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ESG, Capital Structure, and Financial Performance of brazilian listed companies

ABSTRACT

This study analyzed whether ESG practices moderate the relationship between capital structure and financial performance in Brazilian companies listed on B3 (2010–2024). To address potential endogeneity, two-stage least squares (2SLS) was applied to panel data, using sector-average ESG scores and their pillars as instruments. Performance was proxied by ROA and Tobin's Q, capital structure by leverage, and ESG by the LSEG Combined Score, which incorporates controversies. The results indicated that ESG had no significant effect on financial performance as an aggregate measure, nor did it moderate the leverage-performance relationship; however, the individual pillars positively influenced performance. This evidence suggests that the economic impacts of ESG remain incipient in the Brazilian context, marked by voluntary disclosures and sectoral heterogeneity. The study contributes by framing ESG as an informational factor in capital structure decisions, reinforcing the importance of robust econometric methods and pointing to avenues for future research.

1. INTRODUCTION

The debate on ESG issues is tied to social, cultural, and climatic changes that have reshaped how society and governments understand the role of companies, making these factors increasingly relevant to investor and managerial decision-making (Bagh et al., 2024). Companies that develop ESG activities signal a commitment to long-term value creation, stakeholder engagement, and resilience amid evolving market dynamics (He, Guo & Yue, 2024). One widely used measure of these practices is the ESG Combined Score proposed by LSEG, which captures environmental, social, and governance actions while discounting for controversies incurred (Ahmed, Hamad & Qader, 2024).

However, implementing ESG actions requires financial resources, and the preservation of shareholder wealth must always be considered, avoiding information asymmetry and possible negative impacts on the company's image (Andrade *et al*., 2026), also taking into account the preservation of shareholder wealth (Friedman, 1970). In this sense, the relationship between the ESG practices adopted by companies and their financial performance has been investigated, as well as their decisions on obtaining and applying capital.

A company's capital structure, the combination of debt and equity financing, plays a key role in shaping financial health. Analyzing Chinese listed companies (2010–2022) via GMM, Zhao & Zhang (2024) found that ESG indicators are negatively associated with debt financing and positively with equity financing. Conversely, Kleponė & Neverauskienė (2025) found that fast-growing technology startups in the Baltic region with higher third-party capital tend to generate lower returns.

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In studying the influence of ESG activities on companies' financial performance, there are still divergent results in the literature. Saygili, Arslan & Birkan (2022), when analyzing companies listed on the Turkish stock exchange between 2007 and 2017, concluded that the disclosure of ESG practices negatively affected companies' returns. In contrast, Ahmed, Hamad & Qader (2024) analyzed the effect of ESG on the performance of non-financial companies in the United Kingdom during the period from 2012 to 2021. By using a panel data regression approach and employing the GMM model, the authors concluded that the combined ESG score, which discounts the effect of controversies from the index composition, emerged as a positive factor for ROA, improving financial results.

There are still studies that have failed to prove any significant relationship between ESG practices and financial performance. In examining 85 European companies in the energy sector between 1995 and 2020, Makridou, Doumpos & Lemonakis (2024) concluded that, although there is a tendency for a positive relationship between ESG practices and financial performance, no statistical significance was found. Studies such as that by Bruna *et al*. (2022) show that the impact of ESG on financial performance varies non-linearly over time, making it important to consider time lags.

Despite theoretical and empirical efforts, the impact of ESG on financial aspects has not yet been accurately determined. Cardillo & Basso (2025) point out that moderating variables may play an important role in this relationship, which could explain inconsistencies in the results. This is due to possible compensatory mechanisms of sustainable practices, which mitigate the risks associated with high leverage, such as the cost of capital or negative investor perception. Thus, the study of these themes together becomes relevant. Given the above, the following question arises: **Does ESG moderate the relationship between capital structure and the financial performance of Brazilian companies?** Hence, the objective of this study is to investigate whether ESG moderates the relationship between capital structure and performance in publicly traded companies listed on B3 in the period between 2010 and 2024.

The main results indicate that leverage has a negative impact on financial performance. ESG practices, when analyzed by using the index that aggregates the three pillars, have no impact on accounting or market performance, nor do they moderate the relationship between capital structure and performance. The environmental and social pillars, on the other hand, when analyzed individually, have a positive impact on the profitability of the companies in the sample. The governance pillar did not have a direct impact on performance but acted as a mitigator of the negative effect of indebtedness on the market value of the companies.

In this way, this article stands out by examining the moderating role of ESG practices in the relationship between capital structure and financial performance, incorporating endogeneity treatment in an emerging market. The findings advance the understanding of sustainable practices in corporate finance, showing that, in the Brazilian context, ESG practices require time to mature and produce results, being a relevant way to deal with the negative effects on performance produced by leverage.

2. THEORETICAL FOUNDATION

2.1 Capital structure and financial performance

Capital structure refers to the proportion of debt and equity a company holds to meet its operating commitments (Modigliani & Miller, 1958). The debate on this topic spans decades, beginning with Durand (1952) and consolidated by Modigliani & Miller (1958), who argued that, in perfect markets, capital structure is irrelevant to firm value. Recognizing this assumption's distance from reality, the model was later extended to incorporate risk-adjusted return (Modigliani & Miller, 1959).

