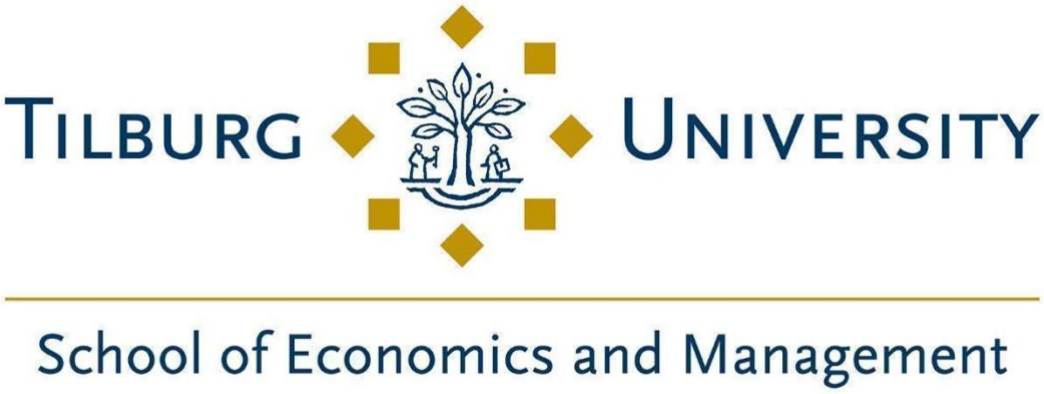


# The Impact of Mandatory ESG Disclosure on Firm Performance: Evidence from Brazil

*Master Thesis Finance*


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# 1. Introduction

The relevance of environmental, social, and governance (ESG) factors has increased significantly over the past decade. The increased importance given by investors, regulators, and civil society is reshaping corporate strategy and global investment decisions. Historically, corporate engagement with sustainability, especially the disclosure of ESG information, was a voluntary movement. Firms frequently adopted these practices to be perceived as corporate citizens, signaling superior quality to the market. This voluntary approach to reporting sustainability performance aligns with Spence's (1973) Signaling Theory and is also supported by Fombrun et al.'s (2006) findings. Additionally, the act of voluntary reporting was often correlated with financial advantages, including reduced perceived risks and enhanced investment opportunities (Sen et al., 2006).

However, the expansion of self-reporting sustainability performance, which was usually unaudited and not standardized, exposed several limitations that contributed to the persistence of market information asymmetry (Healy & Palepu, 2001). This setup cleared the way for the concept later known as "greenwashing", where firms with weaker ESG performance engaged in symbolic reporting to manage public perceptions rather than their actual initiatives. (Clarkson et al., 2008). The divergence between intended signaling and actual sustainability performance stemming from the increasing amount of voluntary reporting underscores the necessity for regulatory intervention to enhance both disclosure standards, comparability, and reliability (Ioannou & Serafeim, 2017).

While essential for correcting market asymmetries, the empirical evidence of the impact of mandatory sustainability disclosure remains nascent and mixed. For instance, the findings of Ioannou and Serafeim (2017) demonstrate that mandates were usually associated with an increase in firm valuation (Tobin's Q) due to amplified information quality. On the other hand, Nampoothiri et al.'s (2024) research on the European Union (EU) Non-Financial Reporting Directive (NFRD) demonstrates that mandatory disclosure does not significantly affect firm value. Therefore, it can be inferred that the institutional enforcement, time horizon, and specific country context potentially exert a divergence in results.

Given the mixed evidence provided by previous studies, a significant research gap persists, especially concerning the causal effects of regulatory shocks in major emerging economies. As one of the largest emerging markets and due to its global biodiversity importance, Brazil presents an ideal environment for the present analysis. The ultimate goal of this master's thesis

is to provide a robust quasi-experimental research design to understand the precise causal impact of Brazil's recent mandatory ESG reporting regulation on firms' financial and sustainability performance. Consequently, it offers a pioneering context-specific view from an emerging market perspective.

The main research question this thesis seeks to answer is "What is the impact of mandatory ESG disclosure on the firm performance of companies listed in Brazil?". This research assesses the impact of CVM's resolution No. 59/2021 on Brazilian publicly listed firms' sustainability and financial performance. The principal objective is to move beyond simple correlation to establishing a causal linkage between the regulation and post-implementation corporate outcomes.

To address the main goal of this research, several sub-questions were developed to guide the empirical analysis. Firstly, concerning market perception, I seek to answer whether the mandate enhances firm valuation (Tobin's Q) as predicted by the signaling theory due to the reduction of information asymmetry, or whether it destroys value due to the realization of short-term compliance costs and transitional investments.

Secondly, the impact of the legislation on operational performance is also investigated. In this regard, I aim to determine if there was any measurable impact on profitability, as proxied by Return on Assets (ROA), or on their financial structure, as proxied by Total Liabilities (LTQ). These financial metrics are crucial for capturing whether compliance costs or capital expenditures associated with new sustainability initiatives offset the potential efficiency gains and lower cost of capital.

Furthermore, with the purpose of measuring changes in sustainability performance, I seek to answer whether the regulatory shock incentivized companies to enhance their Environmental, Social, and Governance ratings. By expanding the analysis to each of the ESG pillars separately, this research provides a granular understanding of the heterogeneous consequences of the mandate across financial and sustainability metrics.

To carefully address these questions and identify the causal effect, this study employs a firm-level financial and sustainability data analysis ranging from 2018 to 2024. The selected time window captures both the periods pre- and post-mandate, which took effect in 2022. The financial and accounting variables are retrieved from WRDS Compustat Global, and the sustainability variables are downloaded from the Refinitiv LSEG Workspace.

To reinforce methodological rigor and robust causal identification, this study implements two complementary research designs. The present analysis starts with the employment of Panel Data regressions with firm fixed effects, quarterly observations and restricted to Brazilian firms. Thus, it allows the assessment of within-country dynamics and heterogeneity. Subsequently, a Differences-in-Differences (DiD) design is implemented to capture causal inference. The DiD estimations compare the treated Brazilian firms to a constructed control group of U.S. firms constituents of the S&P 1500 index.

The control group is selected carefully via Propensity Score Matching (PSM), which is based on pre-treatment covariates, and aims to eliminate selection bias and ensure comparability across firms. Companies in the control group present similar characteristics when compared to the treated group, but were unaffected by the regulatory shock. This combination of research methodologies, alongside with rigorous robustness checks and two-way clustered standard errors, ensures that findings properly isolate the impact of CVM Resolution No. 59, controlling for both unobserved firm heterogeneity and global time trends.

The empirical analysis returns critical findings that assist in the understanding of regulatory shocks in emerging markets. The main result from the Difference-in-Differences estimation points out to a statistically significant negative causal relationship with firm valuation. It can be inferred that relative to the matched U.S. control group, Brazilian companies faced a Tobin's Q decrease of approximately 30% ($\beta = -0.462$, $p < 0.05$). This finding suggests an adverse short-term market reaction in the two years following the sustainability disclosure regulation. This could be attributed to the market pricing in new risks associated with the mandate, such as compliance and preparatory costs (Albuquerque et al., 2018).

Additionally, the study measured no economically or statistically significant effect of the regulation on firms' profitability (ROA). This result indicates that any possible short-term operational efficiency gains or reductions in financing conditions, linked to increased transparency, were totally offset by reporting and transitional costs that were driven by the new regulatory framework.

Regarding financial structure, the baseline panel data regressions initially pointed to a statistically significant positive correlation between the mandate and total liabilities, which indicated a 20% increase in total debt. This finding is aligned with Albuquerque et al. (2019), which suggested that firms usually financed their transitional investments using higher leverage. However, the above mentioned significant effect is lost after controlling for

fundamental firm characteristics, such as size and leverage. Thus, it implies that the initially observed increase in debt was likely driven by broader corporate strategy rather than an independent effect of the mandate.

In the context of the underlying changes in sustainability performance, this study measures the impact driven by the new legislation based on firms' E, S, G pillar scores and ESG overall score. The captured effects of the regulation were positive across the Environmental and Governance dimensions, but not statistically significant when compared to the control group. The highest estimated increase was observed in the Environmental pillar, which is in line with the strong global scrutiny recently faced by Brazil over its environmental record. Additionally, the lack of statistical significance across the ESG ratings strengthens the observed theoretical expectation of an inherent implementation lag. Sustainability performance, tangible improvements usually demand time to be fully implemented and results realized.

Given the findings mentioned above, the results of this thesis partially oppose the pure signaling theory which indicates that mandatory disclosure immediately enhances value (Ioannou & Serafeim, 2017), particularly in the short run. Instead, the statistically significant negative causal impact of Tobin's Q strongly aligns with the literature highlighting the notable short-term costs and risks associated with regulatory shocks in emerging markets (Albuquerque et al., 2019).

Furthermore, the positive yet not statistically significant result measured for ESG ratings is consistent with the hypothesis of an implementation lag in sustainability initiatives, as suggested by the sustainability transitions literature (Geels, 2002). This indicates that, in the short run, mandatory reporting legislations exert a primary impact on the disclosure quality and quantity rather than driving changes in sustainability performance (Ioannou & Serafeim, 2017). Moreover, it suggests that the true sustainability performance impact is only to materialize gradually over a longer time horizon.

Therefore, the present study uniquely contributes to current literature by demonstrating that the short-term consequences of mandatory ESG regulation are closely related to the institutional environment and market maturity. The statistically significant negative market reaction observed in Brazil provides further support for the idea that emerging markets face a higher sensitivity to regulatory compliance costs and transparency burdens during the initial adjustment phase.

Considering all presented above, it can be inferred that the implementation of CVM Resolution No. 59/2021 initiated a short-term adjustment phase for publicly listed firms, represented by a statistically significant negative impact on firm valuation. However, the full economic and sustainability benefits of enhanced sustainability disclosure are likely to emerge over a longer period of time.

The remainder of this thesis is organized as follows: Section 2 encompasses the analysis of the relevant literature review, connecting the theoretical and empirical context surrounding ESG disclosure and regulatory effects. Section 3 overviews the data constructions, providing details on sources, sample selection, variable definitions, and descriptive statistics. Section 4 refers to the methodology, carefully detailing the Panel Fixed-Effects and Difference-in-Differences econometric specifications, and robustness tools and tests. Section 5 presents the empirical results, covering baseline results, robustness checks, and sectoral heterogeneity analysis. To conclude, Section 6 summarizes the contributions of the present study, discussing the theoretical interpretation, acknowledging limitations, and identifying avenues for future research.

# 2. Literature Review

## 2.1 Theoretical Foundations and Global Evidence on ESG Disclosure

During the past few years, the importance given to ESG by companies, investors, policymakers, and society in general has grown rapidly. At first, sustainability reports were mainly in the form of a voluntary disclosure, which was promoted by the companies and with little to no influence of regulators. According to Fombrun et al. (2006), companies have the desire to be recognized as responsible corporate citizens to achieve reputational gains while reducing risks. Previous studies have concluded that being recognized as a responsible corporate citizen is usually correlated with improved investment and financing opportunities (Sen et al., 2006), enhanced employee recruitment (Turban and Greening, 1997), and driving customer loyalty and preference (Marin et al., 2009). In line with the findings above, the number of firms that began to deliberately report their ESG performance has been growing exponentially.

