1,1) model were estimated for each of the sample actions, including a *dummy* that receives 1 for the day of publication of the evaluated information in which there was at least one woman in the BoD and 0 for the other days. Considering the significance level of 10%, it was observed that: in 12 stocks, there was an increase in conditional volatility on the date of publication of the report, and in 3 stocks, there was a reduction in conditional volatility. This relatively low number of statistically significant occurrences, even at an already flexible significance level of 10%, is in line with the results of the study of events; that is, the effect of disclosure of information on the presence of at least one woman in the BoD does not seem to have represented new information for the market within the terms evaluated and based on the disclosure date considered.

Considering that (i) in general, the variables did not show significance; (ii) in the robustness tests, the significance occurred in few cases; and (iii) in the *dummy* regression analysis for the presence of women on the board showed no significant effect (nor the percentage of women in the BoD), the main results suggest that, in general, the disclosure of information on the presence or not of women in the BoD did not have a statistically significant impact on the return of the companies' stocks (at least in the period analyzed by the study, and based on the adopted methodological procedures).

Given that previous studies have shown aspects of EMH for the Brazilian market (Duarte et al., 2015), the stock market can price, even partially, the composition of the companies' BoD so that, as in most cases, the market is not surprised by the disclosure of this information (Epstein & Schneider, 2008; Savor, 2012), the disclosure of the reference report informing the presence of at least one woman in the BoD did not significantly impact the return of the company's stocks.

These results may indicate an aspect of EMH in the semi-strong form, whose public information is already absorbed by stock prices (Fama, 1970; 1991). Thus, information on the composition of the BoD, as well as the presence of women in the BoD (measured with the *dummy* of at least one woman in the BoD), would possibly already be priced by the market so that this event does not impact statistically significantly on the stock returns. This may be related to the date of disclosure used as the basis for this study.

In the minority of cases, when market agents are surprised by a new member of the company's BoD, the disclosure of reports can have a positive or negative impact, according to market expectations (Dah et al., 2014), which can help explain the events analyzed separately, in relation to the minority of companies that showed significance, both with a positive and negative sign.

However, this "shock" of information and statistical significance, both positive and negative, may be more related to a possible novelty (Dah et al., 2014; Sanford & Tremblay-Boire, 2019), evidenced in the minority of cases and not linked to the presence or not of women in the BoD. Moreover, considering the data and the period analyzed, in addition to previous studies, the evidence may indicate that women and men in leadership positions may be more similar than different (Sanford & Tremblay-Boire, 2019) so as not to cause a surprise in the market.

Thus, the hypothesis of the study that the disclosure of information regarding the presence of women in the BoD has a statistically significant impact on the stock returns of Brazilian companies was not supported.

5 FINAL CONSIDERATIONS

This study evaluated the possible effects of the presence of women in the BoD on the return of companies' stocks in the Brazilian stock market. The returns of the companies' stocks relative to the date of disclosure of the companies' reference reports to the CVM ("zero date") were analyzed through an event study, and in these reports is available information related to the BoD, for example, the composition of the Board, number of women, among others. Companies listed on B3 were considered, and financial data were collected in the Economática Database.

The event study methodology can help understand the expectation of market agents in relation to some company events (Lin et al., 2016). The results show that, generally, at least one woman on the board did not show statistical significance in the stock returns for the study window and according to the methodological procedures adopted in this research.

The results showed, therefore, that the presence of at least one woman in the BoD, as well as possible member exchanges, possibly proved to be events expected by market agents and may have already been incorporated into prices (Dah et al., 2014; Sanford & Tremblay-Boire, 2019) or, even, may have been previously disclosed in other communication channels. In the few cases of statistical significance, possibly when the exchanges of BoD members surprised market agents, such a "surprise" event may have impacted a significant relationship, and, therefore, this relationship may be more aligned with the exchange of BoD members in which the new people who will compose the BoD were not expected by the market (Dah et al., 2014; Sanford & Tremblay-Boire, 2019). These results may show an aspect of EMH in the semi-strong form, in which public information is incorporated into stock prices.

This study advances the literature by adopting a new analysis perspective to identify the impact of gender diversity, specifically the presence or absence of women in the BoD, considering that most studies use other methods (regression analysis) and variables (ROA and ROE) for this. The article also shows that at least one woman in the BoD seems to be an expected event in the market, or even that this information was previously incorporated into the stock price when its disclosure was made by another communication channel on another date. It should also be noted that equivalent results were observed for volatility in stock returns.

A limitation of this study was to consider only Brazilian companies for analysis and only one source of information to represent an event to be analyzed. Also, another limitation was to analyze gender diversity only by the presence or absence of women in the BoD or even by the percentage of women in the BoD.

In the case of resubmitted reports, the use of the most up-to-date date may also limit the research results, given that the information may have already been disclosed previously to the market. In this way, new research can compare the different dates the reports were resubmitted. The reports also have other information than that considered in this study (presence of women in the BoD), and this information also has the potential to impact the stock price; this effect may also imply limitations to the results of this study. For future studies, it is also suggested to analyze gender diversity with other proxies (presence of LGBTQIAP+ people, presence of younger or more experienced board members, presence of board members with some academic background, etc.), and also the use of other performance indicators.

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