

A Work Project, presented as part of the requirements for the Award of a Master's degree in  
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THE ROLE OF SUSTAINABILITY REPORTING IN CORPORATE SUSTAINABILITY  
PERFORMANCE: AN INVESTIGATION INTO HOW THE NOVEL CSRD IMPACTS  
CORPORATE SUSTAINABILITY PERFORMANCE.

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## **Abstract**

This pioneering study investigates the impact of the Corporate Sustainability Reporting Directive (CSRD) on corporate sustainability performance and explores the moderating role of R&D intensity on this relationship, using a Difference-in-Difference approach. Contrary to expectations, the CSRD negatively impacted overall ESG performance of EU-based firms compared to US counterparts, with performance damp in social and governance dimensions but no significant impact on environmental performance. R&D intensity did not moderate this relationship. Policymakers are encouraged to use the insights gained to refine regulations and adapt future framework development processes. For managers, it highlights that compliance alone does not guarantee ESG improvements.

**Keywords:** CSRD, ESG, Sustainability Reporting, Regulatory Impact, R&D Intensity, DiD

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## **1 – Introduction**

In the past 50 years, the global concern about the environment has undergone significant transformations, giving rise to the vast popularity of the concept of sustainability – “meeting the needs of the present without compromising the ability of future generations to meet theirs” (World Commission on Environment and Development 1987, 16). European Commission president von der Leyen’s aim to achieve Europe’s sustainability transition by “reconciling the economy with the planet” (2019) led to some success, however, was also highly exploited by profit-driven businesses that aimed to take advantage of the new trend (Santos, Coelho and Marques 2023). As a result, the pursuit of ‘greenwashing’ – the act of misleading consumers by falsely portraying a company’s products, practices, or policies as more environmentally friendly than they truly are (Hayes, Clarke and Eichler 2024) – became highly common, making it as much of a corporate buzzword as sustainability itself (Lyon and Montgomery 2015). The major issue with the simultaneous rise of both concepts is the lack of clarity for companies and consumers, making it increasingly difficult to decipher which corporate actions truly support sustainable means. Hence, this lack of transparency posed, and continues to pose, a major challenge to the collective progress toward true sustainability (United Nations 2024).

To address this challenge and reacting to the growing demand for transparency in environmental, social, and governance (ESG) practices, the European Union launched the Corporate Sustainability Reporting Directive (CSRD) in mid-2022, aligning with the EU Green Deal (European Parliament 2022). The CSRD is the extensive successor of the Non-Financial Reporting Directive (NFRD), addressing previous limitations such as the scope and depth of sustainability disclosures. Importantly, unlike the NFRD, the CSRD necessitates the audit of the disclosed content of the report, enhancing the quality, consistency, and transparency of corporate sustainability reporting, thereby simplifying comparability and complicating greenwashing (Baumüller and Grbenic 2021).

Prior research has proven that apart from its primary objective of disclosing non-financial information to promote transparency, the implementation of the NFRD also led to improved sustainability performances of subject firms, measured by ESG criteria (Bigelli, Mengoli and Sandri 2023; Aluchna, Roszkowska-Menkes and Kamiński 2022; Stein and Venter 2023). As Cuomo et al. (2024) find, this relationship is positively moderated by research and development (R&D) investment. Given that the CSRD represents a more extensive version of the NFRD, it raises the question of whether a similar effect will be evident for the new directive. This paper aims to provide an answer to this question, shedding light on the relationship between the newly enacted directive and corporate sustainability performance, and how it is moderated by R&D investment. To do so, a Difference-in-Difference (DiD) approach is adopted, comparing the ESG performance of firms subject to the directive (EU-based) to comparable firms not directly affected by the directive (based in the United States (US)), for the years 2018 - 2023. The DiD models are fed with data from the FactSet database, supported by MSCI ESG Research LLC's (MSCI) ESG ratings.

This paper serves as a pioneering study aiming to provide initial insight into the effectiveness of the CSRD in promoting sustainability. It addresses the current research gap by investigating how this regulatory framework influences corporate sustainability performance in practice. Apart from filling this academic gap, the outcome of this research is also worthwhile for policymakers, as they can make use of the insights to gain a clearer understanding of how firms respond to new sustainability regulations. The outcome of this paper also sheds light on whether such a directive can serve as a meaningful tool for advancing sustainable business practices.

To examine the impact of the CSRD implementation on corporate sustainability performance, this paper will adopt the following structure (see Appendix A & B for elaborate table of contents and list of tables & figures). Firstly, Section 2 covers prior literature in the field and makes use of it to formulate the hypotheses. Section 3 summarizes relevant data, variables, and descriptive

statistics and outlines the methodology. Section 4 reports the findings. Section 5 then discusses the results, dives into stakeholder implications, acknowledges limitations, and suggests directions for future research. Lastly, Section 6 offers concluding remarks.

## **2 – Theoretical Background & Hypotheses**

### **2.1 – CSRD**

On the 22<sup>nd</sup> of June 2022, the European Commission officially communicated the political agreement on the CSRD, requiring approximately 50,000 companies operating within the European Union to comply with comprehensive sustainability disclosure requirements until 2029 (McGuinness 2022). Under this directive, affected companies are mandated to comply with several novelties, extending and significantly revising the existing NFRD. As Hummel and Jobst (2024) highlight, the CSRD extends the NFRD in terms of depth and scope of the reporting contents, specifically requiring, among other points, a description of the firm's sustainability strategy, sustainability-related targets, such as potential greenhouse gas emission reductions, or sustainability-linked incentive schemes for employees. Moreover, building on the criticism of the NFRD, the newly implemented CSRD includes mandatory auditing of the report's content, rather than the mere verification of whether a report has been submitted, as was the case under the NFRD (see Appendix C and D for more extensive differences) (Hahnkamper-Vandenbulcke 2021). With this modification, the "EU Commission aims to improve the quality and consistency of sustainability reporting throughout the EU" (Holzheuser, Hairabedian and Valence 2023), taking one step closer to achieving the goals set out by the EU Green Deal.

Beyond being a directive that impacts the reporting behavior of corporations, researchers and field experts agree that the implementation of the CSRD calls for companies to further embed sustainability into their strategies (Farkas and Matolay 2024; Thun, et al. 2024; Baks 2024; Fang, et al. 2023). More specifically, Fang, et al. (2023, 2) argue that "while the letter of the

CSRD calls for extensive reporting, the intent of the CSRD is to drive change in business conduct”. Hence, this indicates that a major effect of the implementation of the CSRD is expected to be the improvement of a firm’s corporate sustainability performance. But does this hope resemble the truth? Exactly this gap between what researchers expect and what policymakers hope to achieve from the implementation of the CSRD, and how companies actually react to the new directive, will be of key focus for this paper.

Given the recency of the topic, the available publications on the CSRD are rather scarce, at most discussing the potential that its implementation may possess (Hummel and Jobst 2024; Baks 2024). Hence, this paper aims to shed light on this field and provide first insights into how companies’ sustainability performances respond to the directive’s enactment, leading to the guiding question for the report:

**GQ:** *To what extent does the introduction of the CSRD influence firms’ corporate sustainability performance?*

## **2.2 – Corporate Sustainability Performance & ESG**

Before being able to dive into this question, it is important to clarify the concept of corporate sustainability performance, outline its tangibility, and motivate its relevance to CSRD.

Corporate sustainability performance, as the term suggests, evaluates a company’s effectiveness in implementing sustainable practices. Given the broad scope of the term “sustainability”, academic literature widely accepts the use of ESG scores as a standardized framework for assessing firms’ sustainability performance (Khaled, Ali and Mohamed 2021; Tamimi and Sebastianelli 2017). This framework is based on evaluating both qualitative and quantitative indicators within the ESG dimensions, such as environmental stewardship, social responsibility, and corporate governance (Barbosa, et al. 2023). The results of these evaluations are then quantified by external providers, yielding tangible scores for firms’ corporate

sustainability performances. Most rating agencies typically provide four scores: an individual score for each of the three ESG pillars and one combined overall score. The overall value, which is usually ranked into levels, is a weighted average calculated based on the relative importance of each ESG pillar within the specific industry context (Muck and Schmidl 2024). This weighting often aligns with a materiality matrix, which prioritizes ESG dimensions based on their significance to stakeholders and their impact on business success (Rodrigues 2023). For instance, environmental metrics like emissions reduction might carry greater weight in industries such as energy or manufacturing, while social metrics, such as employee welfare or community engagement, might be prioritized in service-oriented sectors. Governance indicators, while universally relevant, may vary in importance depending on the regulatory environment and market expectations. By adopting this weighted approach, agencies aim to better reflect the relevance of ESG dimensions across industries, enabling a more tailored approach to sustainability performance evaluation (Liu, et al. 2023).

Given that the CSRD is expected to affect companies' sustainable actions, and ESG scores are the most widely adopted method for measuring corporate sustainability performance, it is evident that this variable is highly suitable for the paper's analysis (Fang, et al. 2023). Moreover, the quantitative nature of ESG scores facilitates straightforward trend analysis, further qualifying ESG as the dependent variable in evaluating the impact of the implementation of the CSRD on firms' sustainability practices.

## **2.3 – Hypothesis Development**

### **2.3.1 – Institutional Theory and the Role of Reputation**

In order to be able to formulate a hypothesis for the relationship between the CSRD and a firm's sustainability performance, it is essential to understand the underlying mechanism. To do so, it is important to recognize the strong connection between a firm's reputation and its performance, along with the amplifying role of today's mass media. This dynamic is closely aligned with

institutional theory, which emphasizes the significance of environmental pressures - whether regulatory, societal, or competitive - as key drivers of organizational change (DiMaggio and Powell 1983). Firms under the pressure of public scrutiny and institutional expectations may adopt proactive strategies to align with sustainable practices, not only to meet regulatory requirements but also to maintain their reputation and potentially obtain a competitive advantage (Pasamar, Bornay-Barrachina and Morales-Sánchez 2023). As media coverage can quickly expose and amplify any misconduct or unsustainable practices, firms are increasingly motivated to ensure that their corporate actions reflect positively on their social and environmental commitments (Li and Long 2024).

