

# ADOPTION OF ESG PRACTICES AND ACCOUNTING FRAUD RISK IN COMPANIES LISTED ON THE B3

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## ABSTRACT

This study aims to investigate the association between the voluntary adoption of ESG (Environmental, Social, and Governance) practices and the risk of accounting fraud in Brazilian companies listed on the B3. To test the hypothesis, data on the level of ESG practice adoption were collected from Bloomberg, and the risk of fraud was measured using the Altman, Baydia, and Dias (1979) model, re-estimated by Martins and Ventura (2020). The sample comprised 214 non-financial companies listed on the B3 from 2016 to 2022. The panel regression results did not reject the null hypothesis, indicating a correlation between ESG practice adoption and reduced fraud risk. Notably, the Social (S) factor was the most significant among the ESG components in reducing fraud risk, suggesting that stakeholders should closely monitor this aspect. Conversely, the Governance (G) factor did not exhibit statistical significance. The findings provide practical insights for organizational contexts, demonstrating that investments in ESG initiatives can serve as mechanisms to control and mitigate the risk of accounting fraud, potentially enhancing investor confidence and capital market stability.

**Keywords:** ASG Practices. Fraud Risk. Environmental, Social, and Governance Performance. Sustainability Policies.

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## 1 INTRODUCTION

In the contemporary business landscape, the intersection between sustainable business practices and value creation is gaining increasing importance, with investors demanding greater engagement from companies in sustainable practices beyond traditional financial performance (Shakil, 2021), especially those dedicated to ESG practices – environmental, social, and governance (Edmans & Kacperczyk, 2022), the main focus of this work.

The ESG approach represents an ongoing commitment from managers in their respective decision-making processes (Hemingway & MacLand, 2004; Rodgers, Soderbom & Guiral, 2015; Edmans & Kacperczyk, 2022). This approach seeks to promote business sustainability and corporate responsibility, demonstrating the importance of integrating environmental, social, and governance factors into an organization's operations and strategies. Furthermore, there is evidence that companies with better ESG scores and disclosure of corporate sustainability practices are more highly rated, face fewer financial constraints, and have lower capital costs (Jiménez & Zorio-Grima, 2021; Wong et al., 2021; Gao, Wu & Liu, 2024), as well as lower internal and external risk (Khan, Serafeim & Yoon, 2016).

As a result, higher ESG scores should, in principle, enhance the company's reputation, making it more attractive to stakeholders concerned with sustainability issues; this results in higher market value and superior performance compared to companies with less integration of environmental, social, and governance practices (Forte, Crisóstomo, and Peixoto Neto, 2024).

From the opposite perspective, there is some distrust that the pursuit of ESG practices may be used only to improve the company's image with customers and investors (Laufer, 2003) or that the pressure to comply with ESG metrics may lead to practices such as greenwashing and data manipulation (Rau & Yu, 2024). Furthermore, according to Prior, Surroca, and Tribo (2008), organizations that have historically engaged in profit manipulation and fraud may be inclined to invest in ESG factors to shape their image. This aims to build trust with potential investors and reduce stakeholder distrust of potential dysfunctions in their financial reports and indicators.

Furthermore, it is necessary to consider the historical wave of scandals related to corporate governance, marked by the abrupt collapses of relevant companies such as Enron, WorldCom, Parmalat, Petrobras, and Samarco, among others (Monay, Uzêda Castro, & Pim Dos Santos, 2024; Rau & Yu, 2024). Especially in the case of Enron, the opacity of accounting information and the manipulation of results by managers were attributed at the time to the deterioration of business morality, as reflected in the absence of Corporate Social Responsibility (CSR) (Chih, Shen, & Kang, 2008).

Research findings exploring the relationship between ESG (Environmental, Social, and Governance) factors and financial fraud are heterogeneous, reflecting differences in the mechanisms by which these practices influence organizational behavior. Some literature points to a negative relationship between ESG and fraud, arguing that adopting these practices strengthens corporate governance, improves internal controls, and reduces information asymmetry, thereby limiting managerial discretion and, consequently, earnings manipulation (Bozzolan et al., 2015). Additionally, incorporating ethical principles and corporate social responsibility tends to promote an organizational culture oriented towards integrity, thereby reducing incentives for opportunistic practices such as earnings management (Shafer & Lucianetti, 2018). Clementino and Gonçalves (2022) report that companies with stronger CSR practices face lower fraud risk.

On the other hand, the literature also suggests that ESG practices can be used opportunistically, as a legitimization or greenwashing strategy, without having a real effect on the quality of accounting information (Liao, Chen & Zheng, 2019; Rau & Yu, 2024). In this context, an important gap remains: there is still no consensus on the specific role of each ESG dimension, especially governance, in mitigating fraud, particularly in emerging markets (Zumente & Bistrova, 2021). In the Brazilian case, this debate is even more relevant, as the regulatory environment can induce a degree of homogeneity in governance practices, reducing firms' ability to discriminate against fraud risk. Therefore, the main objective of this study is to examine whether there is a negative relationship between ESG factors and the risk of fraud in companies listed on the B3.