The findings of Modigliani & Miller (1963) prompted reflection on the tax benefits of debt, introducing the concept of bankruptcy costs into capital structure discussions. Studies by Kraus &

Litzenberger (1973) and Scott (1976) argued for a balance between debt costs and benefits, giving rise to the Trade-Off Theory, which posits an optimal level of indebtedness where costs and benefits are proportional. Myers & Majluf (1984) offered a contrasting perspective, arguing that firms prioritize internal resources, followed by debt, and only then equity issuance. This capital hierarchy, rooted in information asymmetry, forms the basis of the Pecking Order Theory.

Beyond these theoretical approaches, empirical studies have sought to identify the determinants of capital structure, converging on factors such as information asymmetry, bankruptcy costs, and agency costs. Among these, the relationship between financial performance and capital structure has received particular attention, given its implications for shareholder wealth creation (Ampomah et al., 2025).

Lin *et al*. (2023) analyzed data from 175 hotel companies in 12 countries between 2019 and 2022, a period that covers the COVID-19 pandemic. The evidence found revealed that financial leverage had a significantly stronger negative association with company performance during the pandemic compared to pre-pandemic periods, highlighting how economic shocks can amplify the risks of high leverage.

In the Brazilian context, Machado & Freitas (2023) analyzed the financial leverage strategies adopted by Brazilian publicly traded companies and their effects on organizational performance during the COVID-19 pandemic. In analyzing companies indexed to the *Ibovespa*, the authors examined the behavior of variables from one year to the next and identified whether debt levels and performance indices underwent significant changes. The evidence from the study points to a reduction in corporate leverage during the period analyzed in order to enable better management throughout the crisis. Thus, the following hypothesis is proposed:

H1: Financial leverage is negatively associated with the financial performance of the companies in the sample.

2.2 ESG concept

The term ESG formally appeared in the United Nations report Who Cares Wins (2004), referring to company actions that benefit both society and the environment, while also incorporating corporate governance. The concept covers three dimensions: **E (environmental)**, related to environmental impacts such as carbon dioxide emissions and waste management; **S (social)**, which concerns social impact, including labor issues and diversity; and **G (governance)**, which involves company internal issues such as transparency (Li *et al*., 2021).

From a management perspective, ESG activities can impact the value of companies and should be integrated into the strategic management of organizations. Barman and Mahakud (2024) argue that even in a context of economic uncertainty and geopolitical risk, transparency in ESG information has a moderating effect on corporate performance.

From the investors' perspective, choosing companies with good ESG practices leads to a lower perception of risk, reflecting lower volatility. As a result, the market may give more credibility to those companies, providing them with better access to capital (Zhao & Zhang, 2024).

2.3 ESG and financial performance

The relationship between ESG activities and financial performance is inherently complex, as performance reflects the organization's broader investment decisions rather than any single factor (Campos-Rasera et al., 2021). The Stakeholder Theory (Freeman, 1984) offers a relevant lens here, arguing that shareholder value maximization is not an organization's sole objective. In the ESG context, value creation for stakeholders strengthens reputational outcomes and better meets their expectations (Valle & Sarturi, 2022).

The literature contains divergent empirical results regarding the impacts of environmental, social, and corporate governance practices on financial performance. While some, such as Chininga, Alhassan & Zeka (2023), suggest that ESG investments can generate financial benefits for the

organization, others, such as Saygili, Serafettin & Birkan (2022), point out that the existence of additional costs has a negative impact on financial performance.

Divergent results can emerge even within a single study, as shown by Moutinho & Silva (2024), who examined Brazilian ISE-listed companies during the COVID-19 pandemic. Their findings revealed greater resilience and lower volatility among ESG stocks, yet the financial impacts were mixed: no significant relationship was found from an accounting perspective, while a positive effect emerged from a market perspective. Capital expenditures were also identified as relevant to explaining these outcomes.

The literature reveals divergent results regarding the relationship between ESG activities and financial performance. Moskovics et al. (2024) suggest that this divergence may stem, in part, from a nonlinear temporal impact of ESG activities on company returns, a limitation that some studies have addressed by incorporating time lags. This stems from the fact that ESG effects on financial indicators are rarely immediate: in the short term, sustainability investments generate significant costs, while profitability tends to materialize over the medium and long term (Song, Zhao & Zeng, 2017).

Bruna *et al*. (2022), when using a panel regression model with a time lag to analyze European companies between 2014 and 2019, corroborated the non-linearity of the relationship and concluded that the impacts of ESG investments on financial performance are perceived after at least one year. Likewise, Ahmed, Hamad & Qader (2024) highlight the importance of considering past financial performance to understand current financial results, especially when it comes to understanding the impacts of ESG. These activities take some time to translate into financial terms in business dynamics. Thus, the following hypothesis is proposed:

H2: ESG practices and their dimensions, when lagging behind, are associated with the companies' financial performance.