Spence (1973) developed the theory of signaling, providing the foundation behind firms' engagement in voluntary reporting. This theory supports the idea that a company disclosure acts as a “signal” of quality, credibility, and superior management. In traditional finance, disclosure has long been recognized as a tool to reduce information asymmetry between firms

and investors (Healy & Palepu, 2001). Thus, it can be concluded that in an environment where information asymmetry is present, companies with stronger ESG practices tend to have a higher incentive to signal their performance (Verrecchia, 1983).

According to Li et al. (1997), there are two different explanations for firms' engagement in voluntary ESG reporting: signaling and greenwashing. The signaling serves as a means of seeking distinction from firms with weaker practices. However, due to the lack of regulation and standards, disclosure costs were considered relatively low, and even firms with poor ESG performance engaged in voluntary reporting. These firms used the action of reporting with the purpose of gaining legitimacy, emphasizing points in which the company was performing well and choosing not to disclose bad operating areas, leading to a term called "greenwashing" (Clarkson et al., 2008).

Freitas de Neto (2020) classifies the phenomenon of "greenwashing" as the combination of two firm behaviors: weak environmental performance and positive communication about their environmental practices. Furthermore, the absence of guidelines and standards by policymakers and unions also made the assessment and comparison of such reports extremely difficult, increasing the likelihood of greenwashing.

Signaling theory anticipates disclosure as a tool for credible differentiation; however, in the ESG spectrum, it can also be misused as a symbolic tool, which means that firms can use the action of reporting to manage perceptions rather than performance (Cho & Patten, 2007). Consequently, the outcomes of voluntary and mandatory ESG reporting are likely to diverge, underscoring the need for regulatory intervention.

Ioannou and Serafeim's (2017) study concludes that mandatory disclosure stimulates companies to enhance both the quality and quantity of their ESG reporting, and thus, reduces information asymmetry and agency costs. Their analysis on ESG reporting mandates in China, Denmark, Malaysia, and South Africa, show evidence that an increase in sustainability disclosure motivated by regulation are associated with a rise in firms' valuation, represented by Tobin's Q. Following their findings, it can be concluded that reporting mandates increases the amount of information available for the distinct stakeholders, elevates information quality, allows greater comparability due to the implementation of disclosure standards, and potentially drives firm value.

Nampoothiri et al. (2024) study the impact of recent changes in the European Union's Non-Financial Reporting Directive (NFRD) on listed European firms. The EU NFRD mandates that

certain large firms are obligated to report their sustainability performance. Contrasting Ioannou and Serafeim's findings, Nampoothiri et al. (2024) results suggest that the mandatory ESG disclosure does not significantly affect firm value. However, the results indicate small inter-industry differences. The divergence between Nampoothiri et al. (2024) and Ioannou and Serafeim's (2017) is likely to stem from differences in institutional enforcement, time horizon, and countries under analysis.

Moreover, the literature aiming to understand the relationship between mandatory ESG disclosure and its impact on firm financial and sustainability performance is still nascent, and evidence remains mixed. Both ESG ratings and ESG reporting mandates have significant relevance to society, investors, firms, and scholars. Previous studies were focused on analysing the effect of such regulations in developed countries. Thus, there is little work conducted in emerging economies, which is the focus of the present study.

## 2.2 ESG Ratings and Link to Firm Performance

Following the popularization of ESG reports, investors and analysts of the capital markets started to take sustainability information into account in their valuation models, creating further demand for more sophisticated reporting structures (Ioannou & Serafeim, 2014). In response to the increasing pressure from both the investment community and non-shareholding stakeholders, many governments introduced regulations for ESG disclosure, either in the form of legislation, regulatory frameworks, or stock exchange listing requirements.

For a long time, the most significant criticism of sustainability reporting was attributed to the lack of rigor, credibility, and comparability. Consequently, seeking to reduce this issue, the United Nations Environment Program (UNEP) developed the Global Reporting Initiative (GRI). The GRI was implemented with the objective of establishing sustainability reports as relevant and as reliable as a firm's financial reports. The GRI proposed guidelines that shaped and standardised ESG disclosure, making it more transparent and comparable. These sorts of initiatives promoted by intergovernmental organizations, governments, investors, and civil society were crucial for making ESG reporting as important and as analyzed as financial reporting.

These standardization initiatives enhanced reporting quantity and quality, promoting and accelerating the development of quantitative measures of sustainability performance. Around the 1990s-2000s, a tool to estimate non-financial performance for investors and stakeholders

was created. Similarly, to what is seen for credit scores, which measure a firm's creditworthiness by predicting its likelihood of repaying debt, ESG scores evaluate a company's sustainability impact and performance. However, Berg et al. (2022) highlight that, unlike credit scores, which are highly correlated and standardized, ESG scores often point to disagreement between the different score agencies.

The ESG score is split into three pillars: Environmental, Social, and Governance. Firms are evaluated according to their impact in the three areas, and an overall score is derived based on these results. Due to the historical lack of standardization, credibility, and comparability of sustainability reports, the ESG ratings present more difficulty to be precisely calculated when compared to credit ratings, thus being one of the reasons for the differences in sustainability grades between distinct rating agencies. According to Berg et al. (2022), these differences are usually related to measurement, weight, and scope, as agencies include distinct ESG categories and issues in their assessment.

Currently, ESG scores are still not showing great standardization between different providers. However, underscoring the financial materiality of sustainability performance, ESG ratings expanded intensively and became a fundamental instrument for investors seeking to align their investments with their values and societal goals. These sustainability reports are an important tool in assessing which and how ESG factors can impact a firm's financials and risk profile. (Liu, Y. et al., 2023). According to Eccles et al. (2014) and Friede et al. (2015), firms with higher ESG sustainability ratings tend to outperform peers both in stock market and accounting measures, pointing to a positive relationship between ESG and corporate financial performance.

Sustainability rating agencies analyze large datasets to extract insights into various elements of a firm's environmental, social, and governance performance. Larcker et al. (2022) argue that while investors utilize this information to make investment decisions, companies rely on it to acquire third-party feedback on their own sustainability initiatives. According to Liu et al. (2023), ESG scores are being used by investors to screen investments, integrate sustainability factors into their portfolio, and control for associated risk. Thus, it's clear that it is in the firm's best interest to enhance its sustainability rating.

Furthermore, there are several studies that indicate a relationship between a firm's ESG and financial performance. Ademi and Klungseth (2022) and Aydoğmuş et al. (2022) findings provide evidence that both individual and combined ESG scores have a significant and positive

impact on firm value (Tobin's Q) and profitability (Return on Assets (ROA)). Malich and Husi's (2021) findings suggest that firms with higher ESG scores benefit from a lower cost of capital, as they are perceived by investors as more resilient to financially material risks associated with sustainability. Seeking to understand the influence of ESG score on financial performance, Candio's (2024) research points out the distinct financial impact of the different ESG pillars. Candio's (2024) findings demonstrate that out of the three pillars, the governance score has the strongest influence on firms' accounting-based measures.

## 2.3 ESG Disclosure Regulation in Brazil

The present study focuses on understanding how Brazilian firms were affected by the ESG disclosure regulation. To investigate the main research question, I focused on publicly traded companies listed in the Brazilian Stock Exchange (B3). Brazil figures as one of the largest emerging economies in the world and is currently ranked 7th in population size and 9th in Gross Domestic Product (GDP).

Brazil has also signed the Paris Agreement, which indicates the country's commitment to scaling down greenhouse emissions and to investing in developing resilience to climate change. The largest country in South America is also a biodiversity powerhouse, holding roughly 20% of the world's total species, which makes Brazil's sustainability outcomes globally material.

However, until recently, the Brazilian government paid little attention to assessing the firms' sustainability performance, ultimately leading to a configuration where disclosure was primarily voluntary. As previously stated, the issue with voluntary reporting lies in the lack of enforcement, institutional voids, standards, and measurement. Furthermore, the challenges in properly evaluating companies' sustainability performance increased investors' skepticism and entry barriers to the Brazilian Stock Exchange.

In 2021, the Brazilian Securities and Exchange Commission (CVM) authorized the implementation of resolution No. 59, obligating publicly traded firms to disclose their ESG practices and outcomes (Comissão de Valores Mobiliários, 2021). The regulation was developed in response to investors' demand for amplified access to firms' environmental, social, and governance information, reflecting the Brazilian government's efforts to protect investors and increase transparency in the capital markets.

CVM's resolution No. 59 expanded disclosure obligations in the annual reference form, seeking to improve the quality and quantity of information available to the market, reducing

the information asymmetry phenomenon, and thereby providing resources for more rational investment decisions. Firms are incentivized, though not obligated, to publish ESG reports in alliance with a set of standards, subjected to independent review (audit), and containing specific information set by guidelines.

A key component of resolution 59 is that it follows a "comply or explain" model. If companies choose not to disclose any subsection/area, they must justify their decision, leaving investors to evaluate whether the explanations are reasonable. In that way, the new regulation balances the potential costs of reporting with the upsides of enhanced transparency. The framework adopted by the Brazilian government is consistent with other global developments, such as the European Union's Corporate Sustainability Reporting Directive (CSRD), which focuses on increasing transparency and comparability levels of ESG data and incentivizing companies to adopt more robust ESG practices.

Overall, existing literature focuses on the significance of ESG disclosure for minimizing information asymmetry and increasing firm value, yet findings on the consequences of mandatory reporting still diverge and are concentrated in developed countries. Despite Brazil's emerging relevance as a large developing country and its latest implementation of mandatory ESG reporting through CVM's Resolution No. 59, empirical evidence on how this mandate has affected companies' financial and sustainability performance is still lacking. This master's thesis contributes to the literature by providing a firm-level empirical framework of the impact of Brazil's ESG disclosure regulation on firm value, profitability, and sustainability performance, offering unique viewpoints from an emerging-market context.

# 3. Data

## 3.1 Data Sources and Sample Selection

The dataset used to answer the research questions of this master's thesis combines firm-level financial and sustainability information for publicly traded companies from 2018 to 2024. The time window selected for the analysis captures both the years pre and post CVM Resolution No. 59, which is crucial for capturing the real effect of the ESG legislation on Brazilian firms. The sample data were retrieved from two primary databases, WRDS Compustat Global and Refinitiv LSEG Workspace. The final dataset consists of two main panels structured on a quarterly and yearly basis, each tailored to a specific stage of the empirical analysis. The panel used for all regressions, consisting only of Brazilian companies, is quarterly and financial data

reported in Brazilian Reais. The panel applied to the Difference-in-Differences regressions comparing Brazilian to American firms on a yearly basis and accounting variables are reported in U.S. Dollars. See Table 1 below:

**Table 1**. Dataset specifications

| Dataset | Coverage | Frequency | Variables Included | Purpose |
|---|---|---|---|---|
| Dataset 1: Brazil Panel | Brazil (2018-2024) | Quarterly | Financial Indicators Only | Regressions within Brazil; Sectorial analysis |
| Dataset 2: Brazil-US Panel | Brazilian and U.S. Firms (2020-2023) | Yearly | Financial + ESG Vaariables | Difference-in-Differences Analysis |

The accounting and market-based indicators were retrieved from the WRDS Compustat Global database. The variables of interest were available in distinct time formats. Therefore, some of the raw data had to be transformed into quarterly and/or yearly basis. Annual variables were evenly distributed across quarters following the assumption of linear variation. For the variables retrieved on a daily basis, the last day of the quarter ending month was used to represent the quarterly value, and the last day of the year for yearly variables.