Therefore, this study analyzes the relationship between the adoption of ESG practices and the risk of accounting fraud in Brazilian companies listed on the B3, using a panel data regression model for the period from 2016 to 2022. The results indicate a negative association between the level of adoption of ESG practices and the risk of fraud, with stronger effects for the environmental (E) and social (S) factors, while the governance (G) factor did not show statistical significance.

Based on these findings, the research contributes to the literature by highlighting that the effects of ESG factors are heterogeneous, particularly in the Brazilian context. From a practical standpoint, the results are relevant for investors and analysts, indicating which dimensions of ESG have a greater capacity to signal fraud risk; for regulators and policy-makers, suggesting possible limitations of governance as an isolated mitigation mechanism; and for business managers, showing that investments in social and environmental aspects can function as more effective instruments for reducing reputational and informational risks. Additionally, the research contributes to society by broadening the understanding of the role of corporate practices in mitigating fraud and strengthening transparency and trust in the capital market.

## 2. THEORETICAL FRAMEWORK

In general, there are different interpretations of what constitutes fraud, but broadly speaking, it boils down to actions such as deceiving, misleading, and gaining an advantage over someone (Girau, Bujang, Jidwin & Mohamed, 2021). According to Albrecht et al. (2012), accounting fraud involves the use of improper accounting practices, including

the falsification of accounting records, financial reports, or transactions to deceive investors, creditors, and other decision-makers.

Fraud involving the misuse of accounting statements can cause significant losses and devastating consequences for a company's image (Ngai et al., 2011; Hou, Wang, & Ma, 2021). An example is the case of the reinsurance company IRB Brasil, which announced through a material fact notice the need to republish its financial information for the fiscal year ended December 31, 2019, suffering an approximately 84% reduction in market value by the fourth quarter of 2023, according to a survey conducted using broadcast data.

Additionally, Johnson, Xie, and Yi (2014) present evidence that companies involved in fraudulent activities face reputational sanctions from their customers, which translate into increased operating costs. Krauspenhar and Rover (2020) highlight the implications of accounting fraud at Via Varejo, noting that the discovery of the fraud led to negative abnormal returns and higher volatility in its shares. However, they also observed positive abnormal returns when the company demonstrated interest in investigating the accounting irregularities, revealing and estimating the impact of the fraud, despite an initial negative shock.

The importance of reputation in business is consistently observed, highlighting how the trust of clients and investors can be damaged by fraudulent practices (Hou, Wang, & Ma, 2021; Rau & Yu, 2024). This finding underscores the need for management to implement strategies to mitigate fraud risks and minimize potential losses resulting from this practice.

From the perspective of accounting fraud risk, ESG factors can play a dual role in organizations, serving both to strengthen ethical culture and prevent accounting fraud (Harjoto, 2017) and to manage and manipulate results (García-Sánchez et al., 2020).

Ambrosio et al. (2020) highlight that an ESG investment can be fundamentally understood as a shift in focus from shareholders to all stakeholders; that is, the investment decision does not solely aim to maximize financial returns for shareholders, but also takes into account other affected parties, such as employees, customers, suppliers, creditors, and the community.

As investors, financial institutions, and companies recognize the need to consider not only financial returns but also the broader impacts their activities have on society and the environment, ESG criteria are becoming increasingly relevant, suggesting that these same investors are more inclined to expand their investments in institutions that affirm a commitment to the environment and society and possess a good corporate reputation (Yin et al., 2023). This reflects a shift in perceptions of companies, which now recognize that their businesses have a purpose beyond generating profit and returns for shareholders. They are perceived as mechanisms of social transformation, whose purpose is also to generate value for all stakeholders in society (Ambrosio et al., 2020).

Relating sustainable development to financial performance is relevant because, as Brocket and Rezaee (2012) point out, economic sustainability is the necessary foundation for implementing sustainable practices in other areas, such as environmental, social, and corporate governance. Having a solid financial base is crucial for companies to invest in sustainable initiatives and fulfill their responsibilities across all these dimensions.

Thus, a company's ESG performance can be directly related to reducing the risk of fraud by institutions. Pathak and Gupta (2022) demonstrate that ESG performance significantly reduces opportunistic earnings management. Additionally, high-quality ESG engagement improves internal and external governance and promotes self-discipline among managers, thereby discouraging inappropriate conduct and preventing corporate fraud (Su et al., 2023).

According to Rodgers, Soderbom, and Guiral (2015), social and corporate responsibility aspects are catalysts that, when incorporated by a company, lead to greater ethical and moral control in its strategic decisions. For Tran and O'Sullivan (2020), ESG factors are considered the opposite of fraud, as they represent a commitment to ethical and moral conduct that, in turn, reduces the probability of financial distortion.

Thus, when managers undertake to develop high-quality ESG practices, they should promote a corporate culture with high ethical standards and, consequently, greater transparency in corporate governance, stemming from these moral and ethical obligations (Hoi et al., 2013; Edmans & Kacperczyk, 2022). Therefore, a strong corporate culture, as an institutional mechanism, can reinforce companies' internal governance and promote managers' self-regulation, thereby reducing corporate fraud.