This increasing importance of reputation is further explained by Azizah, Wulaningrum and Diah (2021), amongst others, who found that reputation is positively correlated with firm performance. As a result, companies have a strong incentive to prevent any dissemination of information that could harm their public image. In this context, the increasing transparency demands, such as those under the CSRD, force firms to examine and enhance any practices that might lead to negative reputational outcomes (Sehgal, Garg and Singh 2022). Moreover, whilst gathering the necessary data for the CSRD report, information may surface that was not known by the company, hence leading to improved sustainable actions (Khor, Figueiredo and Ooi 2020). Lastly, the CSRD also encourages companies to integrate more sustainability into their core strategies and operations. This proactive approach leads to better management of environmental and social risks, which can enhance overall ESG performance (Libit and Freier 2013). Hence, considering the previously mentioned perspectives and theories, it is evident that research suggests that the implementation of the new CSRD should positively impact corporate sustainability performance.

### 2.3.2 – Hypothesis One

In addition to analyzing the implications of the underlying theories and dynamics of the relationship, prior research can further provide concrete insights that help refine and substantiate a hypothesis. Despite the novelty of research on CSRD, given that the directive is the direct successor of the NFRD, it is possible to derive hypothesis indications by considering previous literature conducted on the relationship between NFRD reporting and ESG performance. For example, Bigelli, Mengoli and Sandri (2023) found that the implementation of the NFRD led to improved overall ESG scores of companies subject to the legislation. Thus, considering the improvements that the CSRD adopted over the NFRD, a similar effect should be expected when analyzing the impact of the CSRD on ESG performance. Based on this argumentation and the previous literature implications, it is possible to deduce the first hypothesis for the above-mentioned guiding question:

**H1:** *The average corporate sustainability performance of EU-based firms was positively impacted by the implementation of the CSRD.*

Extending the first hypothesis, this paper will also examine the impact of the implementation of the CSRD on the performance of the individual ESG pillars. As discussed in Section 2.2, this approach acknowledges that the ESG pillars are distinct constructs, each subject to different external pressures and shaped by unique criteria. By disaggregating the ESG components, this analysis aims to provide a deeper understanding of how the directive influences specific areas of corporate sustainability performance. Considering the Porter Hypothesis, which indicates that strict environmental policies stimulate environmental performance, the sustainability directive is expected to positively impact the environmental performance of firms (Porter 1991; Zhang, et al. 2024). Aluchna, Roszkowska-Menkes and Kamiński (2022) analyzed the impact of NFRD on the distinct ESG scores of companies listed on the Warsaw Stock Exchange. They found that although the overall ESG performance improved following the implementation of

the legislation, not all pillars improved equally. Rather, the researchers identified that whilst environmental and social performances improved, no significant change was observable for governance performances (Aluchna, Roszkowska-Menkes and Kamiński 2022). This absence in effect was attributed to the already well-established institutionalization of corporate governance within the Polish market, establishing a solid foundation for governance standards long before the legislation was implemented. As a result, there was limited room for further measurable improvement in governance performance compared to the environmental and social dimensions, where the baseline was lower, and the regulatory push had a more evident impact (Aluchna, Roszkowska-Menkes and Kamiński 2022). Given that this argumentation on varying baselines can be generalized to a European and even global scale, the findings of this paper act as a guide for extending hypothesis one. Hence, the following hypotheses can be derived:

**H1a:** *The environmental performance of EU-based firms was positively impacted by the implementation of the CSRD.*

**H1b:** *The social performance of EU-based firms was positively impacted by the implementation of the CSRD.*

**H1c:** *The governance performance of EU-based firms was not significantly impacted by the implementation of the CSRD.*

### **2.3.3 – Hypothesis Two**

The relationship between R&D investment and corporate sustainability performance can be grounded in the resource-based view (RBV) theory, which indicates that firms with unique and valuable resources, such as R&D capabilities, can achieve competitive advantages (Wernerfelt 1984). In the context of sustainability, R&D investments enable firms to develop innovative solutions, improve operational efficiency, and address ESG challenges, thereby enhancing their overall sustainability performance (Padgett and Galan 2010). Moreover, firms with substantial

R&D investments appear to possess the necessary resources to adapt effectively to the regulatory changes promoted by the CSRD (Cuomo, et al. 2024).

Building on this theoretical foundation, existing literature on ESG performance further suggests that a firm's investment in R&D may act as a moderating factor in the relationship between CSRD implementation and ESG performance (Anqi, et al. 2023; Jia and Guang 2024). More specifically, Dicuonzo, et al. (2022, 1191) conclude that “companies investing more in R&D have better ESG performance“, implying a positive moderation. In a study on the moderating role of R&D investment in the relationship between NFRD and ESG performance, Cuomo, et al. (2024, 735) found that “the level of R&D expenditure positively moderates the effect of the Directive [NFRD] on firms' social and environmental performance”. Whether this trend can also be translated to the newly enacted CSRD and how R&D investment moderates the relationship between CSRD and ESG performance will be a further aim of this paper. Considering the findings of existing literature, the following hypothesis is concluded:

**H2:** *R&D investment positively moderates the relationship between CSRD and corporate sustainability performance.*

## **2.4 – Research Question & Conceptual Framework**

Combining the insights of all of the previous paragraphs, the following overarching research question is deduced:

*To what extent does the introduction of the CSRD impact firms' corporate sustainability performance, captured by ESG, and how is this relationship moderated by R&D investment?*

Similarly, concluding from the research question and the hypotheses motivated above, the following conceptual framework is visualized:

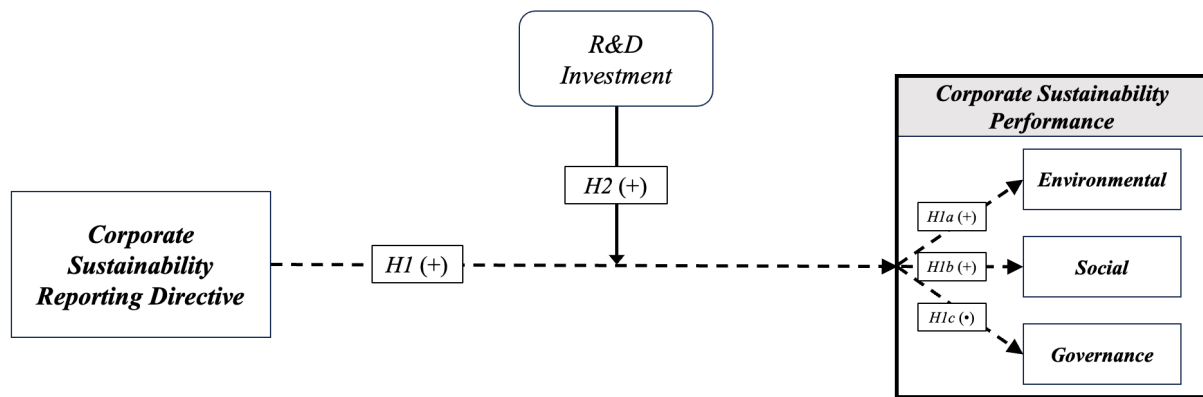


Figure 1 - Conceptual Framework

### 2.4.1 – Control Factors

It is important to recognize that in the conceptual framework, several factors may influence the depicted relationship, which are, however, not of primary focus to the paper's analysis. Therefore, to help isolate the impact that the implementation of the CSRD has on corporate sustainability performance, numerous control factors are included.

Several studies examining the relationship between NFRD and ESG performance controlled for firm size, financial leverage, profitability, and region (Aluchna, Roszkowska-Menkes and Kamiński 2022; Cicchiello, Marrazza and Perdichizzi 2022; Stein and Venter 2023). These variables are important to control as they influence a company's ability to invest in sustainability. In terms of region, the studies compared Europe against the US since companies in the US were mainly unaffected by the NFRD, yet most comparable to those in the EU. Although smaller EU-based firms that are not subject to the directive could have also served as a control group, their suitability is questionable for two main reasons. On one hand, the availability of data for small firms is highly limited, complicating an accurate assessment (Stein and Venter 2023). On the other hand, comparing large and small EU-based firms could yield skewed results due to substantial differences in their firm characteristics. Hence, using large US firms as a control group provides a more robust comparison, enhancing the validity of the findings and ensuring a more representative analysis (Stein and Venter 2023).

Whilst not considered in the field of NFRD, further controls that are used by researchers investigating general ESG performance are firm age and industry affiliation (Fadilah, Uzliawati and Mulyasari 2022; Martiny, et al. 2024). The variables capture the relative importance of ESG to a firm in a given industry or business lifecycle, therefore also being important to control in the model.

By creating synergy and integrating the diverse controls used in various fields of research that are linked to CSRD, this paper aims to provide a comprehensive and reliable analysis that is able to isolate the impact of the CSRD's implementation on ESG performance.

## **2.5 – Relevance**

The research on the introduction of the CSRD and its influence on corporate sustainability performance holds significant relevance for both academia and corporate practice.

For academia, this study addresses a gap in sustainability research by examining the real-world impact of the CSRD on firms' corporate sustainability performance. Given the scarcity of empirical studies on the CSRD due to its recency, this research contributes valuable insights into the effects of regulatory changes on corporate behavior, helping to advance the theoretical understanding of how sustainability regulations influence business practices.