The sample consists of all companies publicly listed in Brazil and U.S. companies constituents of the S&P 1500, that were publicly traded during the whole event window, thus avoiding selection bias and ensuring representativeness of the capital markets. Companies with an Initial Public Offering (IPO) after 2018, and firms that went private and/or bankrupt in the studied period were excluded from the sample.

The Brazil-U.S. panel was constructed via Propensity Score Matching (PSM), which was applied to the whole population of publicly listed companies in Brazil and the constituents of the S&P 1500. This procedure was applied to prevent selection bias and ensure that the compared companies have similar profiles. In the present study, the American firms act as the control group for the Difference-in-Differences analysis, while the Brazilian firms serve as the treated group, which was affected by the ESG disclosure mandate.

The ESG data were collected from Refinitiv LSEG workspace, which provides yearly sustainability scores based on over 450 indicators. The corporate responsibility variables include the overall ESG score and the individual score of each of the three ESG pillars: Environmental, Social, and Governance. The overall ESG rating is based on an average of the pillar scores. This granular structure allows for investigating the heterogeneous effects across

the ESG dimensions, and consequently capturing any possible distinct impact of the legislation on each pillar.

The dataset was further filtered by addressing some data quality issues. The missing values were addressed either by finding the information in reliable sources, such as firms' investor relations, or by dropping that observation. Observations were dropped when the missing information was not manually found in a reliable source, and it was a core variable. In addition, duplicates were removed and inconsistent data corrected. All continuous variables were winsorized at the 1st and 99th percentiles to reduce the impact of outliers in the analysis.

The final sample consists of two main panels: within-Brazil and Brazil-US. The first is applied to all panel data regressions and sectoral analysis restricted to Brazilian firms, and consists of 247 companies and 6831 observations. The second panel has observations on both Brazilian and American companies, and was used for the Difference-in-Differences analysis. The second panel is leaner as the time window was filtered to two years prior, and two years after the legislation, and firms without ESG ratings available during the whole period were also dropped. This consists of 261 firms and 1042 observations.

## 3.2 Construction of Key Variables

Table 2 summarizes the main variables applied in the current study. All financial data is reported in local currencies. Panel 1 consists of quarterly observations, while Panel 2 is set on a yearly basis. Some variables were constructed by the author with information acquired in Compustat Global and/or LSEG Refinitiv Workspace. All variables are winsorized and displayed in real terms. Firm's ISIN code and quarters/years dates identifiers were used to merge the datasets.

**Table 2.** Key Variables specifications

| Category | Variable | Definition / Formula | Source |
|---|---|---|---|
| Dependent Variable | Tobin's Q | Proxy of Firm Valuation: (Market Value of Equity + Total Debt) / Total Assets) | Compustat* |
| Dependent Variable | Return on Assets (ROA) | Proxy of firm Profitability: (Net Income / Total Assets) | Compustat* |
| Dependent Variable | Total Liabilities (LTQ) | Proxy of firm Financial Risk | Compustat |
| Dependent Variable | ESG Score | Proxy of Firm Sustainability Level | LSEG Refinitv Workspace |
| Dependent Variable | E,S,G Pillar Scores | Proxy of Firm Sustainability Level per Pillar | LSEG Refinitv Workspace |
| Explanatory Variable | Post | Dummy = 1 for 2022, 2023, and 2024, 0 otherwise | Author |
| Explanatory Variable | Treat | Dummy = 1 for Brazilian Firms, 0 for U.S. firms | Author |
| Explanatory Variable | Post x Treat | Interaction Term Capturing the Real Effects of the Mandate on Brazilian Firms | Author |
| Explanatory Variable | High ESG (>70th pct) | Dummy = 1 if a firm's ESG Score is above the 70th percentile within the sample, 0 otherwise | Author** |
| Explanatory Variable | High ESG x Post | Interaction term between the High ESG dummy and the Post period dummy | Author |
| Control Variable | Size | Log (Total Assets) or Log (Revenue) represents Size | Compustat |
| Control Variable | Leverage | (Short-Term Debt + Long-term Debt) / Total Assets | Compustat |
| Control Variable | Return on Assets (ROA) | (Net Income / Total Assets) | Compustat |
| Control Variable | Cash | Cash and Short-term Investments | Compustat |

* Calculated based on data from Compustat.

** Calculated based on data from LSEG Refinitiv Workspace.

## 3.3 Descriptive Statistics

Tables 3 and 4 report the descriptive statistics for the two panels used in the analysis. It consists of the principal characteristics of the main variables in the models. Table 3 presents firm-level summary statistics for the Brazil panel, while Table 4 shows the same for the Brazil-U.S. panel and includes ESG variables. It's important to note that all variables are winsorized at the 1st and 99th percentiles with the goal of reducing the effect of outliers.

For the Brazil panel, the mean Tobin's Q equals 1.43 with a median of 1.11 and a relatively wide dispersion with SD equaling 1.00. Thus, suggesting a significant heterogeneity in market valuation among publicly traded companies in Brazil. The mean quarterly ROA is 0.8 percent. The Leverage ratio averages 0.77, cash and Short-term investments is about 12 percent of total assets, and the mean log of Assets is 3.67.

In the Brazil-U.S. Panel, the data is displayed annually and represents 1.042 firm-year observations. The average Tobin's Q is 1.61 with a standard deviation of 0.83. The mean annual ROA is 5 percent. The average Leverage ratio is 0.64 with small dispersion represented by a 0.22 standard deviation. The log Revenue of 14.64 represents a proxy of firm size. This panel has the introduction of ESG variables, which permits for comparability across a sustainability perspective. The average overall ESG score is 58.4 with a standard deviation of 16.3. The three pillars, Environmental, Social, and Governance, average respectively 51.1, 60.7, and 61.0. These values suggest that companies tend to underperform in the sustainability aspect.

**Table 3.** Summary statistics within-Brazil panel

| Variable | N | Mean | Median | SD | Min | Max |
|---|---|---|---|---|---|---|
| Tobin's Q | 6820.000 | 1.433 | 1.109 | 1.004 | 0.353 | 6.228 |
| Return on Assets (ROA) | 6511.000 | 0.008 | 0.009 | 0.037 | −0.158 | 0.131 |
| Total Liabilities | 6831.000 | 35126.378 | 2821.822 | 164126.982 | 10.110 | 1370960.381 |
| Size (log Assets) | 6831.000 | 3.671 | 3.645 | 0.899 | 1.466 | 6.170 |
| Leverage | 6831.000 | 0.765 | 0.644 | 0.622 | 0.003 | 7.037 |
| Cash and Short-term Investments | 6831.000 | 0.124 | 0.101 | 0.111 | 0.000 | 0.782 |

Sample restricted to Brazilian firms.
All variables winsorized at the 1st–99th percentiles when applicable.
Table reports number of observations (N), mean, median, standard deviation, and range statistics.

**Table 4.** Summary statistics Brazil vs. U.S. panel

| Variable | N | Mean | Median | SD | Min | Max |
|---|---|---|---|---|---|---|
| Tobin's Q | 1042.00 | 1.61 | 1.33 | 0.83 | 0.67 | 5.26 |
| ESG Overall Score | 1042.00 | 58.44 | 59.67 | 16.27 | 13.79 | 89.63 |
| Environment Pillar Score | 1042.00 | 51.14 | 54.45 | 23.75 | 0.00 | 93.63 |
| Social Pillar Score | 1042.00 | 60.73 | 60.99 | 18.40 | 12.70 | 93.11 |
| Governance Pillar Score | 1042.00 | 61.02 | 63.10 | 20.60 | 13.88 | 94.00 |
| Size (log Revenue) | 1042.00 | 14.64 | 14.60 | 1.29 | 10.83 | 17.67 |
| Leverage | 1042.00 | 0.64 | 0.65 | 0.22 | 0.09 | 1.39 |
| Return on Assets (ROA) | 1042.00 | 0.05 | 0.04 | 0.09 | −0.28 | 0.44 |

Sample consists of Brazilian and U.S. firms.
All variables winsorized at the 1st–99th percentiles when applicable.
Table reports number of observations (N), mean, median, standard deviation, and range statistics.

### 3.4 Representativeness and Data Limitations

The master dataset represents a highly significant share of total market capitalization, which guarantees representation and adds robustness to the present research. Nevertheless, some limitations are still present. First, the sustainability data for Brazilian firms is extremely scarce until nowadays, with less than 20% of all public companies having their sustainability performance assessed from 2020 onwards. For this reason, the Brazil-U.S. panel shows a smaller number of observations. Given the above, during the PSM process, a ratio of 1-to-2 was applied to increase sample significance and representativeness. Thus, for every Brazilian company (treated), there are 2 U.S. companies (control).

Second, ESG ratings may differ between different providers due to methodological and measurement inconsistencies (Berg et al., 2022). Third, the period after the regulation took effect embraces only two fiscal years (2022-2023), which limits the ability to measure long-term effects. To reduce these concerns, multiple robustness checks were conducted, including winsorization, fixed effects, propensity score matching, two-way standard errors, and others.

## 4. Methodology

### 4.1 Research Design Overview

This study adopts a quasi-experimental research design seeking to establish the effects of mandatory ESG disclosure in Brazilian firms. The research focuses on evaluating the impact of CVM's Resolution 59 (2021) on firms' financial and sustainability performance through different dependent variables and empirical strategies.

To deeply understand the causal identification of this regulatory shock in Brazil, two complementary empirical methods were applied. Following Greenstone (2002), who employed a panel regression with a fixed-effects framework to capture the effect of an environmental regulation on industrial activity, this study applies Panel Data regressions using quarterly observations for Brazilian firms to assess the dynamics within the country. The data range from 2018 to 2024, which allows for measuring the periods prior to and post-regulation.

Secondly, Difference-in-Differences (DiD) models were employed with annual data ranging from 2020 to 2023. American firms performed as a control group after being matched with Brazilian firms with similar characteristics via Propensity Score Matching (PSM). The DiD models capture the average causal effect as it compares the impact of the treatment relative to a control group that was unaffected by the new regulation. Such research method was previously employed by Ioannou and Serafeim (2017) to estimate the consequences of mandatory sustainability reporting while controlling for global time trends.

Combining the distinct designs enhances both time-series variation (pre vs post-mandate) and cross-sectional variation (Brazil vs U.S.), developing an ideal setting to isolate the regulatory impact while still controlling for firm-specific heterogeneity and possible macroeconomic shocks.