Studies by Su et al. (2023) and Gao, Wu, and Liu (2024) provide evidence that a high ESG rating has a significant deterrent effect on corporate fraud. The authors emphasize that a high ESG rating can affect corporate fraud by easing funding constraints, improving corporate innovation, and strengthening internal controls. Conde (2024) analyzes the performance of stocks listed on the B3 Corporate Sustainability Index (ISE) in 2022 and 2023 and compares them with other stocks using a clustering approach. In this study, the results suggest that greater commitment to ESG is associated with lower risk and, therefore, lower volatility. Thus, it can be stated that investments in sustainability and the compilation and disclosure of this information in financial reports can enhance the company's credibility, a relevant factor for investment and growth in future projects requiring financing. Therefore, adherence to ESG factors can facilitate an entity's development and continuity.

According to Martins and Cunha (2022), evidence indicates that ESG variables exhibit different correlations between companies' market values and their disclosures. The authors found that the social factor showed a marginally significant association, whereas the environmental and governance factors did not. This finding suggests that practices focused more on the social aspect may have a more pronounced impact on users' perceptions of information than environmental and governance factors.

According to Darrat, Gray, Park, and Wu (2014), management with a strong emphasis on corporate governance is associated with a lower probability of insolvency. Similarly, business actions, in addition to corporate governance management, such as environmental factors, are relevant to business performance. Fernandes (2013) showed that positive environmental disclosure reduces a company's cost of equity, demonstrating that a strong socio-environmental image enhances the company's credibility in the market. Therefore, it can be stated that investing in sustainability and disclosing this information in financial reports can leverage the company's credibility, a relevant factor in reducing risk.

Considering the conflicting results found in the literature, the following research hypothesis is proposed:

H1: There is a negative relationship between ESG factors and the risk of fraud in companies listed on the B3.

Additionally, tests were conducted using individual variables to verify whether there is a negative relationship between elements E, S, and G and the risk of fraud among companies listed on the B3 (Brazilian Stock Exchange).

### 3. METHODOLOGY

#### 3.1 Sample

The study used as a sample companies listed on the B3 Stock Exchange that had ESG (Environmental, Social, and Governance) scores registered on the Bloomberg terminal. Bloomberg's global ESG database has data from more than 11,800 companies in over 100 countries, including Brazil (Bloomberg, 2021). The Bloomberg ESG disclosure score is calculated from information voluntarily provided by companies, including sustainability reports, information on their investor relations websites, and assessments conducted directly with the companies (Conca et al. 2020).

Furthermore, the choice of this sample set was based on the availability of comprehensive data and the standardized disclosure of financial information. The Bloomberg ESG database is recognized for its broad coverage and detail, encompassing more than 120 quantitative and qualitative metrics related to the ESG triad (Wong et al., 2021). It is worth noting that disclosure of ESG practice information for the Bloomberg ESG disclosure score is optional; however, companies that choose to disclose such practices demonstrate transparency and responsibility towards their stakeholders (Li et al., 2018). However, some categories of companies were excluded from the sample, including financial institutions, insurers, and reinsurers, due to their intrinsic characteristics that could significantly distort the indices used in the fraud detection model.

The sample period covered the last seven years, from 2016 to 2022, based on the availability of ESG data from Brazilian companies listed on the B3 stock exchange in the Bloomberg terminal database and accounting data in the Broadcast database. In total, the sample comprises 214 companies. Methodologically, the ESG disclosure index in the Bloomberg database ranges from 0 to 100 across ESG aspects, with 0 representing the minimum score assigned to companies that effectively incorporate ESG factors, and 100 representing the maximum score. Furthermore, the Environmental (E), Social (S), and Governance (G) sub-items were evaluated separately. Sub-item E contains information on gas emissions, water use, waste, and the company's environmental policies, while sub-item S includes data related to employees, products, and interactions with communities. Finally, sub-item G addresses the structure of the Board of Directors and executive compensation.

#### 3.2 Dependent variable: Fraud Risk

To analyze the fraud risk of the sample companies, the bankruptcy and insolvency prediction model (Z-Score) proposed by Altman, Baydia, and Dias (1979) and re-estimated by Martins and Ventura (2020) was used. The Z-Score model is an analytical tool that identifies companies at risk of insolvency. As highlighted by Troacá (2013), among all indicators, solvency assumes a primary position in the financial analysis of a company due to its ability to indicate the prospects of fulfilling its short- and long-term obligations, as well as its substantial impact on valuation through discounted cash flow. The original Z-Score model of Altman, Baydia, and Dias (1979) is presented in equation 1, and its parameters are detailed in Table 1.

$$Z_i = -1,84 - 0,51 X_1 + 6,32 X_3 + 0,71 X_4 + 0,52 X_5 \quad (1)$$

Where:

$X_1$  = (Current Assets - Current Liabilities) / Total Assets

$X_3$  = EBIT / Total Assets

$X_4$  = Enterprise Value

$X_5$  = Sales / Total Assets

The association between bankruptcy, insolvency, and fraud risk stems from the financial and economic pressures companies face during difficult times. A Z-score close to 1 indicates a high risk of insolvency, which can naturally lead managers to manipulate financial statements and reports to conceal poor results and continue attracting investors, thereby maintaining competitiveness against direct competitors. Therefore, in addition to predicting bankruptcies, the Z-score can also serve as an important warning sign of potential accounting fraud. (Altman, Baydia, and Dias, 1979).