From a practical perspective, the findings will help policymakers evaluate whether the directive is achieving its intended goal of improving sustainability. This allows for potential adjustments to later stages of the rollout plan of the CSRD or provides valuable insights to policymakers who may wish to adopt similar directives in other regions of the world, such as the US (Bernoville 2024).

### **3 – Methodology**

This section will explain the selected research design, followed by a description of the sample data and selected variables. The developed models will be presented, concluding with an overview of the descriptive statistics.

#### **3.1 – Research Design**

This paper adopts a quasi-experimental design, making use of the Difference-in-Difference (DiD) approach to assess the impact that implementing the CSRD has on the corporate sustainability performance of EU-based firms. This research design enables the study of the differential effect of the passing of the CSRD (intervention) on firms subject to the directive (treatment group) versus companies that are unaffected by the legislation (control). The outcome assesses whether there is a significant difference in the change in the ESG performance of firms in the treatment group compared to the change in the control group over time.

#### **3.2 – Sample Data**

The quantitative information required for the assessment conducted in this paper is entirely derived from the FactSet database, with the ESG ratings provided by MSCI (FactSet 2022). For the longitudinal study ranging from the pre-intervention period (2018-2022) to the post-intervention period (2023), a total of approximately 20,000 firms based in the EU and US were sampled. From this initial sample, all firms were excluded that did not provide seamless observations for all variables included in this study.

Given the large scope of the novel legislation, the European Commission (2024) decided to phase the implementation of the CSRD into four key sections:

1. Large companies already subject to the NFRD must comply with the CSRD by reporting on their fiscal year 2024 for reports published in 2025,
2. Large firms not subject to the NFRD, meeting two of the following three criteria, must comply by 2025, reporting in 2026:

- a. more than 250 employees
  - b. more than €50 million in net turnover
  - c. more than €25 million in total assets,
3. All listed small and medium-sized enterprises (SMEs) must report by 2027, on the fiscal year 2026,
  4. All non-EU companies with net turnover exceeding €150 million and a subsidiary or branch in the EU must report for the fiscal year 2028 by 2029.

As this rollout indicates, the gradual extension of sustainability reporting to a broader set of companies leads to a large subset only being affected by 2027 or 2028. Hence, it is evident that their reactions to the directive may be deferred and not yet perceivable. To control for this deferral, this paper will only consider companies that are within the first two stages of the CSRD rollout plan. The final sample used for this study is as follows.

The treatment group consists of 358 EU-based firms, while the control group includes 593 US-based firms. The groups were selected by identifying all EU and US companies listed in the database that provide seamless ESG ratings for 2018 until 2023 and meet the criteria of the first two phases of the CSRD rollout plan. The control group is limited to US-based firms, not only to align with previous research but also because they provide the most relevant comparison to EU-based firms (Cicchello, Marrazza and Perdichizzi 2022; Vastag and Whybark 1994). This strengthens the explanatory power of the study by offering a consistent and meaningful basis for the DiD approach of this paper. It is worth mentioning that it is not surprising that the control group is larger than the experimental group, considering that there are almost 1.5 times the number of large firms (>250 employees) in the US as compared to the EU (European Union 2023; NAICS 2023).

### **3.2.1 – Selection Bias**

To minimize any possible selection bias, both the experimental and control groups were selected through purposive sampling, including all firms that were eligible based on the predefined criteria. Hence, for the collected samples, the entire available population is considered for the investigation, aiming to ensure the reliability of the findings.

## **3.3 – Variables**

### **3.3.1 – ESG Performance**

A multitude of firms have taken on the responsibility of quantifying corporate sustainability performance by evaluating firms' ESG indicators to yield a tangible performance score. Among the leading providers is MSCI, which evaluates companies across various industries and sectors, offering in-depth analysis and ratings on firms' commitments to sustainability (Boffo and Patalano 2020).

MSCI's ESG rating is based on the assessment of 33 diverse Key Issues (KI), ranging from carbon emissions to tax transparency. 13 KIs fall under the environmental pillar, 14 under social, and six under governance (see Appendix E). For the governance pillar, the weighted average of all six KIs determines the final rating for a company (MSCI 2024). However, for the other two pillars, only a maximum of seven KIs per pillar are considered for the assessment. The KI selection is industry-specific and based on an annual assessment of the "extent to which the business activities of the companies in each industry generate large environmental- or social-related externalities" (MSCI 2024, 10). Hence, the final environmental and social scores are based on the weighted average of all KIs that fall under the industry-specific selection (MSCI 2024). To arrive at an overall rating, the weighted averages of the individual scores of each pillar are calculated and once again "adjusted relative to industry peers and committee reviews" (MSCI 2024, 9), yielding a final numerical score ranging from 0-10 (see Appendix F).

The final numerical rating for each company is then converted into a letter rating, with AAA and AA representing the leading ESG players per industry and CCC representing the lowest-performing firms (Table 1). According to Bell (2020), firms that achieve higher ESG ratings are often perceived as lower-risk entities with a greater ability to withstand external pressures and adapt to long-term global shifts in regulatory, social, and environmental aspects. Such companies are typically seen as more resilient and strategically well-positioned for sustainable, long-term growth. Conversely, companies that receive lower ESG ratings are viewed as more vulnerable to material risks, such as environmental liabilities, governance failures, or social unrest, which may compromise their financial performance and long-term viability (Whelan, et al. 2021).

*Table 1 - ESG Letter Conversion Table (MSCI 2024)*

<b>Letter Rating</b>	<b>Leader/Laggard</b>	<b>Final Industry-Adjusted Company Score*</b>
AAA	Leader	8.571 - 10.0
AA	Leader	7.143 - 8.571
A	Average	5.714 - 7.143
BBB	Average	4.286 - 5.714
BB	Average	2.857 - 4.286
B	Laggard	1.429 - 2.857
CCC	Laggard	0.0 - 1.429

\*Appearance of overlap in the score ranges is due to rounding error. The 0-to-10 scale is divided into seven equal parts, each corresponding to a letter rating.

**3.3.2 – R&D Intensity**

To assess the moderating role of R&D expenditure on the direct effect, the annual expenses per firm in both the treatment and control groups are collected for the years ending in 2018-2023. To capture the size effect of firms and simplify comparability and interpretation, the R&D expenditure is divided by total assets, yielding R&D intensity (Haque, Siddique and Kumar 2024). As for the ESG performance insights, the information is collected from the FactSet database (FactSet 2022).

### **3.3.3 – Control Variables**

In order to increase the explanatory power of the model, several control variables are included. Following the legitimacy theory, firm size and age are considered controls in the model, given their positive relationship with sustainable performance (Dowling and Pfeffer 1975; Fadilah, Uzliawati and Mulyasari 2022). Whilst firm size is assessed based on the total assets, firm age refers to the age that a firm was at a given observation. In addition, the financial leverage variable allows the control of varying financial backgrounds that could affect a firm's willingness to invest in ESG activities (Akca, Karan and Yıldız 2021). The Debt-to-Equity ratio is used to represent leverage, capturing to what extent a company relies on debt versus equity to finance its operations and investments (Brealey, Myers and Allen 2020). Profitability, assessed in the form of return on assets (ROA), is considered as a further control variable, given its positive relationship to ESG performance (D'Amato, D'Ecclesia and Levantesi 2023). Another important control variable is industry affiliation, as ESG risks and opportunities differ substantially across sectors. The significance of ESG factors is shaped by industry-specific challenges, with some sectors facing more intense environmental and social scrutiny compared to others (Martiny, et al. 2024). Given that MSCI's ESG ratings account for these industry variations, controlling for industry affiliation is essential to ensure a more isolated assessment of the CSRD's impact on ESG performance. Lastly, as explained above, the region is controlled by comparing EU-based firms against US-based firms. Table 2 below provides an overview of all variables.

Table 2 - Variable Overview

Variables	Description/Formula
<b>Independent Variables</b>	
CSRD	Is a firm subject to the CSRD based on Region and Time?
Treatment	(1) EU-based / (0) US-based
Period	(1) Post-Implementation (2023) / (0) Pre-Implementation (2018-2022)
<b>Dependent Variables</b>	
ESG Performance	
Overall	MSCI Rating Score (1-7)
Environmental	MSCI Rating Score (0-10)
Social	MSCI Rating Score (0-10)
Governance	MSCI Rating Score (0-10)
<b>Moderating Variable</b>	
R&D Intensity	R&D Expenditure / Total Sales
<b>Control Variables</b>	
Size	Total Assets (in Million €)
Age	Years since founded
Leverage	Total Debt / Total Equity
ROA	Profitability measured as Net Income / Total Assets
Industry	Industry Affiliation

### 3.4 – DiD Models

The DiD models used to investigate whether the implementation of the CSRD has an impact on the corporate sustainability performance of firms are as follows.

#### 3.4.1 – Model-Free DiD

Together with graphical observation, a preliminary model-free calculation provides initial insights into the average treatment effect (ATE) that the implementation of the CSRD (intervention) had. As the intervention is both region- and time-dependent, treatment represents EU-based firms and control represents US-based firms, whilst pre and post reflect whether the period captures observations before or after the implementation of the CSRD. Hence, the following calculation is used to derive the ATE:

$$ATE = \Delta Treatment - \Delta Control \quad (1)$$

whereby:

$$\Delta Treatment = Treatment Post - Treatment Pre \quad (2)$$

$$\Delta Control = Control Post - Control Pre \quad (3)$$

The outcome is regression-free and based solely on the ESG ratings' mean values. Hence, it is only indicative in nature and provides no suggestion of the statistical significance.