## 4.2 Econometric Framework

The following section presents the economic framework and is separated into four subsections: Panel Data regressions (Brazil-only), Difference-in-Differences models (Brazil vs. U.S.), Expected effects, and Robustness checks and Alternative specifications.

To further expand this research and to enhance both significance and robustness, several regressions were performed. All regressions follow either the baseline Panel Data model or the baseline Difference-in-Differences model closely.

### 4.2.1 Panel Data Regressions - Brazilian Firms Analysis

The first set of empirical regressions has the goal of measuring the general effect of the new ESG mandate within Brazil using fixed effects, control variables, and a time dummy to represent the moments pre- and post-regulation. As per the model below:

$$Y_{i,t} = \alpha_i + \beta Post_t + \gamma_1 Size_{i,t} + \gamma_2 Leverage_{i,t} + \varepsilon_{i,t}$$

Where $Y_{i,t}$ represents firm *i*'s performance in quarter *t*, measured alternatively by Tobin's Q, Profitability (ROA), or Total Liabilities (LTQ). Tobin's Q as a dependent variable serves as a proxy for firm valuation, which allows for capturing how the mandate impacted firm value. ROA is used as a proxy for profitability and is crucial to identify if the legislation had an impact on firms operational performance. Lastly, LTQ represents the total liabilities and allows for the identification of whether the new mandate had any impact on the firm's debt.

$Post_t$ is a time dummy variable that equals 1 for quarters after the ESG mandate and 0 otherwise. Since the regulation took effect in fiscal year 2022, from the first quarter of 2022 onwards, the dummy equals 1. $X_{i,t}$ represents the control variables, which include firm size (log of total assets) and leverage. $\alpha_i$ denotes firm fixed effects and $\varepsilon_{i,t}$ represents the idiosyncratic error term.

The coefficient of interest, $\beta_1$, captures the average effect of the ESG mandate on Brazilian firms after accounting for firm-specific unobserved heterogeneity. Standard errors are two-way clustered for further robust inference under both cross-sectional and serial correlation. To mitigate the influence of outliers, all continuous variables are winsorized at the 1st and 99th percentiles.

This analysis begins by estimating a baseline panel data model with firm-fixed effects for the full sample. Firm performance, profitability, and debt levels are compared in the period pre- and post-CVM 59/2021 resolution. Supplementary regressions were performed to further test model robustness. Cash ratio and sales growth are added to expand the control set of variables. Financial firms are filtered out to account for structural differences in their balance sheets. Additionally, a sector-specific post-treatment regression is also employed, seeking to understand if the regulation had a different impact between sectors.

### 4.2.2 Difference-in-Differences (DiD) - Brazil x U.S.

The second part of the empirical analysis is focused on identifying the causal impact of the new mandate via a difference-in-differences design. The DiD framework compares changes in firm

outcomes in Brazil relative to the U.S, which respectively represent the treated and control group.

$$Y_{it} = \alpha_i + \lambda_t + \beta_1(Post_t \times Treat_i) + \beta_2 Post_t + \beta_3 Treat_i + \gamma' X_{it} + \varepsilon_{it}$$

Where, $Treat_i$ equals 1 if firm *i* is publicly traded in Brazil and 0 for American companies. $Post_t$ has a value of one for the post-treatment years (2022 and 2023) and 0 otherwise. $Post_t \times Treat_i$ is the interaction term and captures the true effect of the new CVM mandate. The interaction term represents the differential change in treated firms' outcomes, that is, the impact of the resolution relative to control companies. $X_{i,t}$ represents control variables (Size, Leverage, and ROA). $\alpha_i$ denotes firm fixed effects and $\varepsilon_{i,t}$ represents the idiosyncratic error term.

The coefficient of interest, $\beta_1$, represents the mean treatment effect of the ESG disclosure regulation on firm valuation and sustainability performance. Firm valuation is represented by Tobin's Q, and firm sustainability performance has E, S, G, and ESG overall scores as proxies. Firm and year fixed effects are added to capture unobserved heterogeneity at the firm and time levels. Industry-year fixed effects are also added to address sectoral differences. Standard errors are two-way clustered by firm and year.

To further understand the impact of the legislation, an alternative DiD regression was employed to identify whether the mandate had a greater impact on firms that were already perceived as sustainable before the regulation. These are firms that had a high ESG score prior to the legislation taking effect.

The parallel-trends assumption was tested, and results fail to reject similar pre-treatment trends across treated and control firms (Appendix 1, 2, 3 & 4). To enhance comparability and mitigate selection bias, a Propensity Score Matching (PSM) was implemented on the pre-treatment data (2021) to select U.S. firms that were similar in size, leverage, profitability, and sustainability performance to the Brazilian firms in the sample. The ratio was 1-to-2, which means the matched sample has 2 U.S. firms for every Brazilian company. The matches are combined by the nearest match method, and results indicate a significant reduction in imbalance across all covariates. Post-matching statistics are presented in Appendix 5, and the post-matching standardized mean differences are below the adopted 0.1 threshold (Austin, 2011). After this procedure, the DiD was run with the matched sample.

### 4.3 Expected Effects

This section details the expected relationship between the dependent and explanatory variables, which is based on theoretical and empirical literature. As previously reported in Table 2 of the data section, the dependent variables are Tobin's Q, ROA, and total liabilities for financial performance, and ESG scores for sustainability performance. These variables are employed to assess how the mandate affected Brazilian firms in distinct ways. (Value, Profitability, Capital Structure, and Sustainability).

Following Spence's (1973) signaling theory and Dowling and Pfeffer's (1975) legitimacy theory, the coefficient associated with the ESG disclosure mandate is expected to be positive. Mandatory disclosure is usually associated with increased transparency, which tends to enhance investors' confidence and reduce information asymmetry.

In the Panel Data models, the $Post_t$ dummy represents within-Brazil changes after CVM resolution No. 59 took effect. For the Difference-in-Differences estimations, the interaction term $Post_t \times Treat_i$ captures the relative impact in Brazilian firms when compared to U.S. companies.

For the regression testing whether the resolution affected firms' valuation, where Tobin's Q is the dependent variable, a positive coefficient is expected. According to Ioannou and Serafeim (2017), a mandatory disclosure regulation is generally associated with an increase in market value due to reduced information asymmetry. The ESG reporting mandate should amplify firms' commitments to sustainable practices, which, following Krüger (2015), would signal superior management quality and reduce long-term risks.

For the coefficients associated with Return on Assets (ROA), a proxy for firms' profitability, the anticipated sign is positive, as the new CVM resolution may increase efficiency, mitigate risk exposure, and allow for lower lending costs (Friede et al., 2015). However, short-term costs associated with compliance, reporting, and transitional investments to a greener economy could offset the benefits mentioned. Thus, the captured effect might be economically small.

The coefficient associated with firms' financial structure, proxied by Total Liabilities (LTQ), is expected to show a positive relationship with the ESG regulation. According to Gross and Roberts (2011), firms associated with high sustainability performance tend to experience improved access to financing rates, which should induce a lower cost of capital. However, ESG initiatives usually require substantial upfront investments (Albuquerque et al., 2019). Thus, firms may temporarily see increased debt levels to fund transitional investments while also benefiting from improved borrowing conditions.

For sustainability performance, proxied by ESG overall and the E, S, G pillar scores, the expected coefficients are positively correlated with the sustainability reporting mandate. Christensen et al. (2021) analysis of the EU Directive 2014/95/EU suggests that mandatory sustainability regulation is usually associated with higher disclosure quality and improved ESG ratings for affected firms. Thus, it's expected that Brazilian firms are encouraged by the new mandate to strengthen internal practices, improve data quality, and align with international reporting standards. The effect is anticipated to be stronger in the E (environmental) pillar, due to the amplified focus of the mandate on this specific pillar and environmental metrics being generally more comparable across firms and industries. In addition, the environmental focus imposed by global investors on Brazilian companies tends to increase, given the importance of Brazil's biodiversity for the entire world.

Lastly, the interaction term High ESG x $Post_t$ is predicted to be positive. It's expected that top-in-class ESG performers prior to the mandate should show an increased benefit from the regulation as they face lower compliance/reporting costs and receive greater recognition from investors due to reduced information asymmetry.

## 4.4 Robustness Checks and Alternative Specifications

To ensure the validity and reliability of the models, multiple robustness checks and alternative specifications are performed. These advanced analyses provide further support that the main results are not driven by outliers, sample composition, or model specifications. Alternative control specifications include extra regressions with an expanded control set of variables. Cash ratio and sales growth are added to the main panel data regressions and coefficients of interest remain stable, which provides supplementary support that the baseline model is not driven by omitted factors.

Following the standards applied in relevant financial papers, sample restrictions were implemented to further test the results obtained. Firms in the financial sector are excluded from the main sample as they routinely show a distinct balance-sheet and regulation structure when compared to other sectors. Regressions with the restricted sample present results qualitatively consistent with the baseline model, again confirming that the baseline model is not driven by omitted variables.

To test for sectoral heterogeneity, Industry-specific post-treatment regressions are performed to understand whether the regulation had an uneven impact across sectors. The results suggest that while magnitudes differ, the sign of the impact is consistent between industries.

In an attempt to mitigate the influence of outliers, all continuous variables are winsorized at the 1st and 99th percentiles. Furthermore, to guarantee robust inference under serial and cross-sectional dependence, two-way clustered standard errors are applied to all regression models.

Considering the above robustness tests, it can be derived that the findings are not sensitive to alternative model specifications or sample definitions, providing further strength to the validity of the causal interpretation reached.

# 5. Results and Findings

## 5.1 Overview

This section discusses the empirical findings on how Brazil's sustainability disclosure mandate (CVM Resolution No. 59/2021) impacts firms' valuation, capital structure, profitability, and sustainability performance.

The results are driven by a combination of two complementary research designs. First, a Panel Fixed-Effects Regression Model is employed, containing quarterly data for Brazilian firms, to capture within-country patterns prior to and after the regulation took effect. Secondly, Difference-in-Differences (DiD) models are implemented to account for the impacts of the legislation comparing treated (Brazil) and control (U.S.) groups. Thus, capturing the average causal effect.

## 5.2 Panel Data Evidence - Brazilian Firms Sample

### 5.2.1 Baseline Results

The Panel Data analysis begins by estimating a baseline model restricted to Brazilian firms to understand the within-Brazil impact of the sustainability disclosure mandate. The model includes dummy variables to allow for comparing the moments prior to and after the legislation. Three distinct dependent variables are tested with Tobin's Q representing the firm's valuation, ROA being a proxy for profitability, and total liabilities being an indirect indicator of financial structure.

Table 5 presents the outcomes of the baseline panel regressions for Brazilian firms. Columns 1 to 3 introduce the baseline regressions without control variables, while columns 4 to 6 implement additional controls for firm size and leverage.