Martins and Ventura (2020) re-estimated the coefficients for the Z-score model, taking into account publicly traded companies that have filed for bankruptcy, are in composition with creditors, or are undergoing judicial reorganization in the Brazilian environment. Thus, the original equation was adjusted to reflect the realities and perspectives of Brazilian companies, as shown in equation 2:

$$(Z_i = 1) = \frac{1}{1 + e^{-(8,854 - 1,555x1i - 2,278x3i + 0,002x4i - 0,234x5i)}} \quad (2)$$

According to the equation by Martins and Ventura (2020), results are quantitatively weighted on a scale of 0 to 1, with values closer to 1 indicating a greater association with the risk of fraud.

### 3.3 Independent Variable: ESG Score

The Bloomberg ESG Score refers to the three main factors used to assess a company's sustainability and potential financial performance. According to Bloomberg, the methodology employs a consistent set of topics and data fields, with specific weightings applied to sectors and regions. Although the topics and data fields included in the score are selected primarily according to sector-agnostic standards, some topics may not be relevant to all sectors, such as industrial waste management, which is a crucial issue for manufacturing companies but may be irrelevant to technology companies. Another example is the importance of occupational health and safety policies, which are essential for the construction sector but have a much smaller impact on the financial sector.

The environmental (E), social (S), and governance (G) pillars are equally weighted in the global ESG Disclosure Score. Within the pillars, topics are equally weighted, and topic weights are allocated to fields related to the issue, with quantitative fields receiving more weight than binary fields. The score measures the amount of ESG data a company voluntarily discloses publicly.

**Table 1 – Principles adopted in the formulation of the ESG Score**

| Materiality                                                                                                                                                                                                                                                     | Quantitative Data                                                                                                                                                                                                                                    | Transparency                                                                                                                                                                                    |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The scores measure a company's management relative to financially relevant and sector-specific environmental and social (ES) issues and metrics, as well as governance (G) policies and practices, in accordance with each country's regulations and practices. | The scores are based on publicly disclosed data from companies. As a result, the scores can be updated promptly as companies release new data throughout the year. The scores also consider quantitative data disclosure as a performance dimension. | The methodology and underlying data are completely transparent. Users can view and analyze all the data that drives each score, along with additional features such as weights and percentiles. |

Source: Bloomberg (2024)

Kotsantonis and Serafeim (2019) highlight that to achieve consistent, material results, it is preferable to use absolute metrics rather than comparisons and benchmarks. Additionally, the same authors suggest that information providers be as transparent as possible in their methodologies, not limiting themselves to the scoring system or methodology, but also detailing how data collection is carried out and measured.

The ESG Bloomberg score metrics used in this study are based on the following pillars in their methodology and data collection:

- A) Environmental:** Air quality, climate exposure, ecological impact, energy matrix management, environmental management of the supply chain, greenhouse gas emission management, financing for sustainability, sustainable production, and water use policies.
- B) Social:** Policies on economic accessibility, rights and community relations, customer well-being, customer data privacy and security, level of ethics and regulatory compliance, employee diversity, best labor practices, employee health and safety management, compliance and ethics in the supply chain, product quality management.
- C) Governance:** Composition of the board of directors, diversity and independence of the board, CEO compensation structure, governance of board member salaries, performance-based compensation, shareholder management policy, equitable policies for electing board members, structure of the audit committee, external audit, and opinion of independent auditors.

### 3.4 Control variables

The control variables, although not the subject of the study, should be included in the model to improve the robustness of the results, since they influence the dependent variable (fraud risk).

- A) Economic Recession:** According to Gill (2011) and Lawal, Amogu, Adeoti, and Ijaiya (2017), periods of economic instability increase individuals' willingness to commit property crimes, thereby contributing to increased fraud and operational risks. In this sense, the control variable "economic recession" was included; it is a dummy variable that takes the value 1 in 2016 and 2020 (due to the COVID-19 pandemic) and 0 for the remaining years in the sample.
- B) Negative Cash Flow Variation:** A dummy variable was used to identify negative cash generation for the sample during the analyzed periods. Bhardwaj (2018) states that when managers accumulate a significant volume of liquidity (cash availability), they tend to become more immune to market discipline. This financial leeway, associated with high cash availability, can provide the company with investment opportunities and ease the search for third-party resources, since creditors consider cash availability a potential for debt repayment (Pamplona et al., 2021). Thus, the greater the liquidity generation, the lower the probability that an entity will become delinquent or fraudulent in the short term (Altman, 1968).
- C) EBITDA Margin:** EBITDA (Earnings Before Interest, Taxes, Depreciation, and Amortization) is an economic-financial indicator that measures a company's operational cash generation capacity (Alcalde, 2010). In this work, EBITDA is used as a control variable associated with a company's financial health. According to Moreira et al. (2014), the EBITDA index is an important indicator for business analysis, as it reflects a company's ability to generate resources solely from its operating activities, without accounting for tax and financial impacts. The greater the capacity to generate results, the lower the entity's risk of delinquency and, consequently, of fraud (Vasconcelos et al., 2014).
- D) Payout Ratio:** Dividend distributions are directly associated with a higher or lower risk of accounting fraud. According to Caskey and Hanlon (2013), companies with lower earnings quality, that is, those that showed evidence of accounting fraud, paid dividends less frequently than companies not accused of accounting fraud. Conversely, Kasanen, Kinnunen, and Niskanen (1996) argue that accounting manipulations are more likely to occur in companies with high dividend payouts. Therefore, to verify the relationship between the degree of dividend payments and the risk of fraud, the payout ratio was used, defined as the ratio of dividends distributed in the period to consolidated net income.