2.4 ESG, financial performance, and capital structure

There are indications in the literature of a theoretical/empirical relationship between financial performance and capital structure, which is still being studied. Similarly, beyond the influence of ESG activities on company results, the financial literature has expanded its view of the financial impacts of these activities.

Hence, studies have added current aspects such as ESG practices to the discussion regarding the capital structure chosen by companies. Some studies argue that companies that adopt sustainability measures have greater access to credit, since the market perceives a lower operational and reputational risk (Ktit & Abu Khalaf, 2024). Others report that companies committed to ESG causes do not opt for structures with high levels of debt, as they prefer greater financial flexibility, reducing the monitoring costs that debt demands (Bagh *et al.*, 2024).

Empirical results suggest that companies that implement ESG activities tend to be more cautious about debt issues, sometimes preferring equity financing (Bagh *et al.*, 2024; Jesuka *et al.*, 2025). Good practices guide the company toward a more ethical and transparent environment, which can reduce the creditors' perception of risk and the cost of debt through a lower credit spread, generating better financing opportunities via banks (Ktit & Abu Khalaf, 2024).

Moreover, companies that invest in environmental, social, and corporate governance practices tend to reduce their information asymmetry, and, with agency costs managed, seek external financing less frequently. As they are more aligned with institutional investors, access to equity capital is more accessible (Ktit & Abu Khalaf, 2024), and therefore they have lower leverage (Bagh *et al.*, 2024; Jesuka *et al.*, 2025). Thus, the financial impacts of ESG practices have been studied in a comprehensive manner.

It is in this same sense that studies focusing on leverage analysis consider financial performance variables of interest and vice versa. In this sense, Xu and Zhu (2024), in assessing the impact of ESG on return on assets, consider the level of leverage of companies for a more appropriate analysis. Even when financial performance is measured at the market level (Tobin's Q),

there is literature that supports the consideration of debt aspects to understand the impact of ESG on performance. This can be seen in the study by Ho, Nguyen & Dang (2024), which considered a vast universe of companies listed in 31 different countries.

Ai, Lou and Bu (2024) examined the impact of green innovation on financial performance and its interaction with leverage, using data from Shanghai and Shenzhen A-share markets (2000–2020). Their findings suggest that deleveraging measures and green innovation interact positively, promoting financial performance. Thus, the rational use of financial leverage in green innovation strategies emerges as a relevant dimension in this literature. This leads to the following hypothesis:
H3: The relationship between leverage and financial performance is moderated by ESG practices and their dimensions.

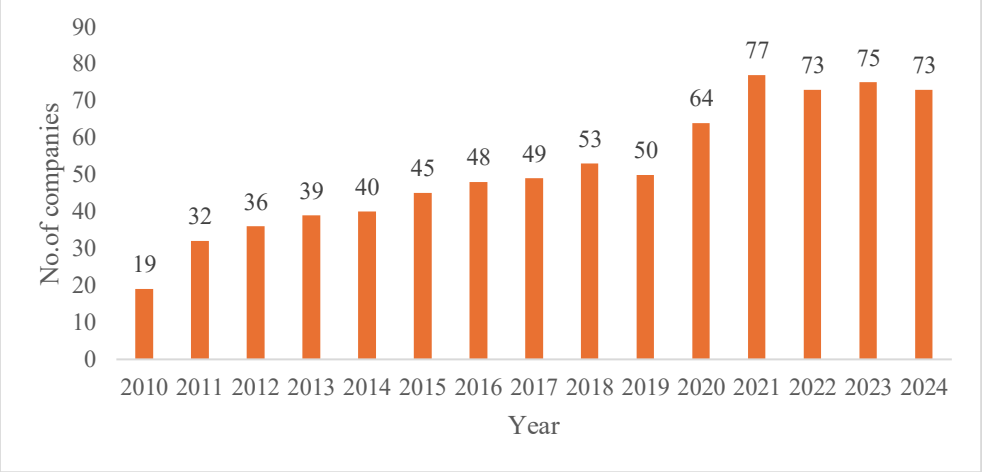
3. METHODOLOGY

3.1 Survey population and sample

The survey population consists of all companies listed on the B3 stock exchange (*Brasil, Bolsa, Balcão* - Brazil, Stock Exchange, Over-the-Counter Market), with an average of approximately 378 companies in the period from 2010 to 2024. The starting year is due to the convergence of financial statements with international standards, which occurred in 2010.

The sample consisted of non-financial companies with positive net equity, with at least four years of ESG information and financial data available in the LSEG Data & Analytics (LSEG) database, comprising 733 company-year observations. Therefore, all data were collected on the LSEG platform.

Graph 1 – Survey sample



Source: survey data (2025)

3.2 Definition and operationalization of variables

Return on assets (ROA) and Tobin's Q were used as proxies for accounting and market performance, respectively. While ROA captures ESG's effect on asset efficiency, Tobin's Q reflects how the market perceives and values companies' ESG engagement.