**Table 5.** The impact of the ESG mandate on firms' market value, profitability and total liabilities

| | tobinsq | roa | ltq | tobinsq | roa | ltq |
|---|---|---|---|---|---|---|
| Post | −0.211** | 0.001 | 6882.790* | −0.039 | 0.001 | 2909.919 |
| | (0.053) | (0.003) | (2374.297) | (0.067) | (0.003) | (1501.709) |
| Size | | | | −0.587** | 0.004 | 12329.155** |
| | | | | (0.141) | (0.004) | (3046.546) |
| Lev | | | | 0.680** | −0.053** | |
| | | | | (0.138) | (0.011) | |
| Num.Obs. | 6820 | 6509 | 6831 | 6820 | 6509 | 6831 |
| R2 | 0.724 | 0.382 | 0.990 | 0.761 | 0.417 | 0.990 |
| RMSE | 0.53 | 0.03 | 16417.04 | 0.49 | 0.03 | 16048.36 |
| Std.Errors | by: isin & yr | by: isin & yr | by: isin & yr | by: isin & yr | by: isin & yr | by: isin & yr |
| FE: isin | X | X | X | X | X | X |

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001
Firm fixed effects included.
Standard errors two-way clustered by firm and year.
Post = 1 for yr ≥ 2022 (CVM 59/2021 in effect).
Outcomes are winsorized. Controls are derived from winsorized inputs.

The baseline regressions without control variables (Columns 1-3) suggest a statistically significant decrease in a firm's market valuation ($P < 0.01$), represented by the -0.211 coefficient for Post in the first column. Given that the mean Tobin's Q is around 1.43 for the Brazilian firms, this decline would represent a 15% reduction when compared to the average firm value. This indicates an apparent initial negative market reaction to the mandate, which is in line with the expectation that firms face short-term adjustment (Albuquerque et al., 2018) and significant preparation costs (Ioannou & Serafeim, 2017).

The coefficient on Post in the second column is 0.001 with p p-value higher than 0.10, which indicates no statistically significant changes in firms' profitability following the mandate. The coefficient of interest in the third column indicates an apparent significant increase in a firms' total liabilities by, on average, 6.882 thousand Brazilian Reais, which would represent a 20% increase in firms' total debt post regulation ($P < 0.05$). This finding is consistent with Gross

and Roberts (2011), Malich and Husi (2021), and Albuquerque et al. (2019), which concludes that firms might face temporary increases in total debt due to increased capital expenditure required for transitional investments and improved borrowing conditions.

However, after adding control variables representing firm size and leverage, the regulatory dummy loses significance even with signs remaining unchanged. Thus, indicating that the differences pre- and post-mandate are not purely consequences of the legislation itself, but are also likely to be driven by firm characteristics.

The coefficient sign and significance of control variables are aligned with theory. In the fourth column, the coefficient for size is -0587 ($p < 0.05$), which suggests that larger firms tend to trade at lower Tobin's Q. This outcome is in line with Claessens et al. (2002) and Offenberg (2010) findings, which indicate that being smaller usually leads to higher relative valuation. The coefficient for leverage indicates that firms holding more debt tend to have higher valuations.

In the fourth column, the coefficient for leverage is the only significant one, and implies that firms with higher debt-to-equity ratios are more likely to have lower profit margins. In the sixth column, the coefficient for size is significant and positive, which indicates that larger firms tend to own more debt and is aligned with Chatterjee and Eyigungor's (2022) findings.

### 5.2.2 Expanded Controls and Exclusion of Financial Firms

In order to ensure that the baseline results are not driven by omitted variables and confirm model robustness, two further regressions were implemented.

First, the empirical model remains unchanged, but companies in the financial sector are filtered out. This process is to ensure that the sample is homogeneous, as financial firms tend to show regulatory and structural differences when compared to other economic sectors. This is in line with common finance research practices. Table 6 reports the regression results.

**Table 6.** The impact of the ESG mandate on firms' market value, profitability and total liabilities - excluding financial firms

| | tobinsq | roa | ltq | tobinsq | roa | ltq |
|---|---|---|---|---|---|---|
| Post | −0.196* | 0.000 | 4247.907* | −0.024 | −0.001 | 688.895 |
| | (0.059) | (0.003) | (1332.275) | (0.079) | (0.004) | (676.956) |
| size | | | | −0.566* | 0.007 | 10799.924** |
| | | | | (0.164) | (0.004) | (2024.586) |
| lev | | | | 0.683** | −0.058** | |
| | | | | (0.155) | (0.010) | |
| Num.Obs. | 5393 | 5139 | 5404 | 5393 | 5139 | 5404 |
| R2 | 0.731 | 0.365 | 0.976 | 0.765 | 0.411 | 0.979 |
| RMSE | 0.53 | 0.03 | 7951.35 | 0.50 | 0.03 | 7395.24 |
| Std.Errors | by: isin & yr | by: isin & yr | by: isin & yr | by: isin & yr | by: isin & yr | by: isin & yr |
| FE: isin | X | X | X | X | X | X |

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001
Sample restricted to non-financial firms (indfmt == 'INDL').
Firm fixed effects included.
Standard errors two-way clustered by firm and year.
Post = 1 for yr ≥ 2022 (CVM 59/2021 in effect).
Outcomes are winsorized. Controls are derived from winsorized inputs.

The results from Table 6 are consistent with the findings of the baseline model. For the first three regressions without controls (1-3), the coefficients signal and significance are similar to the baseline with the full sample. On both models, we perceive a negative correlation between firms' valuation and the regulation, as well as an increase in total debt post-mandate. Firms' profitability remains unaffected by the mandatory disclosure.

As noticed in the baseline model, after adding the control set, the coefficient representing the effect of the mandate loses significance. Thus, also suggests that part of the impact is explained by changes in firms' fundamentals and not solely driven by the regulation.

Secondly, to further test model robustness and ensure results were not being driven by omitted variables, an expanded set of control variables is employed. Additional firm-level controls for liquidity (cash/assets) and sales growth are included. Table 7 reports the main results of the model with an extra control set.

**Table 7.** The impact of the ESG mandate on firms' market value, profitability and total liabilities - with expanded controls

| | tobinsq_w_base | roa_w_base | ltq_w_base | tobinsq_w_ctrl | roa_w_ctrl | ltq_w_ctrl |
|---|---|---|---|---|---|---|
| post | −0.211** | 0.001 | 6882.790* | −0.037 | 0.001 | 2407.036 |
| | (0.053) | (0.003) | (2374.297) | (0.064) | (0.003) | (1461.476) |
| size_w | | | | −0.593** | 0.004 | 12614.761** |
| | | | | (0.149) | (0.004) | (3132.479) |
| lev_w | | | | 0.650** | −0.052** | 3560.080 |
| | | | | (0.159) | (0.011) | (2465.832) |
| cash_w | | | | 0.457* | 0.021+ | −18220.220 |
| | | | | (0.176) | (0.011) | (10985.702) |
| sg_w | | | | 0.000 | 0.000 | −0.367+ |
| | | | | (0.000) | (0.000) | (0.175) |
| Num.Obs. | 6820 | 6509 | 6831 | 6520 | 6257 | 6529 |
| R2 | 0.724 | 0.382 | 0.990 | 0.758 | 0.421 | 0.991 |
| RMSE | 0.53 | 0.03 | 16417.04 | 0.47 | 0.03 | 15595.75 |
| Std.Errors | by: isin & yr | by: isin & yr | by: isin & yr | by: isin & yr | by: isin & yr | by: isin & yr |
| FE: isin | X | X | X | X | X | X |

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001
Sample restricted to non-financial firms (indfmt == 'INDL').
Firm fixed effects included.
Standard errors two-way clustered by firm and year.
Post = 1 for yr ≥ 2022 (CVM 59/2021 in effect).
Controls: size_w (log assets), lev_w (leverage), cash_w (cash/assets), tang_w (tangibility), sg_w (sales growth).
Outcomes are winsorized (_w).

The results in Table 7 remain virtually unchanged, which confirms that the control set applied to the baseline model already captures the most important cross-firm heterogeneity in Tobin's Q, ROA, and Total Debt. In line with the baseline findings, the post coefficient has an apparent significance in Tobin's Q and Total Debt. However, again, it loses significance after the introduction of control variables.

The findings of Tables 6 and 7 reinforce the conclusion that the sustainability reporting regulation did not exert an independent, measurable effect on firms' valuation, profitability, or total debt, even after controlling for additional company fundamentals.

### 5.2.3 Sectoral Differences

A fundamental dimension of assessing corporate sustainability stands in acknowledging industry heterogeneity (IFRS, 2018). As confirmed in previous studies, the risks, issues, and performance levels related to ESG vary widely across sectors and industries. Therefore, I test

whether some industries were affected more or less than others by CVM's ESG reporting regulation.

To examine the impact of the mandate for sectoral heterogeneity within Brazilian companies, I run firm- and year- fixed effect regressions interacting the post dummy with sector dummies based on the WRDS Compustat Global Gsector classification. The Gsector sectoral classification combines firms with similar activities, products, and services in 11 distinct groups.

The coefficients in Table 8 measure the differential post-mandate change in firm fundamentals by sector relative to the energy sector (base). The energy sector is selected to be the base of comparison due to its historically high environmental exposure, early adoption of sustainability practices, and strong investors and media scrutiny over its ESG performance. Furthermore, in order to be econometrically able to conduct this comparison, one sector must be applied as a base to avoid perfect multicollinearity in the model.

**Table 8.** The impact of the ESG mandate on firms' market value, profitability and total liabilities - Sectoral analysis

| | tobinsq | roa | ltq |
|---|---|---|---|
| gsector_fac::15:post | −0.065 | −0.011 | −3648.875 |
| | (0.128) | (0.007) | (4989.037) |
| gsector_fac::20:post | −0.047 | 0.000 | −5161.080 |
| | (0.171) | (0.007) | (6288.551) |
| gsector_fac::25:post | −0.453+ | −0.007 | −5618.582 |
| | (0.189) | (0.008) | (6487.856) |
| gsector_fac::30:post | −0.335 | −0.012 | −2873.287 |
| | (0.203) | (0.008) | (7069.063) |
| gsector_fac::35:post | −0.841* | −0.014 | −6142.338 |
| | (0.293) | (0.008) | (6721.931) |
| gsector_fac::40:post | −0.213 | −0.006 | 20477.589 |
| | (0.180) | (0.008) | (12819.977) |
| gsector_fac::45:post | −0.290 | −0.011 | −13603.597 |
| | (0.222) | (0.008) | (7991.727) |
| gsector_fac::50:post | −0.530 | −0.015 | −1786.641 |
| | (0.303) | (0.014) | (6259.769) |
| gsector_fac::55:post | −0.093 | −0.008 | −794.673 |
| | (0.162) | (0.009) | (6159.651) |
| gsector_fac::60:post | −0.455+ | 0.005 | −4782.011 |
| | (0.194) | (0.010) | (6286.394) |
| size | −0.720** | 0.001 | 10748.346* |
| | (0.126) | (0.003) | (3148.841) |
| lev | 0.672*** | −0.053** | 2110.463 |
| | (0.112) | (0.011) | (2403.362) |
| Num.Obs. | 6820 | 6509 | 6831 |
| R2 | 0.780 | 0.428 | 0.991 |
| RMSE | 0.47 | 0.03 | 15484.93 |
| Std.Errors | by: isin & yr | by: isin & yr | by: isin & yr |
| FE: isin | X | X | X |
| FE: yr | X | X | X |

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001
Firm and year fixed effects included.
Standard errors two-way clustered by firm and year.
Post = 1 for yr ≥ 2022 (CVM 59/2021).
Coefficients show sector-specific post effects relative to base sector (Energy = 10).
Outcomes and controls are winsorized.