Thus, to test H1 in relation to the ESG score, as well as to determine which of the 3 factors has the greatest significance in association with the risk of fraud, an econometric model with unbalanced panel data was developed according to the following equations:

$$Fraude_{it} = \beta_0 + \beta_1 ASG_{it} + \beta_2 RE_{it} + \beta_3 VNC_{it} + \beta_4 M.EBITDA_{it} + \beta_5 PAYOUT_{it} + \varepsilon_{it} \quad (3)$$

$$Fraude_{it} = \beta_0 + \beta_1 A_{it} + \beta_2 RE_{it} + \beta_3 VNC_{it} + \beta_4 M.EBITDA_{it} + \beta_5 PAYOUT_{it} + \varepsilon_{it} \quad (4)$$

$$Fraude_{it} = \beta_0 + \beta_1 S_{it} + \beta_2 RE_{it} + \beta_3 VNC_{it} + \beta_4 M.EBITDA_{it} + \beta_5 PAYOUT_{it} + \varepsilon_{it} \quad (5)$$

$$Fraude_{it} = \beta_0 + \beta_1 G_{it} + \beta_2 RE_{it} + \beta_3 VNC_{it} + \beta_4 M.EBITDA_{it} + \beta_5 PAYOUT_{it} + \varepsilon_{it} \quad (6)$$

Where:

$FRAUDE_{it}$ : Fraud risk variable of company  $i$  in year  $t$ , measured by the Altman, Baydia and Dias (1979) Z-Score re-estimated by Martins and Ventura (2020);

$A_{it}$ : Environmental Score of company  $i$  in year  $t$  extracted from the Bloomberg terminal;

$S_{it}$ : Social Score of company  $i$  in year  $t$  extracted from the Bloomberg terminal;

$G_{it}$ : Governance Score of company  $i$  in year  $t$  extracted from the Bloomberg terminal;

$RE_{it}$ : Dummy variable for economic recession, where 1 was assigned to the years 2016 and 2020 and 0 for the others;

$VNC_{it}$ : Dummy variable for negative cash flow generation in the period of company  $i$  in year  $t$ , where 1 is for negative variation and 0 for positive variation;

$M.EBITDA_{it}$ : Ratio between net revenue generation and operational cash generation capacity of company  $i$  in year  $t$ ;

$PAYOUT_{it}$ : Payout ratio of company  $i$  in year  $t$ ;

$\varepsilon_{it}$ : is the random error of the regression, where  $\varepsilon_{it} \sim N(0, \sigma^2)$ .

## 4 PRESENTATION AND ANALYSIS OF RESULTS

### 4.1 Descriptive statistics

In a preliminary analysis, descriptive statistics were used to examine the behavior of variables collected between 2016 and 2022. The dummy variable for economic recession (RE) was not included in the descriptive statistics because its observations occurred only in 2016 and 2020.

**Table 1 – Descriptive statistics used for the sample**

|              | ZSCORE | ASG     | A       | S       | G       | RE     | VNC    | M. EBITDA | Payout    |
|--------------|--------|---------|---------|---------|---------|--------|--------|-----------|-----------|
| Mean         | 0,2153 | 43,4313 | 36,1627 | 34,3683 | 59,7126 | 0,2717 | 0,4494 | 0,5656    | 0,3169    |
| Median       | 0,2024 | 44,6535 | 37,8436 | 34,1294 | 59,2113 | 0,0000 | 0,0000 | 0,2747    | 0,1861    |
| DP           | 0,1044 | 12,4082 | 21,4337 | 15,2711 | 6,3044  | 0,4451 | 0,4978 | 4,0734    | 3,5542    |
| Minimum      | 0,0000 | 15,5115 | 0,0000  | 0,0000  | 33,1728 | 0,0000 | 0,0000 | (18,3353) | (31,5482) |
| Maximum      | 0,9831 | 70,0634 | 90,5769 | 77,4184 | 89,8555 | 1,0000 | 1,0000 | 62,2567   | 74,2487   |
| Observations | 692    | 692     | 692     | 692     | 692     | 692    | 692    | 692       | 692       |

Source: Research results (2024)

Based on the data in Table 1, the average fraud risk in companies is 0.20, given that the variable can take values up to 1. This indicates that the average fraud risk is relatively low, as it falls in the first quartile of the Z-score model, which is on an increasing scale. In this sample set, the observed median was 0.21, very close to the mean, suggesting a low prevalence of extreme values. Furthermore, the maximum value of the variable is 0.98, close to 1, indicating that the maximum limit of fraud risk is present in the sample set.

For the independent variable ASG, both the combined and segregated variables for each factor are available. The combined variable ASG suggests a symmetrical distribution of the data, since its mean of 43.43 and median of 44.65 are very close, a pattern that is repeated for the isolated variables. However, it is important to note that the variability of the ASG, A, and S data, measured by the standard deviation, is significant, indicating the presence of extreme values, as observed in the minimum and maximum values of the environmental and social factors. For the governance variable, the low standard deviation of 6.3044 indicates little variability in the data, suggesting greater standardization and uniformity in the disclosure and collection of this variable.