For the independent variable related to capital structure, corporate leverage (CL) was used as a proxy, which measures the level of corporate debt. The LSEG platform's "ESG Combined Score" index was used as the independent sustainability variable. This index takes into account whether companies had ESG-related problems, known as controversies, according to Ahmed, Hamad & Qader (2024), which can be understood as the sending of divergent information on the same topic to different institutions, as well as any corporate scandals that violate the principles of environmental, social, and corporate governance activities. This information is relevant because it can impact the overall assessment of a company's ESG score. Individual indices per pillar were also

used, although they do not have an index that takes into account controversies individually per pillar on the platform used.

Chart 1 – Model variables

Variable	Acronym	Operacionalization	Expected sign	References
Dependent variables				
Accounting performance	ROA	Net profit/Total assets	—	Pamplona, Silva & Nakamura (2021); Chagas *et al.* (2023)
Market financial performance	QTOBIN	(Market capitalization + Total debt + Preferred stock + Participations of minority shareholders)/Total assets	—	Lopez-de-Silanes, McCahery&Pudschedl (2019)
Independent variables				
Leverage	LEV	Interest-bearing liabilities/Total assets	(-)	Pamplona, Silva & Nakamura (2021); Chagas *et al.* (2023).
Environmental, social, and corporate governance practices	ESG	"ESG Combined Score" index collected from the LSEG platform	(+)	Ahmed, Hamad & Qader (2024)
Control variables				
Size	SIZE	ln (Total assets)	(+/-)	Chagas *et al.* (2023), Cantero-Saiz *et al*. (2024).
Growth	GROWTH	(Revenue(t) – revenue (t-1))/Revenue (t-1)	(+)	Pamplona, Silva & Nakamura (2021); Ho, Nguyen & Dang (2024)
Capital Expenditures	CAPEX	Capital expenditures/Total assets	(+)	Ho, Nguyen & Dang (2024) Moutinho & Silva (2024)
Age	AGE	ln (year - year of IPO + 1)	(+)	Xu & Zhu (2024).
Tangibility of assets	TANG	Fixed Assets/Total Assets	(+)	Zhao & Zhang (2024)

Source: Survey data (2025)

In order to verify whether ESG and its pillars moderate the relationship between capital structure and performance, moderating terms were used, obtained by multiplying the two variables which were centered in order to avoid multicollinearity in the models in which this moderation is tested, that is, the variable is subtracted by its mean value, thereby generating the centralized ESG and pillar variables and centralized LEV.

3.3 Regression models used

In order to analyze the relationship between environmental, social, and governance (ESG) disclosure practices and the capital structure and performance of companies listed on B3, model (1) was established, considering the inclusion of the sustainability variable represented by the ESG score from LSEG Data & Analytics, as in Shakil (2021), given that its effects are perceived over time. In this study, we consider the lag to be one year, as follows:

$$D_{i,\,t} = \beta_1 LEV_{i,t} + \beta_2\, ESG_{i,t-1} + \beta_3 SIZE_{\;\;i,t} + \beta_4 GROWTH_{\;\;i,t} + \beta_5 CAPEX_{i,t} + \beta_6 \mathrm{AGE}_{i,t} + \beta_7 TANG_{i,t} + \varepsilon_{i,t}$$

To investigate whether ESG practices moderate the relationship between capital structure and financial performance in companies listed on B3, model (2) was used based on Martí-Ballester (2017), Shakil (2021), and Inamdar (2024).

$$D_{i,\,t} = \beta_1 LEV_{i,t} + ESG_{i,t-1} + \beta_3\left(LEV_{i,t} * ESG_{i,t-1}\right) + \beta_4 SIZE_{\;\;i,t} + \beta_5 GROWTH_{\;\;i,t} + \beta_6 CAPEX_{i,t} + +\beta_7 E_{i,t} + \beta_8 TANG_{i,t} + \varepsilon_{i,t}$$

To address potential endogeneity, a two-stage regression was employed, using sector-average ESG scores and their pillars as instruments, following Ruan, Yang & Dong (2024). Data were organized as a panel with robust errors to correct for heteroscedasticity, and instrument validity was confirmed via Staiger & Stock and Cragg-Donald tests ($F > 10$ in all models). Where interaction terms were included, they were instrumented using the product of sector-average ESG (and its pillars) and firm leverage, both mean-centered to reduce multicollinearity. Sector classification followed the TRBC Economic Sector Name from the LSEG platform.

The tables were prepared and the data initially processed by using Microsoft Excel, and the regression estimates and statistical tests were performed by using the Gretl software.

4. RESULTS AND DISCUSSIONS

4.1 Descriptive statistics

Table 1 presents the descriptive statistics of the variables. ROA averaged 0.0391, ranging from −0.2985 to 0.3762, with negative values suggesting that some companies experienced losses during the study period, possibly due to the COVID-19 pandemic. Tobin's Q averaged 1.0758 (0.1645–4.0489); according to Lindenberg & Ross (1981), values of this magnitude indicate that market value is, on average, close to the replacement cost of assets. Firm age was log-transformed to mitigate the influence of outliers.