### 3.4.2 – Model-Based DiD (Baseline)

To yield insight into the statistical significance of the values obtained from the model-free DiD, a baseline DiD model is developed. Using linear regression, this model aims to isolate the effect that the implementation of the CSRD has on firms' ESG performance. Specifically, the objective of the model is to capture how the average ESG rating per firm is affected by a firm's exposure to the CSRD, comparing performance before and after the directive's implementation. The model is computed as follows:

$$\begin{aligned} ESG\ Performance_{it} = & \beta_0 + \beta_1 \times Treatment_i + \beta_2 \times Period_t \\ & + \beta_3 \times (Treatment_i \times Period_t) + \varepsilon_{it} \end{aligned} \quad (4)$$

In the model,  $ESG\ Performance_{it}$  represents the average corporate sustainability performance per firm (i) for the period (t), where the dependent variable takes the form of either the aggregate overall ESG rating or an individual pillar rating, conforming with hypothesis *H1*. The binary dummy variable  $Treatment_i$  is equal to 1 if firm i is subject to the CSRD (treatment group) and 0 otherwise (control group). Similarly,  $Period_t$  equals to 1 if the time period t is after the enactment of the CSRD, whilst it equals 0 if it is before. The coefficients  $\beta_{0-3}$  yield specific insights into the impact of the CSRD on firm's ESG performance. The intercept,  $\beta_0$ , represents the baseline ESG performance for firms in the control group before the implementation of the CSRD, providing the average ESG score when all other variables are 0.  $\beta_1$  represents the difference in ESG performance between the firms subject to the CSRD and the control group, before the CSRD was implemented. The coefficient  $\beta_2$  measures the change in ESG performance over time, capturing how the average ESG score for the firms not subject to the CSRD changes after the implementation of the CSRD. The interaction term,  $\beta_3$ , which is the coefficient of key interest in this model, represents the estimate for the ATE. It captures the additional effect of the CSRD on ESG performance for firms that are subject to the CSRD in

terms of region and time. Lastly, the error term,  $\varepsilon_{it}$ , represents all the random noise that influences ESG performance but is not captured by the model.

### 3.4.3 – Extended DiD Model (Controls)

Given that the baseline model only captures the direct relationship, the extended model incorporates additional predictor variables to account for factors that may influence the dependent variable but are not the primary focus of the analysis. This approach enhances the model's precision, reliability, and overall robustness. The extended model is as follows:

$$\begin{aligned}
 ESG\ Performance_{it} = & \beta_0 + \beta_1 \times Treatment_i + \beta_2 \times Period_t \\
 & + \beta_3 \times (Treatment_i \times Period_t) + C_{it} + \varepsilon_{it}
 \end{aligned} \tag{5}$$

While the remaining variables remain unchanged, the control variables highlighted in Section 3.3.3 are captured by  $C_{it}$ .

### 3.4.4 – Moderation DiD Model (Moderator)

To further add to the explanatory power of the extended model and provide more detailed insights into how the primary relationship changes under different conditions, the following model adopts the moderating variable described in Sections 3.3.2. The model investigating hypothesis  $H2$  is as follows:

$$\begin{aligned}
 ESG\ Performance_{it} \\
 = & \alpha_0 + \alpha_1 \times Treatment_i + \alpha_2 \times Period_t + \alpha_3 \times (Treatment_i \times Period_t) \\
 & + \alpha_4 \times R\&D\ Intensity_i + \alpha_5 \times (R\&D\ Intensity_i \times Treatment_i) \\
 & + \alpha_6 \times (R\&D\ Intensity_i \times Period_t) \\
 & + \alpha_7 \times (R\&D\ Intensity_i \times Treatment_i \times Period_t) + C_{it} + \varepsilon_{it}
 \end{aligned} \tag{6}$$

Whilst  $\alpha_3$  remains the focal parameter of the model, measuring the primary impact of the CSRD on ESG performance, the coefficient  $\alpha_7$  is of key focus to understand the moderating effect of R&D intensity. Specifically,  $\alpha_7$  captures how R&D intensity influences the strength or direction of the CSRD's impact on ESG performance, revealing whether firms with higher R&D

investment experience different impacts from the directive. Overall, the moderating coefficient aims to provide deeper insight into the variability of the CSRD’s effectiveness across different firm contexts. A description of the remaining coefficients can be found in Appendix G.

### 3.5 – Descriptive Statistics

To provide an overview of the sample companies, Table 3 summarizes the descriptive statistics for the key numerical variables included in the analysis. The table reflects the observations of 951 firms across the years 2018 – 2023.

Table 3 - Descriptive Statistics of Numeric Variables

<b>Variables</b>	<b>Observations</b>	<b>Mean</b>	<b>SD</b>	<b>Min</b>	<b>Max</b>
<i>ESG Overall</i>	5706	4.49	1.40	1.00	7.00
<i>ESG Environmental</i>	5706	5.26	2.06	0.00	10.00
<i>ESG Social</i>	5706	5.63	1.33	0.00	10.00
<i>ESG Governance</i>	5706	4.86	1.51	0.00	10.00
<i>R&amp;D Intensity</i>	5706	0.05	0.07	0.00	1.85
<i>Total Assets</i>	5706	18015.20	46465.69	36.40	630826.00
<i>Age</i>	5706	58.82	45.39	1.00	233.00
<i>Leverage</i>	5706	1.05	14.52	-505.78	432.20
<i>Profitability (ROA)</i>	5706	0.78	0.48	0.00	5.86

The mean ESG ratings indicate that, both in terms of overall and individual scores, the sample companies average around the midpoint of their respective scales, with the social ratings averaging highest in the ESG sub-specifications. Importantly, the modest variation, as indicated by the moderate standard deviation (SD) values, reflects disparities in how firms approach sustainability. While some firms lead with advanced ESG practices, others lag behind, highlighting a spectrum of performance across the sample. Hence, this variation provides sufficient ground for investigating whether external factors, such as regulatory policies like the CSRD, act as significant drivers of corporate sustainability performance. Looking at the control variables, the substantial variation reflects the diverse nature of the firms in terms of size, capital structure, and financial health. Together, these control variables provide a robust basis for

capturing the underlying heterogeneity and ensuring that the analysis accurately accounts for firm-specific factors affecting ESG performance.

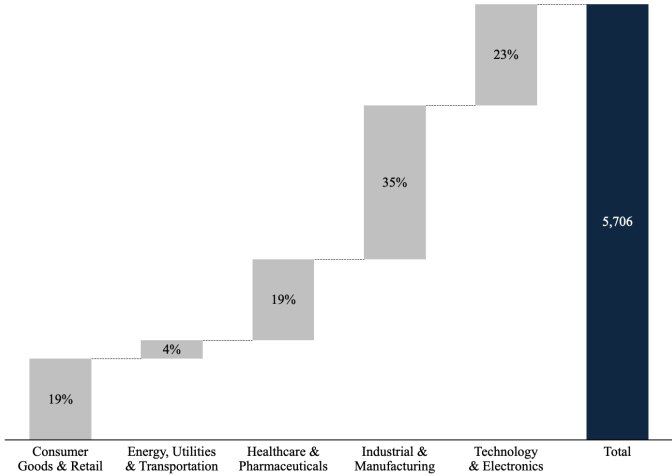


Figure 2 - Overview of Industries (Clustered)

The sample firms represent a total of 99 specific industries. For illustration purposes, however, they have been clustered into five major categories, illustrated in Figure 2. Whilst the majority of firms are industrial or manufacturing firms, the minority fall under energy, utilities, and transportation.

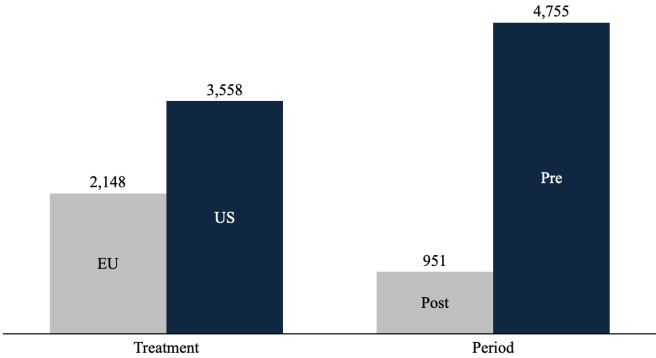


Figure 3 - Distribution of Treatment and Period Variables

Figure 3 illustrates the distribution of firm-year observations for two key predictor variables. The treatment pillar indicates that the sample consists of more US-based firms than EU-based ones. Across these firms, a greater number of observations are recorded for the period before the enactment of the CSRD compared to the post-enactment period.

	Treatment	Period	ESG Overall	ESG Environmental	ESG Social	ESG Governance	R&D Intensity	Total Assets	Age	Leverage	Profitability	Correlation
Treatment	-											
Period	7.24E-17	-										1
ESG Overall	0.34***	0.16***	-									0
ESG Environmental	0.12***	0.04	0.29***	-								-1
ESG Social	0.26***	0.18***	0.44***	-0.07***	-							
ESG Governance	0.14***	0.04	0.53***	0.11***	0.01	-						
R&D Intensity	-0.18***	0.01	-0.16***	-3.38E-03	-0.14***	-0.09***	-					
Total Assets	0.06***	0.02	0.04*	0.14***	-0.17***	-6.67E-03	-0.08***	-				
Age	0.04	0.02	0.16**	-0.03	0.08***	0.03	-0.27***	0.1***	-			
Leverage	-0.02	-5.86E-03	-6.69E-03	9.61E-03	-0.03	2.17E-03	3.59E-03	0.01	8.82E-03	-		
Profitability	-6.39E-03	0.01	0.04	-0.24***	0.14***	0.03	-0.19***	-0.11***	0.13***	-9.91E-03	-	

Note: \*p < 0.1, \*\*p < 0.05, \*\*\*p < 0.01.