Regarding the behavior of the control variables, the VNC variable (negative variation in cash flow) has an average of 0.4494, indicating that 44.94% of the companies surveyed experienced negative cash flow fluctuations during the analyzed period. The high EBITDA margin standard deviation (4.0734) indicates significant volatility in operating results across the sample companies. The extreme values of the Payout ratio (-31.5482, minimum, and 74.2487, maximum) reveal asymmetry in dividend distribution policies: some companies distribute dividends far exceeding their reported profits, while others retain all of their earnings. This heterogeneity suggests the need for more in-depth sectoral analyses to understand the different behaviors present in the sample.

To better understand the relationship between ESG variables and fraud risk, a correlation matrix was developed, as shown in the table below.

**Table 2 – Correlation Matrix**

|         | Z Score | ASG     | A       | S       | G       | RE      | VNC     | M.EBITDA | Payout  |
|---------|---------|---------|---------|---------|---------|---------|---------|----------|---------|
| Z Score | 1       | -0,1972 | -0,2127 | -0,1401 | -0,1035 | -0,0590 | 0,1404  | -0,1525  | -0,0545 |
| ASG     | -0,1972 | 1       | 0,9339  | 0,8917  | 0,5740  | -0,0730 | -0,0583 | 0,0215   | -0,0178 |
| A       | -0,2127 | 0,9339  | 1       | 0,7116  | 0,3954  | -0,0849 | -0,0527 | 0,0215   | -0,0296 |
| S       | -0,1401 | 0,8917  | 0,7116  | 1       | 0,4302  | -0,0563 | -0,0449 | 0,0270   | -0,0147 |
| G       | -0,1035 | 0,5740  | 0,3954  | 0,4302  | 1       | -0,0073 | -0,0543 | -0,0112  | 0,0308  |
| RE      | -0,0590 | -0,0730 | -0,0849 | -0,0563 | -0,0073 | 1       | -0,0946 | -0,0118  | -0,0028 |
| VNC     | 0,1404  | -0,0583 | -0,0527 | -0,0449 | -0,0543 | -0,0946 | 1       | -0,0049  | 0,0137  |

|          | Z Score | ASG     | A       | S       | G       | RE      | VNC     | M.EBITDA | Payout  |
|----------|---------|---------|---------|---------|---------|---------|---------|----------|---------|
| M.EBITDA | -0,1525 | 0,0215  | 0,0215  | 0,0270  | -0,0112 | -0,0118 | -0,0049 | 1        | -0,0020 |
| Payout   | -0,0545 | -0,0178 | -0,0296 | -0,0147 | 0,0308  | -0,0028 | 0,0137  | -0,002   | 1       |

Source: Research results (2024)

As shown in Table 2, there is a negative association between the joint ESG variable and the isolated variables. This may indicate that for each variation in fraud risk, there is an opposite variation in the independent ESG variables, indicating a negative association between fraud risk and ESG adherence. Another point to highlight is that, except for the variables that make up the ESG index, there is low correlation among the remaining variables, suggesting they can be estimated together.

#### 4.1 Estimation of panel regressions for ESG (general), Environmental (E), Social (S), and Governance (G)

With a temporal dimension spanning 2016 to 2022 and a spatial dimension encompassing 214 companies, linear regressions were performed on an unbalanced panel. The Hausman test was then performed, whose null hypothesis assumes the suitability of the Random Effects approach. The Hausman test did not reject the null hypothesis, indicating that the random-effects model is appropriate (p-value > 0.05).

Additionally, to verify whether the time series data are stationary, a unit root test was performed to detect non-stationarity in the time series (Gujarati, Porter, 2011). Of the variables used in the study, only the independent variable, governance, was non-stationary; therefore, it was estimated using first differences, which rendered it stationary.

Furthermore, the data were tested to verify the assumptions of a regression, including the normality of the residuals (JB test: p-value > 0.05), the absence of autocorrelation (Box and Pierce tests: p-value > 0.05), and the absence of multicollinearity (VIF test: VIF < 5). The regressions were estimated using the SUR matrix to correct for heteroscedasticity.

**Table 3 – Regression results – ASG (general)**

**Model 1:**  $Fraude_{it} = \beta_0 + \beta_1 ASG_{it} + \beta_2 RE_{it} + \beta_3 VNC_{it} + \beta_4 M.EBITDA_{it} + \beta_5 PAYOUT_{it} + \varepsilon_{it}$

| Variables               | Coefficient | Statistics T | p-value.  |
|-------------------------|-------------|--------------|-----------|
| C                       | 0.287960    | 13.73030     | 0.0000    |
| Score ASG               | -0.001257   | -3.305843    | 0.0010*   |
| RE                      | 0.024732    | 1.672193     | 0.0949*** |
| VNC                     | 0.022481    | 1.772311     | 0.0768*** |
| M. EBTIDA               | -0.003961   | -2.989283    | 0.0029*   |
| PAYOUT                  | -0.001674   | -1.162164    | 0.2456    |
| R <sup>2</sup>          | 0.036768    |              |           |
| Adjusted R <sup>2</sup> | 0.029748    |              |           |
| Observations            | 692         |              |           |
| Statistics F            | 5.237197    |              |           |
| P (F-statistic)         | 0.000100    |              |           |

Note 1: ESG Score – Index of Environmental, Social, and Governance Practices; RE – Macroeconomic Variable of economic recession; VNC – Negative Cash Variation; M. EBITDA – EBITDA Margin; PAYOUT – Payout Ratio

Note 2: \* and \*\*\* correspond to statistical significance at the 1% and 10% levels, respectively.