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Table 1 – Descriptive statistics of the study variables from 2010 to 2024

Variable	Mean	Median	Standard deviation	Minimum	Maximum	No. of obs.
Tobin's Q	1,0758	0,8960	0,5888	0,1645	4,0489	743
ROA	0,0391	0,0404	0,0653	-0,2985	0,3762	773
LEV	0,2731	0,2562	0,1448	0,0002	0,7456	773
ESG	51,7171	52,6302	18,5528	2,2802	91,4968	773
E	51,0912	55,3344	24,0667	0,0000	96,1136	773
S	56,6160	59,2618	22,6953	0,8730	96,8620	773
G	52,7370	53,7543	21,2398	3,3333	94,2245	773
TANG	0,5001	0,4774	0,1990	0,0836	0,8990	773
CAPEX	0,0467	0,0394	0,0331	0,0000	0,1531	773
SIZE	23,8537	23,8696	1,2153	20,8024	27,7486	773
AGE	2,8053	2,7726	0,6895	0,0000	4,4067	773
GROWTH	0,1251	0,0885	0,3223	-0,7101	5,0488	752

Legends: Tobin's Q = market performance; ROA = return on assets; AGE = age, smoothed by natural logarithm; LEV = leverage; CAPEX = capital expenditures; TANG = tangibility; SIZE = company size, smoothed by natural logarithm; GROWTH = revenue growth; ESG = environmental, social and governance indicator; E = environmental dimension; S = social dimension; G = governance dimension.
Source: Survey results (2025)

The average debt of companies, measured by leverage, is 0,2731, with a small standard deviation of 0,1448 and ranging between 0,0002 and 0,7456. It can be said that approximately 27% of companies' assets are long-term debt on average. Capital expenditure (Capex) averaged 0,0467, with a minimum of 0,0000 and a maximum of 0,1531. This indicates that 4,67% of resources were

invested to increase production capacity, operational efficiency, or extend the useful life of existing assets.

The ESG variable had a mean and a median of 51,7171 and 52,6302, respectively. This indicates that the ESG rating is above 52 points for more than half of the companies. The standard deviation of 18,5528 reveals the variability in ESG disclosure levels, with a minimum value of 2,2802 and a maximum of 91,4968, showing that there are companies with low and excellence levels in sustainability. Therefore, there is no uniformity in the scoring of these sustainable practices. The descriptive statistics for E, S, and G dimensions reflect similar results and show that there are still companies that are not investing in environmental practices, since the minimum value in this dimension is zero.

Firm size was also log-transformed prior to regression, with a mean of 23.8537, median of 23.8696, and values ranging from 20.8024 to 27.7486. Growth opportunity, proxied by revenue growth rate, averaged 0.1251 (−0.7101 to 5.0488), reflecting considerable heterogeneity across the sample, likely influenced by the COVID-19 pandemic (2020) and the economic crisis of 2014, 2016.

4.2 Regression model results

Initially, we tested the behavior of the model variables without including interaction terms to test moderation, both for accounting performance (ROA) and market performance (Tobin's Q), presented in Tables 2 and 3. For all models, the sustainability variable was lagged by one year.

Tables 2 and 3 – Results of performance regressions measured by return on assets (ROA) and Tobin's Q, considering ESG practices and their pillars.

	(Table 2) Dependent variable: ROA				(Table 3) Dependent variable: Tobin's Q			
Variable	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
LEV	−0,1562***	−0,1515***	−0,1514***	−0,1579***	−0,1745	−0,1356	−0,1663	−0,1824
$ESG_{(t-1)}$	0,0002	—	—	—	0,0009	—	—	—
$E_{(t-1)}$	—	0,0007**	—	—	—	0,0030	—	—
$S_{(t-1)}$	—	—	0,0006**	—	—	—	0,0011	—
$G_{(t-1)}$	—	—	—	0,0001	—	—	—	0,0007
CAPEX	0,3903***	0,3393***	0,3828***	0,3939***	4,6682***	4,4536***	4,7102***	4,6872***
TANG	0,0038	0,0003	−0,0080	0,0063	−0,2757**	−0,3004**	−0,2932**	−0,2647**
SIZE	−0,0020	−0,0078**	−0,0058**	−0,0016	−0,1003***	−0,1214***	−0,1043***	−0,0989***
GROWTH	0,0542***	0,0575***	0,0548***	0,0539***	0,1217*	0,1353**	0,1200*	0,1208*
AGE	0,0044	0,0041	0,0040	0,0039	−0,0745**	−0,0778**	−0,0748**	−0,0763**
R^2	0,2072	0,1981	0,1989	0,1970	0,1485	0,1697	0,1490	0,1409
No. of obs.	672	672	672	672	644	644	644	644
P-value (S)	<0,001	<0,001	<0,001	<0,001	<0,0001	<0,0001	<0,0001	<0,0001
Staiger & Stock	144,489	97,3244	154,696	122,364	144,489	97,3244	154,696	122,364

Legends: ROA = return on assets; Tobin's Q= market performance; AGE = age; LEV = leverage; CAPEX = capital expenditures; TANG = tangibility; SIZE = company size; GROWTH = revenue growth; $ESG_{(t-1)}$ = lagging environmental, social and governance indicator; $E_{(t-1)}$ = lagging environmental dimension; $S_{(t-1)}$ = lagging social dimension; $G_{(t-1)}$ = lagging governance dimension. Statistical significance of 10% for (*), 5% for (**), and 1% for (***).
Source: Survey results (2025).