Figure 4 - Correlation Matrix

Lastly, Figure 4 presents the correlation coefficients between the variables under investigation. At first glance, the highest correlations are observed between the ESG overall score and the sub-pillar ratings, indicating that overall ESG performance is closely tied to its individual dimensions, with governance demonstrating the strongest influence. Additionally, the positive and significant correlation between treatment and ESG scores indicates that EU-based firms tend to have higher ESG scores. A similar conclusion can be drawn for overall ESG and social scores in correlation to period, indicating that the respective scores after the implementation of the CSRD tend to be larger across all firms. Although these correlations provide an initial understanding of the relationships between variables, they do not yield insight into the impact of the CSRD on corporate sustainability performance. Considering the maximum correlation coefficient of 0.53, multicollinearity does not pose a concern in this analysis. Similarly, the assumptions for reliable linear regressions, including normality of residuals, homogeneity of variances, absence of influential points, and linearity, are approximately satisfied (Appendix H). Hence, these conditions provide a solid foundation for proceeding with the regression analysis to investigate the CSRD's impact on corporate sustainability performance.

## 4 – Results

In the following section, the results will be presented and interpreted according to the models highlighted above. Each model incrementally adds explanatory power and complexity, yielding the moderation model as the most comprehensive model.

### 4.1 – Trend Analysis

Prior to any computational analysis, the average trend of the ESG ratings was visualized for each of the four pillars (overall, environmental, social, and governance), allowing for a preliminary assessment based on visual inspection.

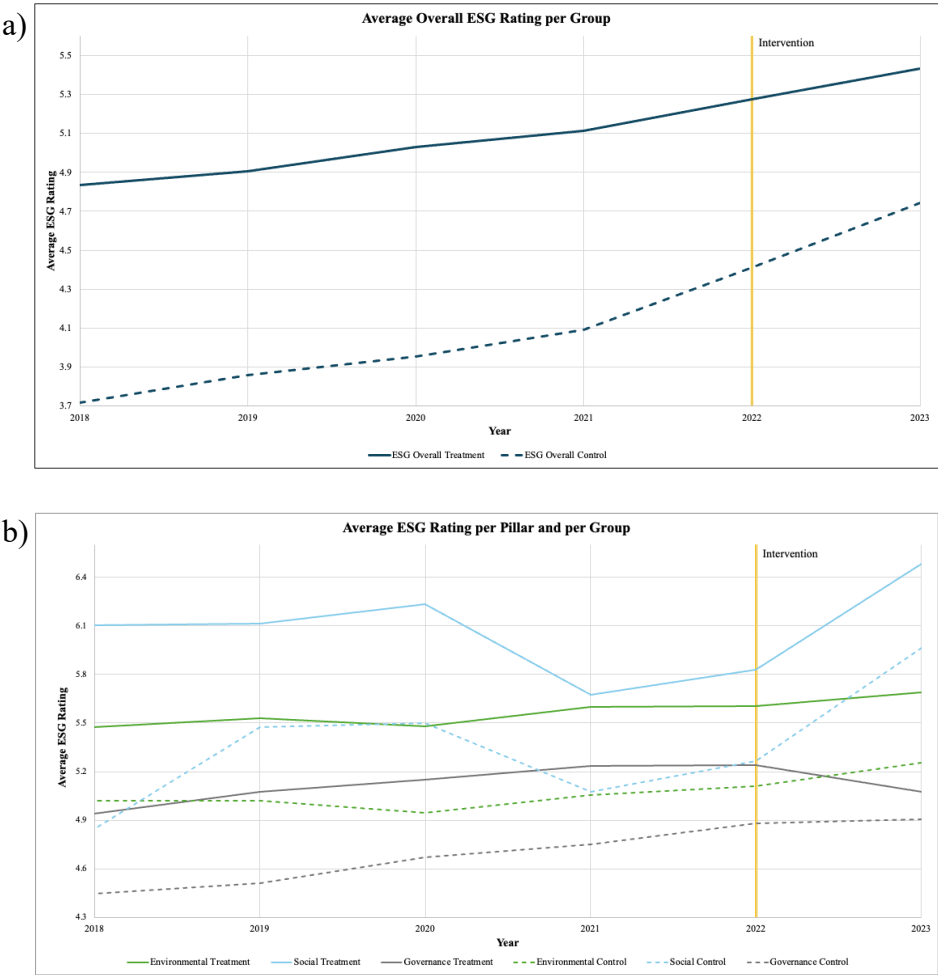


Figure 5 - Line Graph: a) Average Overall ESG Rating per Group, b) Average ESG Rating per Pillar per Group

Figure 5a represents the average overall ESG rating for both the control and treatment groups for the years 2018 until 2023, whilst Figure 5b captures the average ESG ratings of the

individual pillars. Whereas the left side of the graph represents the pre-intervention period, the lines on the right side of the intervention represent the average ESG scores post-CSR enactment. At first sight, it is evident that for each of the four variables, the EU-based firms (solid lines) are awarded higher ESG ratings than the US-based firms (dashed lines). This is represented through the consistently higher solid lines per category, compared to the dashed lines.

#### **4.1.1 – Overall ESG**

Taking a closer look at Figure 5a, it is evident that for both groups, there has been a positive trend in the average overall ESG ratings. Over the six years, US-based firms increased their average overall ESG rating from just above 3.7 to about 4.7, while EU-based firms rose from approximately 4.8 to just below 5.5. In the pre-intervention period, the figure indicates a very similar upward trajectory of the overall ESG scores across both groups, satisfying the parallel trends assumption for DiD models. However, considering the trend after the enactment of the CSR, it appears that whilst the inclination of US-based firms remained approximately the same, the trend of EU-based firms was significantly dampened, yielding a much flatter increase, as seen on the right side of Figure 5a. Thus, this observation gives a first indication of the impact of the CSR's implementation on the overall ESG ratings of EU-based firms. The dampened trend suggests that, while average ESG scores continued to rise, the increase for firms from the EU was less pronounced than that of their US counterparts, which was unaffected by the CSR. Hence, contrary to hypothesis *H1*, this observation indicates that the directive's implementation has led to slower ESG improvements for EU-based firms than they might have achieved without the directive's enactment.

#### **4.1.2 – Individual ESG Pillars**

Examining Figure 5b reveals that very similar conclusions to the overall ratings can be drawn. The trajectories of each ESG pillar for both groups in the pre-intervention period are closely

aligned, once again fulfilling the parallel trends assumption. Considering the lines for the post-intervention period, it is also evident that the trends of the treatment group are less favorable in terms of average ESG scores. Specifically, the slightly flatter positive slopes in environmental and social scores suggest that EU-based firms experienced comparatively weaker outcomes following the CSRD’s enactment in these sustainability areas. For governance, the negative slope of EU-based firms, compared to the incline of US-based firms, further indicates that, similar to the other two pillars, firms based in the EU underperformed in ESG scores relative to their counterparts unaffected by the CSRD. Relating to hypothesis *H1a*, *b*, and *c*, the visual analysis of Figure 5b implies that for each of the pillars, contrary to the hypotheses, the enactment of the CSRD did not lead to increased ESG performance, nor did it remain unaffected, as hypothesized for governance in *H1c*.

**4.2 – Model-Free Evidence**

Given that the conclusions drawn in Section 4.1 are solely based on visual inspection, the following segment will dive into preliminary calculations to quantify the observations. The initial analysis conducted was a DiD calculation without employing linear regression. As outlined in Section 3.4.1, this computation provides a regression-free perspective on the ATE that the CSRD has had on firms’ ESG performances.

*Table 4 - Model-Free DiD Calculations*

<b>Average ESG Rating</b>	<b>Treatment</b>			<b>Control</b>			<b>ATE</b>
	Pre	Post	%	Pre	Post	%	
Overall	5.02	5.44	8%	4.00	4.73	18%	-0.32
Environmental	5.55	5.71	3%	5.04	5.26	4%	-0.06
Social	5.98	6.49	8%	5.24	5.97	14%	-0.23
Governance	5.15	5.10	-1%	4.65	4.91	6%	-0.30

Table 4 above presents several results. Firstly, it is evident that, on average, EU-based firms have consistently higher ESG ratings than their US-based counterparts, conforming to the observations highlighted in Section 4.1. This conclusion remains valid across the four ESG

ratings, as well as across the periods. In addition, Table 4 also emphasizes that, on average, there has been an increase in the overall ESG ratings of the sampled firms throughout the observed period. To be exact, for EU-based firms, the average overall rating increased from 5.02 for the pre-intervention period to 5.44 for the post-intervention period, which represents an increase of 8%. For US-based firms, the increase was even more evident, with the average overall ESG rating increasing by 18% when comparing the period before and after the enactment of the CSRD. Similar trends are observable for the individual scores of the environmental and social pillars. Only the governance pillar stands out, portraying a 1% decrease in average ratings for EU-based firms, whilst US firms experienced a 6% increase in the same period, supporting the assumptions drawn in Section 4.1.2.

Whilst the previous paragraph only supports and quantifies the observations made in Sections 4.1.1 and 4.1.2, they do not provide insight into conclusions on the hypotheses. To gain this insight, Equation 1, specified under Section 3.4.1, is computed, yielding the right-most column of Table 4. As evident, all four dependent variables reveal a negative treatment effect, which, in a DiD analysis, indicates that the intervention led to a smaller increase (or greater decrease) in the outcome variable for the treated group compared to what would have occurred in the absence of the intervention (Jiménez and Perdiguero 2019). Hence, an ATE of -0.32, as for the overall ESG rating, implies that the implementation of the CSRD dampened the average ESG performance of EU-based firms by 0.32 points relative to the US-based firms. This finding aligns with the observations in Section 4.1.1 and reinforces the preliminary conclusion that the result diverges from the expectation outlined in hypothesis *H1*. Considering the outcomes for the individual pillars, the strongest effect is observed in the governance rating, with an ATE of -0.30, followed by the social pillar with an ATE of -0.23. The environmental rating, with an ATE of -0.06, indicates that a slight negative treatment effect is observed, however, given the magnitude, it is questionable whether its practical significance is given. Overall, the results

demonstrate that, although the magnitudes of the effects vary, the CSRD’s enactment negatively impacted EU-based firms across all ESG pillars, relative to their US counterparts. Consistent with the analysis of Sections 4.1.1 and 4.1.2, these findings further emphasize the deviation from the expected outcomes outlined in hypotheses H1 and H1a, b, and c.