Source: Research Results.

Based on the regression results presented in Table 4, the environmental and social variables have a significant negative impact on fraud risk, consistent with initial expectations. This suggests that the greater the focus on these indices in isolation, the lower the risk of fraudulent accounting practices tends to be. On the other hand, the index related to corporate governance was not statistically significant in this analysis, indicating that, in this specific context, it did not significantly influence the risk of fraud. In summary, while environmental and social factors proved relevant in reducing the risk of accounting fraud, governance did not exhibit the same level of influence. Analyzing the main variable of interest in this study, the relationship between fraud risk and adherence to ESG factors is negative at the 1% significance level. In other words, the greater the adherence

to ESG factors, the lower the risk of accounting fraud. This result is consistent with the work carried out by Clementino and Gonçalves (2022), Su et al. (2023), Gao, Wu and Liu (2024) and Tran and O'Sullivan (2020), validating for the Brazilian literature by employing the Z-score dependent variable as an indicator of accounting fraud risk, the analysis corroborates the hypothesis that Brazilian publicly traded companies with greater involvement in environmental, social and corporate responsibility issues present a lower risk of fraud. Thus, H1 of this study cannot be rejected.

The research results indicate a positive, statistically significant relationship between the economic recession (RE) dummy variable and the risk of accounting fraud. In other words, periods of recession appear to increase the likelihood of fraud, consistent with Lawal et al. (2017). According to these authors, economic crises impose additional pressure on companies, creating an environment conducive to fraudulent practices. This pressure for results, often exacerbated in unstable environments, can lead managers to resort to accounting manipulations to camouflage deteriorating financial performance and avoid severe sanctions from investors and regulators.

Furthermore, the analysis of financial variables revealed that the negative cash flow variation (NCV) and EBITDA margin had impacts consistent with theoretical expectations regarding fraud risk. Loncan and Caldeira (2014) had already highlighted that companies with low cash generation are more likely to face financial difficulties, thereby increasing the propensity for fraud. According to these authors, inefficient cash management and high financial leverage limit companies' investment capacity, forcing them to adopt riskier strategies to maintain operational viability. In particular, highly indebted companies encounter obstacles to issuing new debt, and the cash generated is often directed towards paying short-term obligations. This scenario can, in turn, encourage fraudulent practices to protect managers' and shareholders' interests (Loncan; Caldeira, 2014).

However, the payout ratio did not show statistical significance in the proposed model, with a p-value of 0.2456, above the conventional levels of 0.05 and 0.10. This result is relevant because, although previous studies, such as Jensen's (1986), suggest that higher payout policies are associated with lower fraud risks – due to greater transparency and the need to maintain a solid investor base – the findings of this research indicate that this relationship does not hold up in the analyzed context. A possible explanation for this lies in the complexity of dividend policies, which can be influenced by factors such as the economic cycle, corporate governance structure, and the sector in which the company operates. These elements, in turn, were not fully captured in the model used.

Although the payout ratio is a relevant indicator for assessing financial health and corporate governance, its direct relationship with fraud risk may be more complex than the initial model suggests. As argued by Riaz et al. (2016), dividend policy alone may not be sufficient to explain fraudulent behavior, as other institutional and governance variables also play crucial roles in mitigating this risk.

Compared with the study, the study sought to identify the levels of importance of ESG practices associated with accounting fraud in isolation. This verification enables measuring the level of relevance each factor exerts regarding accounting fraud, thereby becoming an essential instrument for monitoring ESG reports and disclosures. Below, the econometric model follows the same regressive principles as Table 4.

**Table 4 – Regression results – A, S, and G**

**Model 2, 3, 4:**  $Fraude_{it} = \beta_0 + \beta_1 A_{it} + \beta_2 S_{it} + \beta_3 G_{it} + \beta_4 RE_{it} + \beta_5 VNC_{it} + \beta_6 M_{it} + \beta_7 EBITDA_{it} + \beta_8 PAYOUT_{it} + \varepsilon_{it}$

| Variables               | Environmental Score | p-value   | Social Score | p-value   | Governance Score | p-value   |
|-------------------------|---------------------|-----------|--------------|-----------|------------------|-----------|
| Constant                | 0.257988            | 0.0000*   | 0.265717     | 0.0000*   | 0.236626         | 0.0000*   |
| A/S/G                   | -0.000682           | 0.0027*   | -0.000955    | 0.0015*   | 0.001345         | 0.3030    |
| RE                      | 0.024527            | 0.0994*** | 0.025505     | 0.0827*** | -0.001217        | 0.9406    |
| VNC                     | 0.022746            | 0.0730*** | 0.023056     | 0.0696*** | 0.013647         | 0.2861    |
| EBTIDA                  | -0.003967           | 0.0032*   | -0.003945    | 0.0030*   | -0.002961        | 0.0042*   |
| PAYOUT                  | -0.001718           | 0.2344    | -0.001657    | 0.2432    | -0.001770        | 0.0734*** |
| R <sup>2</sup>          | 0.035433            |           | 0.035449     |           | 0.013941         |           |
| Adjusted R <sup>2</sup> | 0.028403            |           | 0.028418     |           | 0.005261         |           |
| F-statistic             | 5,039993            |           | 5,042281     |           | 1,606095         |           |
| P (F-statistic)         | 0,000152            |           | 0,000151     |           | 0,156498         |           |
| Observations            | 692                 |           | 692          |           | 692              |           |