Leverage showed a negative and statistically significant relationship with ROA, indicating that higher indebtedness is associated with lower accounting performance. This finding is consistent with Xu & Zhu (2024), who demonstrated, in the Chinese context, that greater financial leverage deteriorates return on assets and moderates its relationship with corporate ESG practices.

As for Tobin's Q, despite the similarly negative relationship, leverage did not show a statistically significant relationship. This result differs from that found by Ho, Nguyen & Dang (2024), who associate higher indebtedness, with better financial performance at the market level (Tobin's Q). However, those authors concluded that the level of leverage controls the relationship between ESG pillars and financial results, which was found in this study when considering financial performance at the accounting level. In turn, Moutinho & Silva (2024), in a study which analyzes Brazilian companies, point out that leverage does not control the impacts of ESG on Tobin's Q, being insignificant in the analysis, as found by this study when performance is measured at the market level.

In all models, it can be seen that the aggregate ESG index, as well as the governance pillar, do not show a statistically significant relationship with performance in any of the models. The lack of significance was also found by Makridou, Doumpos & Lemonakis (2024) when analyzing the relationship between financial performance and ESG in companies in the energy sector. These results differ from those found by Ho, Nguyen & Dang (2024), who concluded that ESG activities have a positive impact on performance as measured by Tobin's Q, i.e., at the market value. In their study, which analyzed more than 13.000 companies from 31 different countries, the authors concluded that financial performance improves by about 0,46% when ESG activities are performed.

Likewise, and in contrast to the empirical results of this study, in an analysis also conducted within the Brazilian context, Possebon *et al*. (2024) found a positive relationship between the aggregate ESG index and the financial performance measured by the ROA. However, the authors considered a different period in their analyses (2018 to 2022). This is relevant due to the significant variation in indexed companies over the period. This study broadens the scope and enables a broader understanding of the behavior of the relationship over time.

Furthermore, another possible justification for the divergence of results in the Brazilian context can be attributed to the different measurement of ESG activities. While Possebon *et al*. (2024) use the LSEG ESG index, this study measures these practices considering the discount of possible controversies on the subject, i.e., the LSEG ESG Combined Score index. This lack of relationship between ESG and ROA also differs from that identified by the empirical results found by Ahmed, Hamad & Qader (2024), who used the ESG Combined index to measure ESG practices. Yet, the latter analyzed the relationship in the context of a developed economy (the United Kingdom), which reinforces the literature suggesting different behaviors of the impact of ESG on the financial performance of companies operating in developed or emerging countries.

The environmental and social pillars showed a positive and significant impact on ROA, suggesting that the adoption of these practices improves accounting performance. However, as Su, Fu & Liderman (2024) note, such effects take time to consolidate and depend on the company's strategy, available resources, and market competition. These results partially diverge from Possebon et al. (2024): while both studies agree that environmental and social practices influence ROA, the direction of the social pillar's effect differs. Possebon et al. (2024) found a negative impact, whereas our findings indicate a positive one.

The governance pillar was not able to influence the ROA of Brazilian companies. This study converges with the findings by Ahmed, Hamad & Qader (2024), who also measured ESG practices discounting the effects of controversies. The lack of a relationship between governance and financial performance can be attributed to several factors. It is possible that governance-related initiatives require a longer implementation period to produce tangible results for companies, compared to actions related to social or environmental aspects. Some governance projects, for instance, may take several years to implement before their impact on profitability becomes evident.

With regard to the impacts of control variables, in the case of performance measured by ROA (Table 2), the behavior of all variables remained consistent in the tested models. Capital

expenditures (CAPEX) and growth opportunities (GROWTH) had a positive relationship, with statistical significance. In the case of CAPEX, it was observed that for each real invested in assets, the company generated, on average, 38 cents of profit in the tested models. Therefore, increases in the acquisition, improvement, or maintenance of long-term assets (real estate, equipment, machinery, and infrastructure) increase the profitability of companies. However, these results are contrary to those found by Rajbanshi *et al*. (2025), who justified their findings by stating that CAPEX is a proxy for idle resources, which, when higher, often result in lower company assessment or performance.

Moreover, when observing financial performance at the market level, these findings corroborate those by Moutinho & Silva (2024), who empirically demonstrated the positive influence of capital expenditures as a control variable for the financial impact of ESG practices. A similar result was also observed by Ho, Nguyen & Dang (2024), who found intercept values for the variable which were similar to the ones in this study (around value 4), which may signal a convergence in understanding the level of impact of these expenditures on controlling the relationship between Tobin's Q and ESG practices.

The growth opportunity (GROWTH) had a positive coefficient in all scenarios. Hence, the increase in revenues is associated with increased profitability and market value of the companies in this study. The study by Xu & Zhu (2024) also indicated the capacity of growth opportunities to control the relationship between ESG practices and companies' ROA, relating positively to the latter. Similarly, but considering market performance (Tobin's Q), Ho, Nguyen & Dang (2024) found that growth opportunities had a positive impact on companies' financial results.