### 4.3 – Baseline Model

Although the model-free variant of the DiD provides valuable initial insights, it does not allow conclusions to be drawn regarding the statistical significance of the observed effects. Establishing this statistical significance is, however, essential for interpreting and discussing the results, as it ensures that the findings are not merely due to random chance but represent reliable and meaningful outcomes (Tenny and Abdelgawad 2023). For this paper, a field convenient confidence level of 95% ( $\alpha = 5\%$ ) is adopted, aiming to create a balance between minimizing Type I and Type II errors (Doan 2005). To gain insight into the significance of the previous findings, a regression-based DiD model is established, following the structure depicted in Equation 4. This baseline model sheds light on the isolated direct effect between sustainability reporting and ESG performance.

To test hypothesis *H1*, its sub-hypotheses *H1a*, *b*, and *c*, and the conclusions drawn on them in the previous paragraphs, the model was run with the overall ESG rating and the individual pillars as dependent variables. The results for this model are collected in Table 5 below.

Table 5 - Results for Baseline DiD Models 1 - 4

Variables	Baseline Model			
	Overall Model 1	Environmental Model 2	Social Model 3	Governance Model 4
Constant	3.99629 ***	5.03747 ***	5.24040 ***	4.65477 ***
Treatment	1.02661 ***	0.50946 ***	0.74328 ***	0.49059 ***
Period	0.73727 ***	0.22476 **	0.72890 ***	0.25703 ***
Treatment : Period	-0.32163 ***	-0.06107	-0.22600 **	-0.30351 ***
R-Squared	0.1423	0.0151	0.0991	0.0225
Adjusted R-Squared	0.1419	0.0146	0.0987	0.0220
Observations	5706			
# of Firms	951			

Note: \*p < 0.1, \*\*p < 0.05, \*\*\*p < 0.01.

Considering the output of Table 5, it is important to mention that due to the setup of this research, the values of the estimates coincide with the computations derived in Table 4 (Section 4.2). This match is particularly evident in the estimates of the constant variables and the interaction terms, representing the average ESG scores for US-based firms in the pre-intervention period and the ATE, respectively. To obtain the remaining averages, simple calculations must be executed, explained in the following. Given that the interpretation is similar for each model, the results of Table 5 will be explained on the basis of the overall model (Model 1).

For the overall rating model, the constant estimate (4.00) reflects the average overall ESG score of US-based firms before the implementation of the CSRD. The treatment variable suggests that, prior to the implementation of the CSRD, EU-based firms had, on average, 1.03 higher ESG overall ratings compared to US-based firms, keeping all other variables constant. Similarly, the period variable shows that the overall ESG rating increased, on average, by 0.74 for US-based firms in the post-intervention period, once again keeping the remaining variables constant. The most important variable in this study, however, is the interaction term, as it captures the differential impact of the CSRD over time for firms subject to the regulation compared to those that are not. Hence, a negative coefficient of -0.32 indicates that the CSRD's implementation reduced ESG scores for EU-based firms, on average, by 0.32 points relative to the control firms. Lastly, to obtain the final remaining column of Table 4, namely the column representing the average overall ESG scores of EU-based firms after the implementation of the CSRD, the previously mentioned values must be summed. Hence, the average overall ESG rating for this subset is 5.44, which is also reflected in Table 5 above. Similar interpretations and calculations apply to the distinct ESG pillar models.

Figure 6 provides a visual representation of the findings summarized in Table 5, clearly illustrating the calculated results of the previous paragraph. Moreover, the figure emphasizes

the interpretation of the ATE by incorporating the counterfactual scenario. The counterfactual represents how the average ratings might have evolved in the absence of the CSRD, offering a visual comparison between the actual and hypothetical outcomes (Starr, Zalta and Nodelman 2022). This approach not only visualizes the ATE but also effectively illustrates the impact of the CSRD on sustainability ratings.

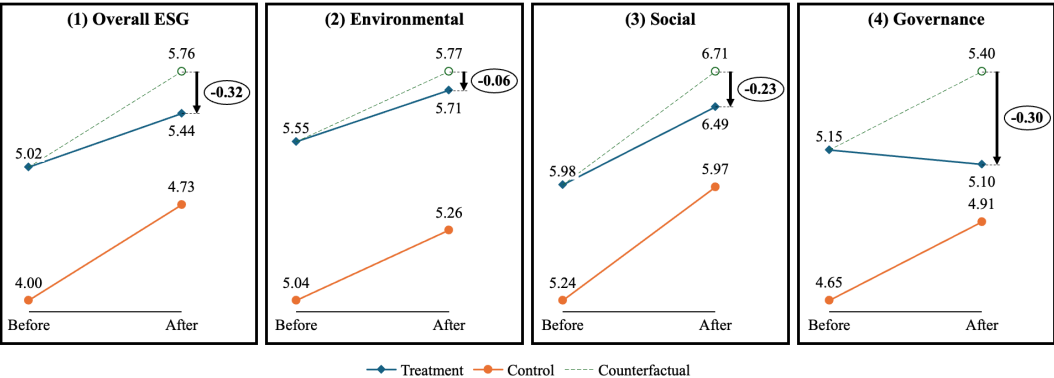


Figure 6 - Slope Graph for Baseline Models

In terms of model fit, the R-squared value measures the proportion of variance in the dependent variable that is explained by the independent variables in the model (Chicco, Warrens and Jurman 2021). For Model 1, the R-squared value of 0.1423 indicates that approximately 14.23% of the variation in ESG scores is accounted for by the independent variables included in the baseline model. This represents a modest level of explanatory power, which is expected given the complexity of factors influencing ESG performance. For the models analyzing the individual ESG pillars, the explanatory power is notably lower, with R-squared values of 1.51% for Model 2 (environmental pillar), 9.91% for Model 3 (social pillar), and 2.25% for Model 4 (governance pillar). The overall fit of the baseline models suggests that while the included predictors capture some meaningful relationships, there is room to include additional variables to enhance their explanatory power.

The final aspect to consider when analyzing the results of Table 5 is the statistical significance of the findings. Using an  $\alpha$  of 0.05 as the threshold, it becomes evident that all but one finding

are statistically significant. This implies that, for the majority of the results, there is sufficient evidence to reject the null hypothesis, suggesting that the observed effects are unlikely to be due to random variation. Therefore, the statistical significance of the interaction terms of Model 1, Model 3, and Model 4 reinforces the preliminary conclusions drawn in Sections 4.1 and 4.2. These findings provide empirical evidence that the implementation of the CSRD had a measurable dampening impact on the overall ESG performance, as well as on the social and governance dimensions, of EU-based firms. Specifically, for governance, the CSRD even had a negative impact on the performance independently of US-based firms, yielding a lower average score than before the implementation. This is reflected in the larger negative interaction coefficient (-0.30) relative to the period coefficient (0.26) in Model 4, as well as the negative trend illustrated in Figure 6. Analyzing Model 2, it is evident that the p-value of the interaction terms exceeds  $\alpha$ , indicating that statistical significance cannot be ensured. Practically, this indicates that the data does not provide sufficient evidence to support that there is a significant difference in the change of environmental scores between the EU- and US-based firms over time. Interpreting this finding, it shows that the CSRD did not have a measurable impact on environmental scores for EU-based firms, compared to the control group, indicating that both groups experienced similar changes throughout the period of observation.

#### **4.3.1 – Synthesis of Findings**

Combining the insights gained above, it is possible to derive initial evidence-based conclusions on hypothesis *H1* and its sub-specifications. Referring to hypothesis *H1*, the results of the baseline model empirically reinforce the conclusions drawn from the model-free DiD, indicating a deviation from the expected outcomes. Specifically, contrary to the hypothesis, the data provides sufficient evidence to support that the implementation of the CSRD is associated with a decline in overall ESG performance for EU-based firms relative to US-based firms. A similar conclusion can be drawn for hypothesis *H1b*, as, contrary to the expectations, the

negative and significant coefficients of the interaction terms imply that the enactment of the CSRD negatively impacted the social ratings of EU-based firms compared to their counterparts. For hypothesis H1c, an even more extreme conclusion can be drawn, revealing that the CSRD negatively impacted the governance ratings of EU-based firms, even when considered independently of the US-based firms. This finding also significantly deviates from the expectations formulated under hypothesis *H1c*. Considering hypotheses *H1a*, the findings of the baseline regression contradict the conclusions derived from the model-free DiD. The statistical insignificance of the interaction terms suggests that, contrary to previous conclusions, the implementation of the CSRD did not have a meaningful impact on the environmental ratings of treated firms. Nevertheless, this finding also deviates from the expected outcome of H1a.

#### **4.4 – Extended Model**

Although the findings of Section 4.3 provide initial empirical insights, the rather moderate explanatory power of the models emphasizes that they can be enhanced by adopting further predictor variables. This section will enrich Models 1-4 by including the control variables depicted in Section 3.3.3. Given the special relationship between industry affiliation and ESG ratings, due to the materiality and weightings, this control variable will be added individually in Section 4.4.2.

##### **4.4.1 – Control Variables (excluding Industry)**

The baseline models have been enhanced by incorporating additional predictor variables, including size, age, financial leverage, and profitability. Table 6 reflects the results of the regressions of Models 5-8.