Note 1: Score A – Environmental practices index; Score S – Social practices index; Score G – Governmental practices index; RE – Macroeconomic variable of economic recession; VNC – Negative Cash Variation; M. EBITDA – EBITDA Margin; PAYOUT – Payout ratio

Note 2: \* and \*\*\* correspond to statistical significance at the 1% and 10% levels, respectively.

Source: Research Results.

Based on the regression results presented in Table 4, the environmental and social variables have a significant negative impact on fraud risk, consistent with initial expectations. This suggests that the greater the focus on these indices in isolation, the lower the risk of fraudulent accounting practices tends to be. On the other hand, the index related to corporate governance was not statistically significant in this analysis, indicating that, in this specific context, it did not significantly influence the risk of fraud. In summary, while environmental and social factors proved relevant in reducing fraud risk, governance did not exert the same level of influence.

Another finding of this study is the identification of which ESG triad indicators exert the greatest association with fraud risk. Based on the results, the social variable is marginally more significant than the environmental variable. This relationship is observed both by the p-value and by the adjusted  $R^2$ . This conclusion is consistent with the studies by Bajic and Yurtoglu (2018), which showed that the social aspect is the most relevant in generating value for the firm.

#### 4. CONCLUSION

The main objective of this study is to investigate whether there is a negative association between the risk of accounting fraud and ESG practices. ESG practices are becoming increasingly widespread and robust in the corporate world, incorporated into various decision-making processes that shape the company's image with stakeholders. To test the main hypothesis of the research, the Altman, Baydia, and Dias (1979) bankruptcy prediction model, adapted by Martins and Ventura (2020), was used to assess fraud risk.

In addition to testing the main hypothesis that there is an association between fraud and the adoption of ESG practices, the research also sought to understand whether environmental, social, and governance factors, in isolation, have a positive association with the risk of fraud, and which of these factors has the greatest impact individually.

The results indicate a negative association between the adoption of ESG practices and the risk of accounting fraud, a result that also holds for the environmental and social factors analyzed in isolation. This finding suggests that these dimensions function as complementary mechanisms for organizational monitoring and discipline, either by increasing transparency or by strengthening external stakeholder pressures, reducing the propensity for opportunistic behavior.

However, the lack of statistical significance for the governance factor indicates that its effects are not captured homogeneously in the analyzed context. This result may be associated with the low variability of this indicator in the sample, possibly due to a regulatory environment that imposes relatively high minimum standards on listed companies, thereby reducing the discriminatory power of this indicator in assessing fraud risk. Additionally, it cannot be ruled out that governance, as measured by aggregate indicators, predominantly captures formal aspects that do not always translate into effective control over opportunistic practices.

On the other hand, the greater prominence of the social factor, albeit marginal compared to the environmental factor, suggests that dimensions of reputation, stakeholder relations, and ethical standards may play a more direct role in inhibiting fraudulent practices. This result is consistent with the idea that social and reputational pressures tend to affect managerial behavior more immediately than formal governance structures. Thus, the findings indicate that, in the Brazilian context, the effects of ESG factors on fraud risk are asymmetrical, reinforcing the need for disaggregated analyses that are more sensitive to institutional specificities.

The results suggest that as companies expand their involvement in social and corporate responsibility practices, fraud risk is mitigated, not necessarily through formal governance strengthening, but through increased reputational pressures and stakeholder scrutiny. In this sense, the reduction in fraud risk seems more closely associated with informal disciplinary mechanisms, such as reputation, legitimacy, and social expectations, than with formal corporate governance structures.

This finding helps explain why the social factor proved relevant, while the governance factor did not show statistical significance. While governance, as measured, may reflect more standardized and formal aspects, the social component tends to capture more dynamic dimensions of organizational behavior, directly influencing managers' incentives. Thus, the results indicate that, in the analyzed context, mitigating the risk of fraud is more related to reputational exposure and alignment with stakeholders than necessarily to an ethical commitment formalized by governance mechanisms.

As a limitation, the presented work used a dependent variable to measure solvency, which does not explicitly capture fraud, potentially hindering the direct identification of fraudulent accounting practices within the scope of the study. Additionally, the Bloomberg ESG independent variable is methodologically opaque, as the platform does not disclose the weights assigned to its components or its detailed composition. This limitation compromises the traceability of the individual impacts of each environmental, social, and corporate governance factor on the risk of accounting fraud for the listed companies analyzed, thereby influencing the robustness of statistical inferences and the generalizability of findings, as is the case with the governance variable.

As a suggestion for future research, it is necessary to examine the more targeted impact of the governance variable, identify which of its components are statistically significant, and examine their associations with fraud risk.

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