When analyzing the financial results at the accounting level, the companies' tangibility and age variables did not have statistically significant results. Yet, the coefficient between tangibility and ROA ranged between negative and positive. As for the time when the company made its IPO (AGE), a positive coefficient was observed. This result is opposite to those found by Liu, Wu & Lin (2025), who observed this negative relationship in a study conducted between 2009 and 2019 on companies listed in the US. This result also differs from that found by Xu & Zhu (2024), that is, a negative impact of company age on financial performance, noting that it controls the financial impacts of ESG practices.

Performing the same analysis for the control variables related to market performance, presented in Table 3, we find that tangibility, size, growth, age, and capital expenditures presented consistent and statistically significant results. The relationship indicated for size (SIZE) is negative with market valuation, indicating that the larger the company, the lower its market valuations. The same result was found by Ho, Nguyen & Dang (2024), who also measure financial performance using Tobin's Q. The study by Coutinho & Silva (2024) shows that the size of Brazilian companies is positively related to Tobin's Q, being able to control the relationship between ESG practices and financial results.

The tangibility component, on the other hand, showed a positive relationship, with 5% statistical significance. In other words, the market positively prices the application of resources in tangible assets, suggesting that it appreciates companies investing in assets that can be used as collateral for their loans, as this provides greater security in transactions. This evidence is consistent with that of Ho, Nguyen & Dang (2024), who found a negative relationship between asset tangibility and financial performance at the market level for companies listed in 31 different countries. Despite a contrary relationship, the authors found that tangibility is relevant for understanding the financial impacts of ESG, as in this study.

To verify whether sustainability practices have a moderating effect, an ESG(*)LEV interaction term was added, following the same logic for its individual pillars, which were centralized and took into account that their effects could be observed at different times of the year, as shown in Tables 4 (ROA) and 5 (Tobin's Q).

Tables 4 and 5 – Results of ROA and Tobin's Q performance regressions, considering the interaction between ESG and its pillars and leverage

	Table 4- ROA				Table 5- Q de Tobin			
Variable	**(9)**	**(10)**	**(11)**	**(12)**	**(13)**	**(14)**	**(15)**	**(16)**
LEV	−0,1564***	−0,1529***	−0,1489***	−0,1554***	−0,1751	−0,1261	−0,1413	−0,1120
$ESG_{(t-1)}$	0,0002	—	—	—	0,0007	—	—	—
$LEV*ESG_{(t-1)}$	0,0003	—	—	—	−0,0039	—	—	—
$E_{(t-1)}$	—	0,0007**	—	—	—	0,0026	—	—
$LEV*E_{(t-1)}$	—	0,0004	—	—	—	−0,0057	—	—
$S_{(t-1)}$	—	—	0,0007***	—	—	—	0,0018	—
$LEV*S_{(t-1)}$	—	—	0,0018	—	—	—	0,0113	—
$G_{(t-1)}$	—	—	—	0,0002	—	—	—	0,0019
$LEV*G_{(t-1)}$	—	—	—	0,0019	—	—	—	0,0327***
CAPEX	0,3875***	0,3347***	0,3723***	0,3848***	4,7038***	4,5193***	4,6384***	4,5487***
TANG	0,0045	0,0019	−0,0055	0,0092	−0,2819**	−0,3147**	−0,2839**	−0,2355*
SIZE	−0,0020	−0,0078**	−0,0062**	−0,0018	−0,1006***	−0,1215***	−0,1063***	−0,1002***
GROWTH	0,0541***	0,0573***	0,0542***	0,0538***	0,1227*	0,1383**	0,1162*	0,1196*
AGE	0,0044	0,0040	0,0040	0,0028	−0,0736**	−0,0758**	−0,0755**	−0,0958***
R^2	0,2080	0,1957	0,1933	0,2000	0,145675	0,170490	0,154664	0,1545
No. of obs.	672	672	672	672	644	644	644	644
P-value (S)	<0,0001	<0,0001	<0,0001	<0,0001	<0,0001	<0,0001	<0,0001	<0,0001
Cragg-Donald	65,6532	45,9832	63,9629	56,628	62,1455	44,4775	65,7508	60,1913

Legends: ROA = return on assets; Tobin's Q = market performance; AGE = age; LEV = leverage; CAPEX = capital expenditures; TANG = tangibility; SIZE = company size; GROWTH = revenue growth; $ESG_{(t-1)}$ = lagging environment, social and governance indicator; $E_{(t-1)}$ = lagging environmental dimension; $S_{(t-1)}$ = lagging social dimension; $G_{(t-1)}$ = lagging governance dimension; $ESG/E/S/G_{(t-1)}$ (*) LEV = interaction terms. Statistical significance of 10% for (*), 5% for (**), and 1% for (***).
Source: Survey results (2025).

The aggregate ESG index showed no statistically significant effect on either ROA or Tobin's Q, nor did its interactions with leverage, indicating that ESG as a composite measure neither drives performance nor moderates the relationship between capital structure and performance. The opposing signs of the interaction coefficients, positive in the ROA model and negative in the Tobin's Q model, further reinforce the absence of a consistent moderating pattern. When analyzed separately, the environmental and social pillars maintained a positive and significant relationship with ROA (models 10 and 11), corroborating earlier findings and suggesting that these practices contribute to operational efficiency and profitability. However, neither pillar showed a significant effect on market performance, nor were their interaction terms with leverage significant, indicating the absence of a moderating role in the leverage-performance relationship.