The findings of Table 8 imply that most sectors did not experience statistically significant changes in valuation, profitability, and total debt when compared to energy companies. However, gsector 35, representing Financials, indicates a significant decline in firms' valuation (Tobin's Q) after the mandate. The $\beta$ coefficient of -0.84 with $p < 0.05$ suggests that, after the mandate, firms in the financial sector faced an additional decrease of 0.84 in their Tobin's Q when compared to companies in the energy sector. Overall, besides the financial sector, the evidence points to no significant differences between the other sectors when compared to energy firms. This suggests that ESG compliance and transition costs followed similar trends across sectors.

## 5.3 Difference-in-Differences Analysis - Brazil vs. United States

In the second stage of this empirical analysis, a Difference-in-Differences (DiD) framework is used to measure the causal impact of the ESG disclosure mandate relative to a matched control group formed by U.S. firms. As previously stated, applying this quasi-experimental research design is fundamental to identifying the impact of the mandate on Brazilian firms, while accounting for macro-level shocks or global time trends that could affect companies from both countries.

The treated group consists of Brazilian publicly traded companies, while the control group is composed of U.S. firms matched through Propensity Score Matching (PSM). The PSM was conducted based on 2021 firm-level covariates (Log_Revenue, ROA, Total Debt, Tobin's Q, ESG Score, and Industry) using a 1-to-2 nearest neighbour approach.

Appendix 5 reports the covariate balance after the matching procedure. All covariates report only slight mean differences between treated and control groups, with post-matching t-statistics close to zero. Thus, indicating that the PSM successfully eliminated the within-firm imbalances observed in the unmatched sample and generated a well-balanced matched sample (Stuart, 2010; Austin, 2011).

In order to apply a difference-in-difference research design, the parallel trends assumption has to be confirmed. The parallel trends assumption tests whether the outcomes of the treated and control firms would have followed the same trajectory if the treatment (mandate) hadn't existed. The visual test was applied to the models below and is detailed in the appendices 1, 2, 3, and 4.

### 5.3.1 Firm Valuation

The difference-in-differences analysis starts with the employment of a regression with Tobin's Q as a dependent variable. Thus, the study seeks to capture the causal effect of the ESG reporting legislation on firm value. For additional robustness, firm, year, and industry-year fixed effects are applied alongside controls for size, leverage, and profitability. Standard errors are two-way clustered by year and firm. Table 9 presents the results of the DiD with Tobin's Q as the dependent variable.

**Table 9.** The impact of the ESG mandate on firms' market value - Difference-in-Differences estimation

| Effect of ESG Disclosure Regulation on Firm Valuation (Tobin's Q) | |
|---|---|
| | (1) |
| Treatment × Mandate | −0.462** |
| | (0.208) |
| Size | −0.349 |
| | (0.266) |
| Leverage | 5.005 |
| | (3.496) |
| ROA | 7.273 |
| | (4.530) |
| Num.Obs. | 1042 |
| $R^2$ | 0.62 |

* p < 0.1, ** p < 0.05, *** p < 0.01
Firm, Year, and Industry×Year fixed effects included.
Standard errors are two-way clustered by firm and year (ISIN.CODE × Year).
Controls winsorized at the 1st–99th percentiles.
Treatment × Mandate as defined in the DiD (Brazil × US, post-mandate years).

The coefficient of interest, *Treatment x Mandate,* is negative and statistically significant at the 5 percent level (-0.462, $p < 0.05$). Thus, suggesting that, relative to U.S. firms, companies in Brazil experienced a decline in firm value (Tobin's Q) after the introduction of CVM's resolution No. 59. Given that the average Tobin's Q for Brazilian companies is around 1.43, the *Treatment x Mandate* coefficient represents a 32% decrease in firms' market valuation.

Therefore, the reported results indicate a short-term moderate to strong negative market reaction to the new regulation that adversely affected firm value. This finding is aligned with

Albuquerque et al. (2018) results, which suggest a negative relationship between sustainability reporting mandates and firm value. According to previous research, this can be mainly associated with significant preparation/reporting costs, transparency-associated risks, and short-term adjustment investments.

Additionally, in order to confirm the robustness of the model and findings, a baseline regression was performed. Table 10 reports the main results of the baseline model.

**Table 10.** The impact of the ESG mandate on firms' market value - baseline Difference-in-Differences estimation

| Effect of ESG Disclosure Regulation on Firm Valuation (Tobin's Q) | |
|---|---|
| | (1) |
| Treatment × Mandate | −0.527** |
| | (0.190) |
| Observations | 1042 |
| R-squared | 0.53 |

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

The negative sign and significance at the 5 percent level are in line with the output table of the main DiD model (-0.527, $p < 0.05$). This indicates that the main Difference-in-Differences model with Tobin's Q as a dependent variable is not driven by the inclusion of specific control variables.

### 5.3.2 ESG Performance

The second Difference-in-Differences model is employed to evaluate whether the sustainability reporting mandate stimulated improvements in actual ESG performance for Brazilian firms. The dependent variables in these models are the Environmental, Social, and Governance individual pillar scores and firms' overall ESG score. By evaluating each pillar individually, I can identify if the mandate had a distinct effect across the pillars.

This model includes firm, year, and industry-year fixed effects and controls for firm size and leverage. Table 11 reports the results of the DiD with ESG performance as the dependent variables.

**Table 11.** The impact of the ESG mandate on firms' sustainability performance - Difference-in-Differences estimation

| | ESG Score | Environment | Social | Governance |
|---|---|---|---|---|
| Treatment × Mandate | 0.526 | 1.672 | −0.267 | 0.288 |
| | (0.965) | (1.921) | (1.004) | (1.430) |
| Size | 0.762 | 2.281 | 1.573 | −0.889 |
| | (0.656) | (1.504) | (1.059) | (1.403) |
| Leverage | 3.471 | −0.133 | 2.631 | 4.530 |
| | (5.656) | (9.401) | (4.883) | (6.562) |
| Observations | 1042 | 1042 | 1042 | 1042 |
| R-squared | 0.93 | 0.92 | 0.92 | 0.88 |

+ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
Firm, Year, and Industry×Year fixed effects included.
Standard errors two-way clustered by firm and year.
Post = 1 for yr ≥ 2022 (CVM 59/2021).
Controls are winsorized.

The larger increase in the coefficient representing the Environmental pillar is consistent with Brazil's biodiversity importance globally and the elevated regulatory, investor, and public scrutiny towards environmental practices in the region. Nevertheless, while coefficients are positive for the Environmental and Governance pillars, and for the overall ESG score, they are not statistically significant. Therefore, findings suggest that, relative to control firms, developments in ESG performance were not yet observable in the two years after the mandate took effect.

However, these results are aligned with prior expectations. Following Geels (2002) and Van Bree et al. (2010) multi-level perspective, sustainability transitions are defined as multiple green-linked innovations struggling against existing systems to replace or reconfigure these systems. Thus, differently than ESG disclosures, ESG scores usually face a more significant implementation lag.

Moreover, ESG ratings are updated on an annual basis and usually reflect multi-year sustainability behavior. Consequently, it is plausible that for the full impact of the regulation to be materialised, it would require a longer study horizon. The findings indicate that the

mandate affected primarily firms' reporting behavior and short-term market perceptions rather than the actual ESG performance outcomes.

### 5.3.3 High vs. Low ESG Firms

Lastly, a difference-in-differences research design was applied to understand whether, after the sustainability mandate, companies that already had strong ESG performance (Top 30%) were affected differently when compared to weaker ESG firms (Bottom 30%). Table 12 reports the regression output.

**Table 12.** The impact of the ESG mandate on Firms' market value - Difference-in-Differences estimation comparing top and bottom ESG performers.

| | Tobin's Q |
|---|---|
| High ESG firm (≥70th pct in 2020) | 0.4200 |
| | (0.2964) |
| High × Post (Treatment effect) | 0.1263 |
| | (0.0889) |
| Leverage | 0.4787 |
| | (0.8831) |
| Size | 0.1403 |
| | (0.1955) |
| Num.Obs. | 573 |
| RMSE | 0.319 |
| Fixed effects | Firm, Year, Industry |
| Std.Errors | two-way: firm × year |

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001
Firm and Year fixed effects included; Industry FE added if available.
Standard errors two-way clustered by firm and year (Cameron, Gelbach & Miller, 2011).
Outcome (tobins_q_w) winsorized at the 1st–99th percentiles. Controls winsorized at the 1st–99th percentiles (where present). High/Low ESG defined using 2020 quantiles (30th / 70th). Post = 1 for years ≥ 2021 (CVM 59/2021).

The *High ESG x Post* interaction term is positive ($\beta = 0.126$), but not significant. Consequently, suggesting that firms that already had strong ESG performance did not experience a significant valuation premium after the mandate, when compared to low ESG performance companies.

The findings of this model imply that investors might have already priced in ESG performance. Therefore, after the mandate, there were no significant differences between High and Low ESG performing firms in the short term.

# 6. Conclusion

## 6.1 Research Question and Approach

This master's thesis research seeks to understand how Brazil's mandatory ESG disclosure mandate, via CVM Resolution No. 59/2021, affected publicly listed firms. The study focuses

on capturing the effects of the sustainability reporting regulation on four dimensions: firms' valuation (Tobin's Q), profitability (ROA), capital structure (Total liabilities), and sustainability performance (ESG scores).

Following the signaling theory (Spence, 1973) and the legitimacy theory (Dowling & Pfeffer, 1975), the mandate was expected to enhance a firm's transparency, reducing information asymmetry, and increasing ESG performance. Thus, aligned with prior studies, the new regulation was predicted to be value-enhancing, as it would drive better risk management and financing conditions, as well as encourage improvements in ESG scores.

This research's empirical analysis combined two complementary designs. Firstly, panel data with fixed-effects regressions were employed using quarterly data of Brazilian firms to measure within-country changes before and after the mandate took effect. Secondly, in order to capture the causal effect of the regulation while still controlling for global shocks, several difference-in-differences estimations were performed to compare the treated firms (Brazilian) to a matched control group (U.S.), constructed through Propensity Score Matching.

In both research designs, all continuous variables were winsorized at the 1st and 99th percentiles, firm and time fixed effects were included, and standard errors were two-way clustered by firm and year. When relevant, industry-year fixed effects were also applied.

Additional robustness checks were also performed, including expanded control sets, filtering out financial firms, and heterogeneity tests. These were employed to ensure that results are not being driven by sample composition, outliers, or model specifications.