Table 6 - Results for Extended DiD Models 5 - 8

Variables	Extended Model (1)			
	Overall	Environmental	Social	Governance
	Model 5	Model 6	Model 7	Model 8
Constant	2.03437 ***	2.91246 ***	5.49011 ***	4.09004 ***
Treatment	0.95881 ***	0.48362 ***	0.73079 ***	0.47326 ***
Period	0.67175 ***	0.20734 **	0.71471 ***	0.23820 ***
Ln(Total Assets)	0.18134 ***	0.27539 ***	-0.04892 ***	0.03348 ***
Ln(Age)	0.13759 ***	-0.12200 ***	0.07928 ***	0.08206 ***
Leverage	-0.00048	0.00073	-0.00223 **	0.00040
Ln(ROA)	0.10194 ***	-0.65566 ***	0.29820 ***	0.03657
Industry	No	No	No	No
Treatment : Period	-0.30697 ***	-0.06512	-0.21900 **	-0.29995 ***
R-Squared	0.2005	0.1126	0.1309	0.0271
Adjusted R-Squared	0.1995	0.1115	0.1298	0.0259
Observations	5706			
# of Firms	951			

Note: \*p < 0.1, \*\*p < 0.05, \*\*\*p < 0.01.

The interpretation of the constant, treatment, period, and interaction term coefficients remains identical to the description in Section 4.3, serving as determinants to whether an observation reflects an EU- or US-based firm and whether this observation is before or after the intervention. For the new control variables, two possible interpretations apply depending on the nature of the predictor variable. For un-transformed predictors, which in this model is only financial leverage, the coefficient represents the average change in ESG rating due to a one-point increase in the variable. Hence, considering Model 7, a one-point increase in financial leverage would reduce the ESG rating of a firm in the US before the enactment of the CSRD by, on average, 0.002 to 5.488, given that all other variables remain constant. On the other hand, the interpretation of log-transformed variables differs slightly. Taking the profitability in Model 5 as an example, a 1% increase in ROA is associated with an increase in ESG rating of, on average, 0.102, keeping all other variables constant.

Investigating the relative R-squared values of each model, it is clear that the inclusion of the additional predictor variables further enhances their explanatory power. However, given the increased number of variables, it is more appropriate to focus on the adjusted R-squared, as this metric not only reflects the goodness-of-fit of a model but also adjusts for the potential of overfitting (Field 2018). For the overall ESG rating, the increase in adjusted R-squared, from

14.19% to 19.95%, implies that the addition of the predictor variables improved the model's explanatory power by over 5%. This also indicates that the extended model better captures the variation in the overall ESG rating than the baseline model. A similar conclusion holds when considering the environmental and social models, for which the inclusion of the predictor variables improved their explanatory power by approximately 10% and 3%, respectively. For the governance model, the adjusted R-squared only improved by 0.39% from Model 4 to Model 8, indicating that, in the governance dimension, the added control variables did not meaningfully improve the already low explanatory power.

Upon closer examination of the results in Table 6, it becomes evident that the control variables representing a firm's size and age are both statistically and economically significant across all models. Not only are the p-values of their coefficients well below the  $\alpha$  threshold, but the effect sizes are also meaningful, indicating that these variables play a significant role in explaining the variation in the dependent variable. Although insignificant for Model 8, a similar conclusion can be drawn for firm profitability as a control variable. Hence, even though the control variables are not the main focus of this analysis, their significance indicates that they play a meaningful role in the overall relationship between sustainability reporting and ESG performance. In contrast, financial leverage does not appear to provide such a contribution, as evidenced by its statistical insignificance in most models and the negligible economic impact across all specifications.

Lastly, the focus is placed, once again, on the interaction terms of Models 4-8. The results demonstrate that by incorporating the additional predictor variables, the precision of the estimated effects was enhanced. For instance, this is evident in the refinement of the coefficient for the interaction term in the overall ESG model, which shifted from -0.32 to -0.31. Although subtle, this improvement highlights the importance of including relevant control variables to

achieve more accurate estimates and robust conclusions. In terms of statistical significance, the inclusion of additional predictor variables did not meaningfully alter the p-values in any of the models, highlighting the robustness of the findings. Hence, given that both the significance and the direction of the interaction terms remained stable, the conclusions drawn in Section 4.3 hold and are reinforced.

**4.4.2 – Control Variables (including Industry)**

Further enhancing the extended model, the final control variable is introduced in this section.

Table 7 reflects how the introduction of industry affiliation impacts the previous results.

*Table 7 - Results for Extended DiD Models 9 - 12*

<b>Variables</b>	<b>Extended Model (2)</b>			
	<i>Overall</i>	<i>Environmental</i>	<i>Social</i>	<i>Governance</i>
	<i>Model 9</i>	<i>Model 10</i>	<i>Model 11</i>	<i>Model 12</i>
<i>Constant</i>	1.90264 ***	4.88516 ***	5.75374 ***	4.31961 ***
<i>Treatment</i>	0.93006 ***	0.66685 ***	0.66253 ***	0.34535 ***
<i>Period</i>	0.66888 ***	0.12880 *	0.73008 ***	0.23984 ***
<i>Ln(Total Assets)</i>	0.20730 ***	0.37382 ***	-0.04681 ***	0.04588 ***
<i>Ln(Age)</i>	0.08253 ***	0.07533 ***	0.01274	0.02835
<i>Leverage</i>	-0.00044	0.00077	-0.00263 **	0.00124
<i>Ln(ROA)</i>	0.13814 ***	-0.08011 **	0.14172 ***	0.05564
<i>Industry</i>	Yes	Yes	Yes	Yes
<i>Treatment : Period</i>	-0.30494 ***	-0.04142	-0.22378 **	-0.29941 ***
<i>R-Squared</i>	0.3033	0.5008	0.2589	0.2289
<i>Adjusted R-Squared</i>	0.2903	0.4915	0.2450	0.2145
<i>Observations</i>	5706			
<i># of Firms</i>	951			

Note: \*p < 0.1, \*\*p < 0.05, \*\*\*p < 0.01.

The interpretation of the results in Table 7 differs slightly from the approach used in previous sections. In earlier analyses, the constant variable represented the average rating for US-based firms across all industries before the enactment of the CSRD. In this section, however, the constant variable represents the average rating for US-based firms before the intervention in a specific reference industry. For instance, in Model 9, the reference industry is advertising/marketing services. Hence, the coefficient of the constant indicates that the average overall ESG rating for a US-based firm in the advertising/marketing services industry before the implementation of the CSRD is 1.90. The interpretations for the remaining control variables

remain identical to before, with the exception that the interpretations are only drawn for the reference industry.

Looking into the adjusted R-squared values, it is evident that the inclusion of industry as a control variable significantly increased the explanatory power of the models. Figure 7 illustrates the R-squared values of each model, providing

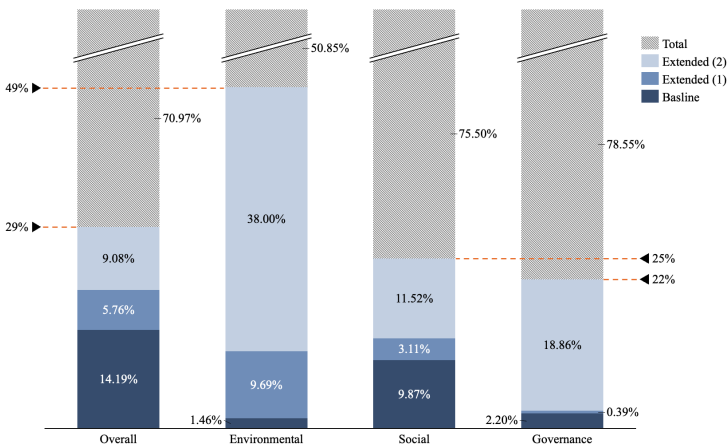


Figure 7 - Adjusted R-squared per Pillar and per Model

insight into how each specification impacted the overall fit of the models. The figure portrays that, apart from the overall pillar, the addition of industry as a control variable added the most explanatory power to the models. Specifically, due to the inclusion of the extended model, the environmental pillar now accounts for over 49% of the variation in the dependent variable, showcasing a considerable improvement in model precision. Across all models, the substantial improvement in overall fit not only enhances the robustness and reliability of the findings but also emphasizes the importance of accounting for industry affiliation. This inclusion highlights the variability in ESG performance across industries and demonstrates the importance of tailoring models to reflect these sectoral differences, ensuring more accurate estimates.

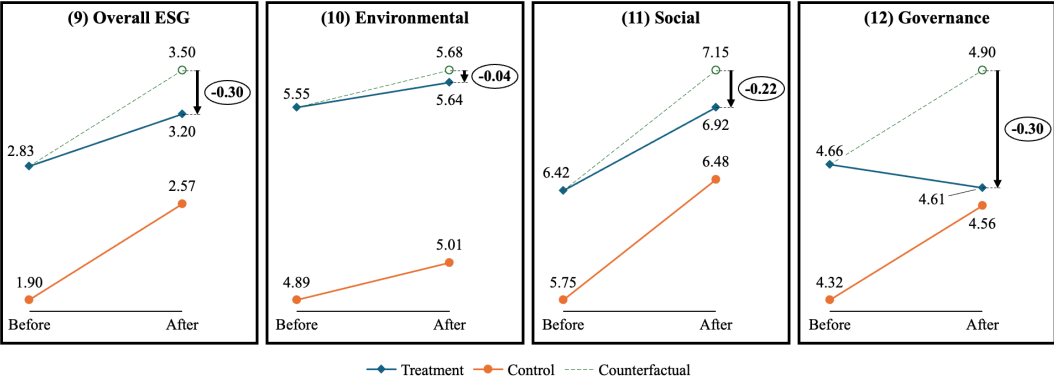


Figure 8 - Slope Graph for Extended Models

Analyzing the slope plot in Figure 8 and comparing it to Figure 6, it is evident that the addition of industry affiliation further refined the precision of estimates of the interaction terms and their associated significance. However, as for Section 4.4.1, the refinement did not alter the direction of the coefficients, nor did it substantially impact their levels of significance. Consequently, the conclusions drawn in Section 4.3 regarding the interaction terms remain valid for Models 9-12.