The governance pillar exhibited a distinct pattern. As in previous models, governance alone had no significant effect on performance, and leverage remained insignificant in models with Tobin's Q, though its consistently negative sign suggests that higher debt levels tend to reduce market performance. However, the interaction term between governance and leverage in the Tobin's Q model (model 16) yielded a positive and statistically significant coefficient (1% level), indicating that governance moderates the relationship between capital structure and market value. Although neither variable is significant in isolation, the significant interaction reveals that the effect of leverage on market performance is contingent on the firm's governance level.

This result indicates that governance acts as a mechanism to mitigate the negative effects of leverage, strengthening investor confidence and reducing the perceived risks associated with

indebtedness. In companies with more robust governance structures, the use of debt tends to be more efficient and strategic, which is positively reflected in market value. This evidence reinforces the propositions of the Agency Theory (Jensen & Meckling, 1976), which points to corporate governance as an instrument for aligning interests, reducing information asymmetries, and disciplining managerial behavior.

When observing the results of the relationship between leverage and ROA (Table 4), it is possible to verify that they were negative and consistent in the three models, with statistical significance at 1% for this study. This indicates that a more leveraged capital structure reduces accounting performance. The negative trend is also observed in the regressions with Tobin's Q, although without statistical significance, reinforcing the idea that the impact of leverage on market performance is more sensitive to governance quality and investor perceptions than to purely accounting indicators.

The remaining control variables (CAPEX, tangibility, size, growth, and age) behaved consistently with the results in Tables 2 and 3. The findings may also reflect the time horizon of the analysis, since ESG effects tend to manifest in the long term and require the accumulation of sustainable practices to translate into financial benefits (Chia, Lim & Goh, 2020; Su, Fu & Liderman, 2024).

Thus, according to the survey results, the survey hypotheses were:

- **H1 (confirmed):** Financial leverage negatively affects the financial performance of companies.
- **H2 (partially confirmed):** Combined ESG did not show a significant relationship with financial performance; however, environmental and social pillars had a positive impact on accounting performance.
- **H3 (partially confirmed):** Combined ESG did not moderate the relationship between leverage and performance; however, corporate governance acted as a moderator in market performance.

5. FINAL REMARKS

This study investigated whether ESG practices moderate the relationship between capital structure and financial performance in Brazilian companies listed on B3 (2010–2024). Given the endogeneity among variables, two-stage least squares (2SLS) regression was employed on panel data, using sectoral ESG score means and their pillars as instruments. Performance was proxied by ROA and Tobin's Q, while ESG was represented by the Combined Score, which incorporates the effect of controversies.

The results indicated that, although ESG practices are on the rise in the Brazilian market, the aggregate index showed no significant effect on financial performance or moderating role in the leverage-performance relationship. When analyzed separately, however, the environmental and social pillars positively impacted firm profitability, while governance, though insignificant in isolation, moderated the effect of indebtedness on market performance.

This finding may reflect the still largely voluntary nature of ESG disclosures in the country, the lack of regulatory standardization, and the sectoral heterogeneity of sustainable practices. Moreover, it suggests that the economic effects of ESG on corporate value may require a longer time horizon to materialize, especially in emerging economies.

It is worth noting that, even when ESG practices do not produce immediate or directly observable effects on performance, their absence can generate negative impacts. In an environment increasingly guided by sustainability criteria, the lack of such initiatives may signal higher risk and weaker long-term commitment. In this sense, ESG practices can function as mechanisms for reputation protection and capital attraction, contributing to organizational resilience and the preservation of market value.

Accordingly, the study highlights a trend toward institutional maturity in the field of sustainable finance in Brazil, characterized by a gradual increase in transparency and the integration

of financial and socio-environmental variables. This transition may represent a converging movement among Brazilian companies toward international standards for ESG reporting and risk assessment, contributing to informational credibility and long-term capital costs.

Theoretically, this study contributes by exploring the interdependence between corporate sustainability and financial structure, approaching ESG through the lenses of moderation and informational risk. Methodologically, it reinforces the importance of addressing endogeneity through appropriate econometric strategies, such as two-stage regression. For the market, the findings suggest that ESG financial effects are heterogeneous and dimension-dependent, with governance playing a key role in mitigating leverage effects. For regulators, the evidence indicates that governance quality can be decisive in strengthening market efficiency and reducing risks associated with corporate debt.

Limitations include the use of a single indicator to measure LSEG's ESG Combined Score and the restriction of the sample to Brazilian companies with available data for the period. It is suggested that future studies expand the temporal and geographic scope, incorporate alternative metrics, and explore machine learning and text analysis methods to capture ESG disclosures. In addition, investigating factors such as greenwashing, corporate governance, and investor perception can enrich the understanding of the role of sustainable practices in risk pricing and in creating business value.

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