## 6.2 Summary of Empirical Findings

### 6.2.1 Firm Valuation

The impact of the sustainability reporting regulation on firms' valuation was assessed both through within-Brazil panel regressions and Brazil-U.S. difference-in-differences estimations. In the panel data analysis without control variables, the *Post* dummy is associated with a statistically significant ($p < 0.01$) reduction in Tobin's Q by -0.21 on average. This coefficient represents roughly a 15% decline in firms' market valuation following the ESG mandate, and thus suggests a negative market reaction in the short term.

In the cross-country DiD model, the interaction term *Treatment x Mandate* is also negative and statistically significant ($\beta \approx -0.46$, $p < 0.01$). Therefore, indicating that relative to U.S. companies, Brazilian firms experienced a market valuation reduction of about 32% of their pre-regulation Tobin's Q mean value. These findings reinforce the notion of an adverse short-term market response to the new legislation.

However, after implementing further robustness checks, the models yielded different outcomes. In the within-Brazil panel regressions, once firm fundamentals are included, the *Post* dummy loses significance, which implies that the apparent reduction in valuation is associated with current changes in firm characteristics after the mandate took effect. On the other hand, the baseline DiD model without controls yielded results similar in magnitude, sign, and significance to the main DiD estimation ($\beta \approx -0.53$, $p < 0.01$), indicating that the main coefficients were not driven by particular model specifications.

### 6.2.2 Profitability

According to the findings in both research designs applied to this study, the new mandate had no apparent impact on the firm's ability to generate profits. For all Brazilian panel regressions and DiD estimations, ROA reported neither an economically nor statistically significant coefficient associated with the legislation. This indicates that profitability was unaffected by the regulation in the short run. Hence, any potential margin gains from enhanced transparency, reduced risk management, or lower financing costs were apparently offset by further reporting costs and transitional investments.

### 6.2.3 Capital Structure

In order to understand whether firms' capital structure was affected by the new sustainability regulation, panel data regressions with total liabilities (LTQ) as dependent variables were performed. In the baseline setting without controls set, the *Post* dummy is statistically significant ($p < 0.05$) and positively associated with an increase in total liabilities of roughly 6.9 thousand Brazilian reais, which represents around 20% growth in total debt after the mandate.

Although after introducing leverage and size as control variables, the regulatory dummy loses statistical significance, even with signs remaining unchanged. These findings indicate that Brazilian companies increased their debt levels after the introduction of the mandate, but the increase is closely linked to underlying firm fundamentals.

### 6.2.4 ESG Performance

In an effort to assess whether the sustainability reporting mandate actually had an impact on firms' sustainability performance, Difference-in-Differences estimations were performed with E, S, G scores, and ESG overall score as dependent variables. This setup is ideal to also understand if any of the individual sustainability pillars were affected differently.

Apart from the coefficient representing the S pillar (Social), all other regression coefficients on *Treatment x Mandate* have a positive correlation with the new mandate. However, the relationship is found not to be statistically significant. The environmental pillar exhibits the highest estimated increase, which is aligned with the intense environmental pressure faced by Brazilian companies, as well as the relative emphasis of the regulation on environmental standards, and the fact that environmental topics generally have more palpable and direct metrics.

However, the lack of statistical significance when compared to U.S. firms suggests that there were no clear improvements in Brazilian firms' sustainability performance in the two years following the disclosure regulation.

Furthermore, contrary to the fast response of ESG disclosure scores investigated by Ioannou and Serafeim (2017), ESG ratings tend to only emerge gradually in the medium/long-term. The gradual increase in firms' sustainability performance is associated with the time demanded by transnational investments to be fully implemented, improvements in reporting standards, and the recognition of those changes by investors and the market.

### 6.2.5 Sectoral Analysis

Supplementary heterogeneity panel data regressions were conducted, aiming to understand whether the regulation had distinct effects between sectors. This investigation was based on the interaction of the *Post* dummy and sector dummies relative to the energy sector.

The regression outcome implies that most sectors did not experience statistically significant changes in market valuation, profitability, and total liabilities when compared to the energy sector.

The only exception is the financial sector, which showed a statistically significant decline in Tobin's Q relative to the energy sector following the implementation of the new regulation.

Thus, suggesting that financial institutions may have been particularly sensitive to the new reporting requirements.

### 6.2.6 ESG Quality - High vs. Low ESG performers

Further difference-in-differences estimations were employed to determine if companies that were considered top ESG performers prior to the regulation benefited more than low sustainability performers.

The findings from such analysis indicate that the top 30% ESG performers did not experience an increase in market valuation relative to the bottom 30% ESG firms after the regulation came into effect. The interaction term *High ESG x Post* is positive, but not statistically significant.

This is an indication that investors might have priced ESG quality prior to the mandate, and that the new disclosure requirements did not reflect any additional differentiation between the groups in the short term.

## 6.3 Theoretical Interpretation

Following the signaling theory and prior empirical evidence (Spence, 1973; Ioannou & Serafeim, 2017; Christensen et al., 2021), the ESG disclosure mandate was expected to reduce information asymmetry by increasing reporting transparency and quality. Therefore, ultimately increasing firm value, profitability, financing conditions, and ESG performance. However, the findings of the present study only partially match these Ex-ante expectations.

First, instead of a positive relationship between the mandate and firms' market valuation, both the DiD estimations and the panel data regressions point to a statistically significant decline in Tobin's Q in the near-term after the mandate. These results oppose prior empirical work suggesting that a disclosure mandate would be associated with an increase in firms' value. Although it is expected that in the early phase of such regulatory implementation, companies usually have substantial reporting costs and transitional investments. The extra cost incurred might be related to a short-term cash flow decrease and elevated perceived risk, which may be amplified in emerging markets.

Second, the finding of no change in firms' profitability indicates that any efficiency gains or a reduction in cost-of-capital due to increased transparency were offset by the extra reporting

and compliance costs in the short run. This is consistent with the theory that efficiency gains accumulate gradually; thus, it is expected to increase in the long term.

Third, the captured increase in total liabilities in the baseline panel models is aligned with the idea that firms finance their transition to the new ESG disclosure requirements using debt. Following Albuquerque et al. (2019), sustainability initiatives typically demand upfront capital expenditures, constantly financed through higher leverage. However, once control for firm size and leverage were added, the effect becomes weak, suggesting that the increased total liabilities are also a reflection of broader corporate strategies in the period.

Fourth, the absence of statistical significance on the improvements in ESG scores, despite their positive point estimates, highlights the lagged nature of sustainability performance. Reinforcing that notion, ESG ratings are only updated on a yearly basis and reflect multi-year behaviour. Moreover, transitional investments in environmental and social practices demand time to be fully implemented and results to be visible.

Finally, these findings indicate that the implementation of CVM Resolution No. 59 started a short-term adjustment phase, which negatively impacted firms' valuation and increased leverage, but with no measurable improvements in profitability or ESG ratings in the two years following the mandate.

Overall, the present thesis evidenced that the Brazilian ESG disclosure regulation has not yet translated into quantifiable sustainability gains, reinforcing the importance of recognizing the temporal role in sustainability transitions. The results of this empirical study indicate that the short-term costs associated with reporting, compliance, and transitional investments culminated in a negative market reaction. However, the full economic and sustainability benefits of enhanced disclosure are likely to emerge over a longer horizon.

## 6.4 Contributions and Limitations

This master's research contributes to the growing literature on sustainability disclosure by being one of the pioneers in assessing the impact of mandatory sustainability disclosure in an emerging economy. Adopting a dual empirical approach, a within-Brazil fixed-effects panel model, and a difference-in-differences design, this study evaluated Brazil's ESG reporting regulation (CVM Resolution No. 59/2021). By following the above setting, this study offers

robust evidence on how mandatory disclosure affects firm value, financial structure, profitability, and sustainability performance.

However, this empirical study faced several limitations that should be considered. Since the full adoption of the regulation took place in 2021, the post-mandate window is considered short. And, due to the nature of sustainability initiatives, the benefits expected from the ESG regulation tend to materialize gradually. Additionally, ESG ratings are only updated yearly and reflect multi-year behaviour, which might obscure early improvements. Additionally, the exclusion of firms due to missing data, especially on the Difference-in-differences estimations, may have affected the statistical power of the tests and potentially hindered the ability to detect a causal relationship.

Given the limitations described above, there are multiple paths to be followed by future research. A clear avenue would be to extend the analysis once more, post-regulation years become available, as this would allow researchers to evaluate whether the short-term valuation decrease reverses, stabilizes, or deepens over time. Another mechanism could involve testing alternative measures of sustainability performance, such as emissions data and assurance quality, which would allow the capture of behavioural adjustments not yet visible in ESG scores in the near term. Finally, by further examining spillover effects on the supply chains and non-listed firms could broaden the evaluation of the regulation's systemic impact.

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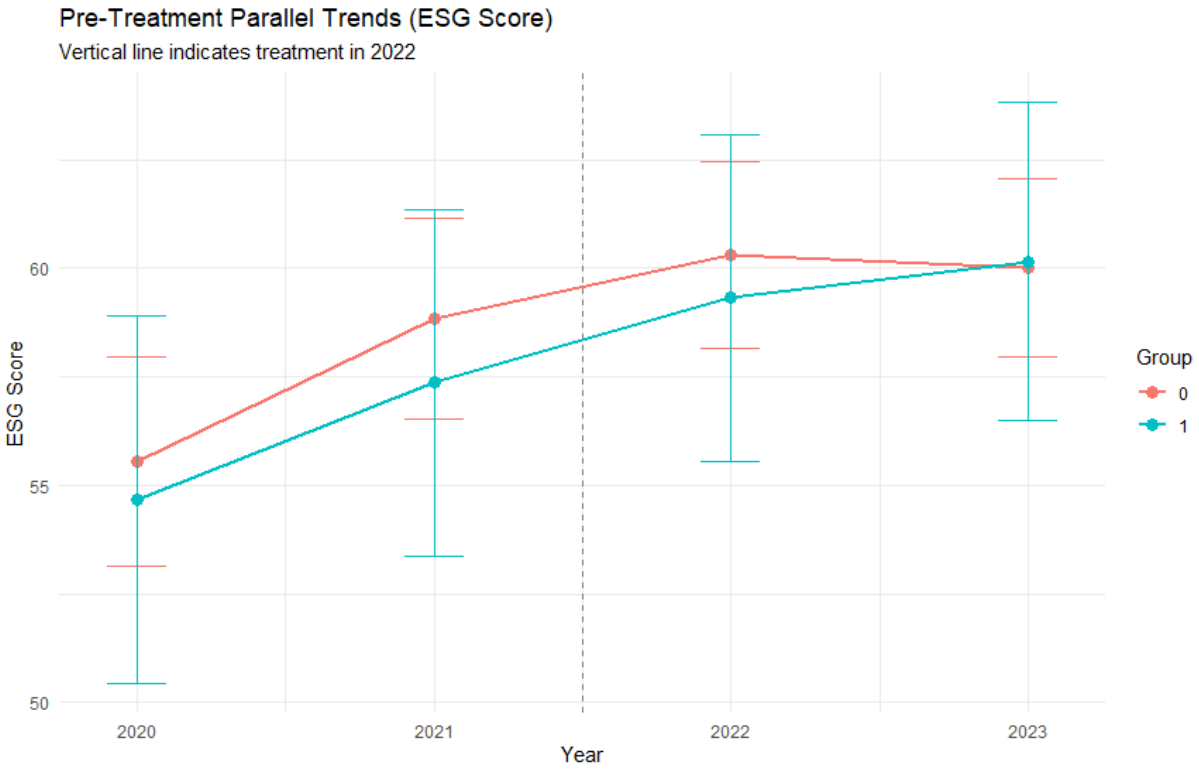
## Disclosure for the use of AI

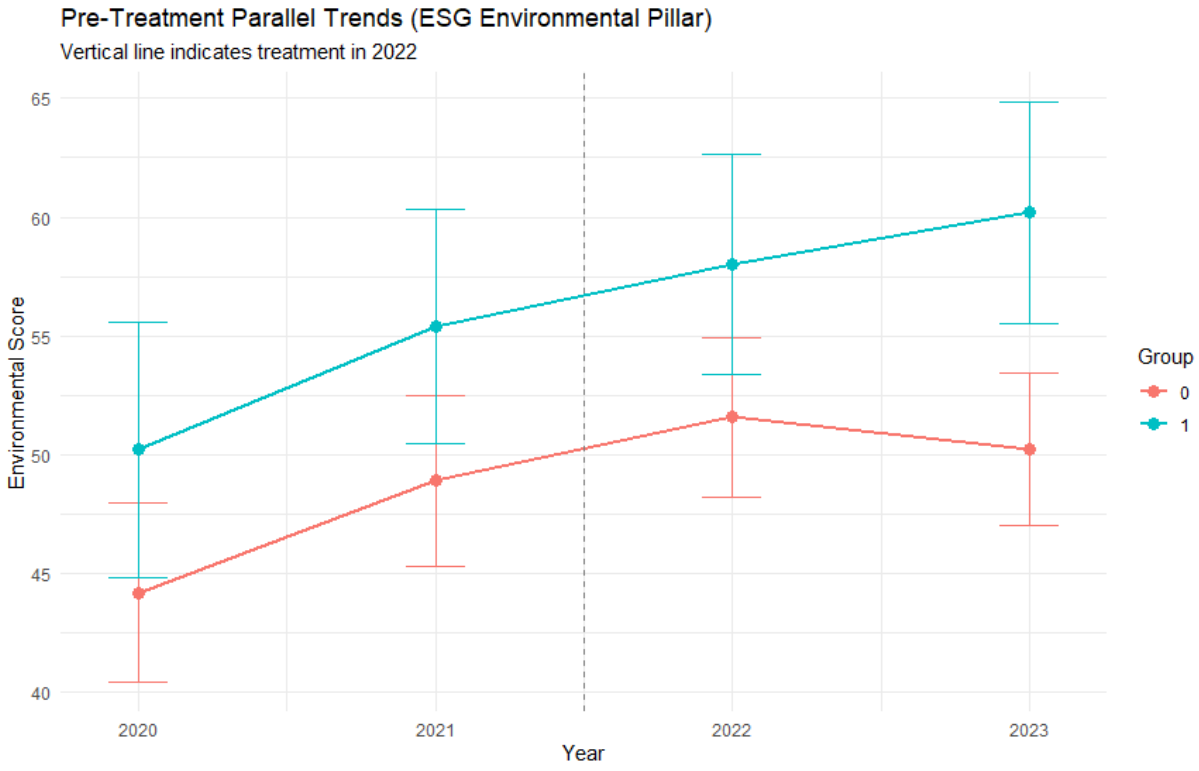
Artificial Intelligence (AI) tools were used in accordance with the AI usage policy from the syllabus. AI was mainly used for coding in R Studio, where it assisted troubleshooting and refining scripts. In a later stage, it also helped to cross-validate the applied framework and possibly suggesting areas of improvements. Lastly, AI was used for proofreading grammar, vocabulary, and coherence.

# Appendix

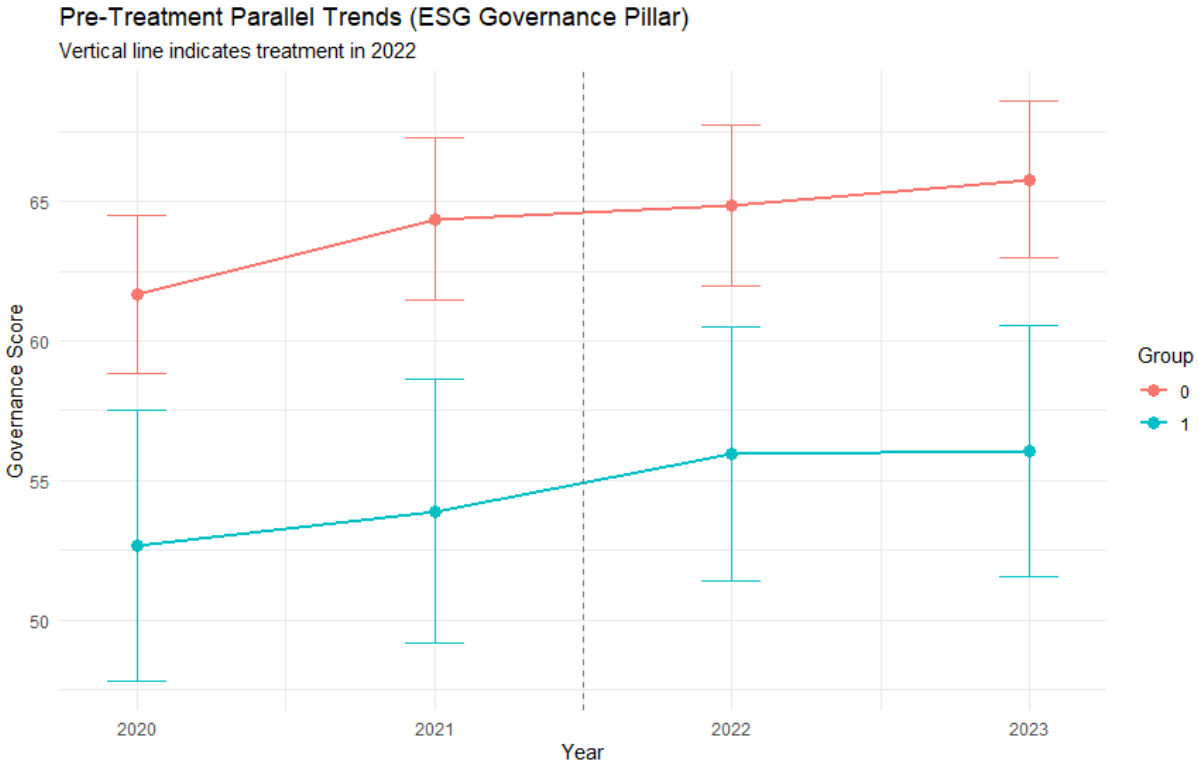
**Appendix 1.** Parallel trends assumption - ESG score



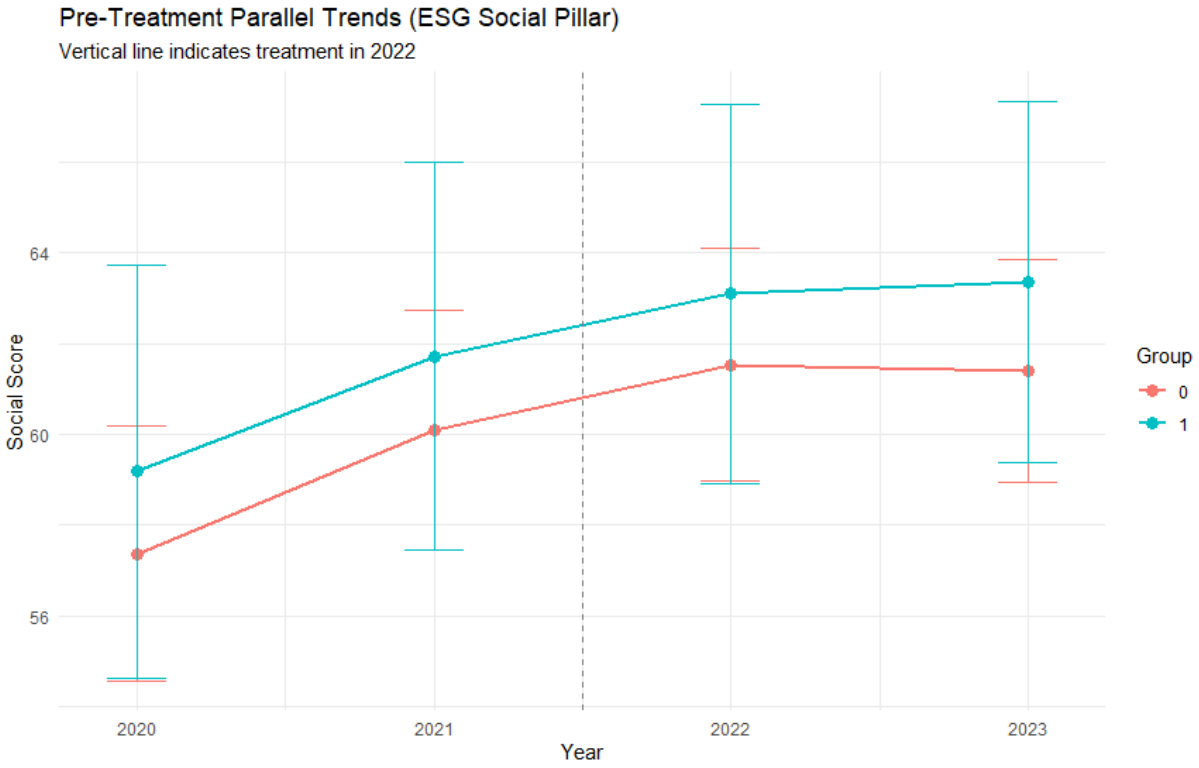

**Appendix 2.** Parallel trends assumption - Environmental score



**Appendix 3.** Parallel trends assumption - Governance score




**Appendix 4.** Parallel trends assumption - Social score



**Appendix 5.** Propensity score matching covariate balance

Covariate Balance: Treated (Brazil) vs. Control (US) — PSM Matched Sample

| Matching Variable | Mean for Treatment | Δ Match | Δ No Match |
|---|---|---|---|
| ESG | 57.362 | -1.484 (-0.630) | 3.181 (1.517) |
| Sales | 14.610 | 0.035 (0.183) | -0.380 (-2.210) |
| Leverage | 0.655 | 0.000 (0.000) | 0.036 (1.037) |
| ROA | 0.071 | 0.009 (0.540) | 0.006 (0.419) |
| Tobin's Q | 1.682 | -0.074 (-0.604) | -1.006 (-7.933) |

Entries show the mean for treated firms (Brazil), and mean differences versus control (US).
For matched and unmatched samples, cells display the mean difference and the corresponding t-statistic in parentheses.