#### **4.4.3 – Synthesis of Findings**

By incorporating the additional predictor variables, the study aimed to provide a more comprehensive understanding of the drivers behind ESG scores and to improve the precision of the estimated effects of the baseline model. While the refinements strengthen the robustness of the findings, the conclusions of the previous sections highlight no specific evidence to believe that the addition of the control variables altered the deductions made on the hypotheses. Hence, the following final inferences can be made.

For hypothesis *H1*, the extended models support the baseline model assumption that, contrary to the expectations, the CSRD has negatively impacted EU-based firms in their overall ESG performance relative to their US-based counterparts. The findings for sub-hypotheses *H1b* and *c* align with this conclusion, indicating that the extended models further reinforce the findings that the CSRD negatively impacted the social and governance ratings of treated firms compared to the control group. Lastly, the analysis of the extended model also fails to provide sufficient evidence of a statistically significant relationship between the sustainability directive and environmental ratings for treated firms. Hence, the findings diverge from the expectations outlined in hypothesis *H1a*. In conclusion, it is evident that the outcomes of the conducted investigation for hypothesis *H1* and its sub-hypotheses deviate significantly from the expectations highlighted in Section 2.3.2. As these unexpected results may stem from a variety of factors, the discussion will aim to shed light on potential explanations for these findings.

## 4.5 – Moderation Model

The following section will focus on investigating whether the conclusions drawn in the previous paragraphs are moderated by a firm’s investment in R&D, captured by R&D intensity. Table 8 summarizes the findings of the moderation model depicted by Equation 6.

Table 8 - Results for Moderation DiD Model 13

Variables	Moderation Model
	Overall Model 13
Constant	1.85275 ***
Treatment	0.95223 ***
Period	0.71649 ***
Ln(Total Assets)	0.21085 ***
Ln(Age)	0.08381 ***
Leverage	-0.00046
Ln(ROA)	0.14687 ***
Industry	Yes
R&D Intensity	0.48486
<b>Treatment : Period</b>	<b>-0.34813 ***</b>
Treatment : R&D Intensity	-0.41803
Period : R&D Intensity	-0.84546
<b>Treatment : Period : R&amp;D Intensity</b>	<b>0.66701</b>
R-Squared	0.3037
Adjusted R-Squared	0.2901
Observations	5706
# of Firms	951

Note: \*p < 0.1, \*\*p < 0.05, \*\*\*p < 0.01.

To complement the findings presented in Table 8, Figure 9 has been created to provide a visual representation of the regression results. The bars represent the regression coefficients, while the error bars illustrate the 95% confidence intervals. Importantly, if the confidence interval crosses zero, the corresponding coefficient is considered statistically insignificant. This is visually highlighted by the red error bars, whilst green error bars indicate statistical significance.

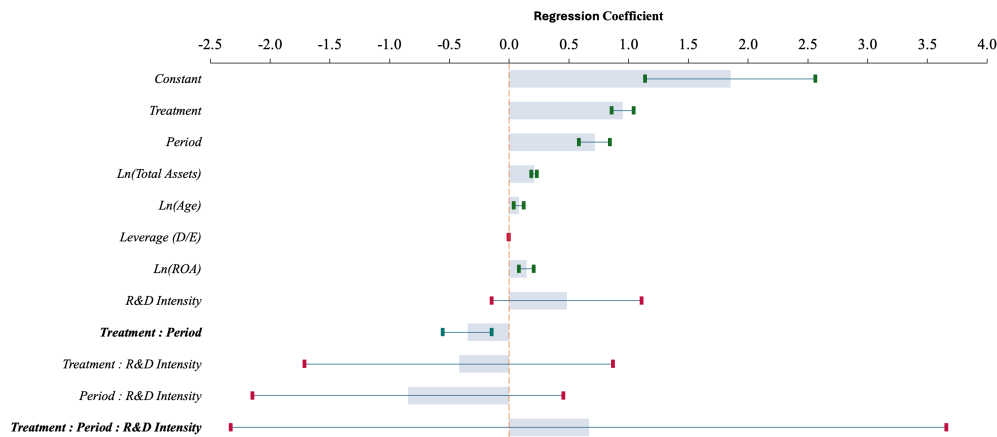


Figure 9 - Coefficient Plot with Significance for Moderation Model

Analyzing the findings in Table 8 and Figure 9, it is evident that the variables carried over from Model 9 exhibit only slight refinements in their coefficients and associated significance levels. This consistency demonstrates that the inclusion of R&D intensity in the model reinforces the robustness and reliability of the findings, highlighting the stability of the core relationships identified in the earlier specifications. This finding is specifically applicable to the interaction term, which consistently remains negative and significant, further emphasizing the finding that the CSRD's implementation has a dampening effect on ESG performance for treated firms compared to their US counterparts.

Focusing on R&D intensity and its role as a moderator, the findings reveal that R&D intensity does not significantly influence the relationship between CSRD implementation and ESG performance. The direct effect of R&D intensity is insignificant, indicating that higher R&D spending alone does not translate into improved ESG scores. Additionally, none of the interaction terms involving R&D intensity – whether with treatment, period, or both – are statistically significant, suggesting that R&D intensity does not moderate the impact of the CSRD on ESG performance. Moreover, the adjusted R-squared of 29.01% demonstrates that while the model achieves a moderate level of explanatory power, the inclusion of R&D intensity does not enhance the model's fit. This suggests that R&D intensity is not a key factor influencing ESG performance in this dataset and context.

Relating to hypothesis *H2*, the expected outcome was that R&D investments would positively moderate the relationship between CSRD implementation and ESG performance. However, contrary to this expectation, the findings indicate that there is not sufficient evidence to support this hypothesis. Hence, the findings suggest that within the scope of this investigation, R&D investment does not play a significant moderating role in the relationship between CSRD implementation and ESG performance.

## **5 – Discussion**

Circling back to the initial research question, the aim of this investigation was to identify to what extent the introduction of the CSRD impacts firms' corporate sustainability performance and how this relationship is moderated by R&D investment. Focusing on the direct effect, the findings suggest that, to a certain extent, the implementation of the CSRD had a significant impact on corporate sustainability performance. Specifically, the directive dampened the overall ESG performance of EU-based firms relative to their US counterparts, with the most meaningful effects observed in the social and governance dimensions. However, the extent of this impact is limited by the finding that environmental performance remained unaffected by the directive's implementation, suggesting a varied influence across the ESG pillars. Regarding the moderation effect, the findings reveal that R&D investment does not significantly impact or moderate the relationship between the CSRD and overall ESG performance.

Given that these findings significantly deviate from the expectations, the following section will explore possible explanations for the unexpected results, distinguishing between the direct and moderation effects. To conclude, policy and business implications will be drawn and the limitations of the paper will be acknowledged, yielding potential routes for future research.

### **5.1 – Direct Effect**

Contrary to hypothesis *H1a*, the findings did not provide sufficient evidence to conclude that the CSRD had a significant impact on the environmental ratings of EU-based firms. One potential explanation for this conclusion could lie in the time factor. While the stringency of environmental policies in the EU already exhausted easy, short-term environmental initiatives among firms, the long-term practices are not yet captured in the environmental ratings (Rahko 2023; Zhang, et al. 2024). Hence, neither an improvement nor a decline in ESG performance was induced by the directive. Relating to hypotheses *H1b* and *H1c*, Eklund (2021) provides insight from an interesting perspective. She concludes that a key takeaway of the COVID-19

pandemic for businesses was the importance of collectivism, indicating that firms should “shift their focus from the shareholder to the stakeholder approach” (Eklund 2021, 7). According to Husted and Sousa-Filhi (2017), in such a shift, social and governance themes are improved, which in turn results in increased ratings. As EU-based firms, however, tend to be more stakeholder-oriented by nature, the post-crisis shift in social and governance themes may not have been as evident, leading to less pronounced improvements (Jurgens, et al. 2010). Hence, this dynamic may have confounded the investigated relationship between the CSRD and corporate sustainability performance, thereby yielding the unexpected results.

Given that the overall ESG rating is a weighted average of the individual pillars, the factors discussed above may likewise explain the deviation of the findings from hypothesis *H1* and vice versa. In addition to the pillar-specific factors, more general explanations may also apply. Firstly, in light of the increased transparency mandated by the CSRD, EU firms might have already disclosed more detailed and potentially unfavorable information about their ESG practices. This greater level of detail could contrast with US-based firms, which have more flexibility to disclose selectively, leading to comparatively greater improvements in average ratings for US-based firms (Hummel and Jobst 2024).

Secondly, a further explanation for the unexpected results could lie in the ranking of the firms before the intervention. While, on average, EU-based firms were already ranked “A” since 2020, US-based firms were only able to reach the average ranking of “BBB” by 2021 (Figure 5a). Given this laggardness, US-based firms had more opportunity and incentive to capture low-hanging fruits and engage in easy sustainability initiatives to improve their ratings in the intervention period compared to EU-based firms. Hence, this could further explain the greater increase in ESG ratings for US-based firms compared to EU-based firms, elucidating the negative treatment effects derived.

In addition, collecting data and preparing a report of the scale required by the CSRD is both time- and resource-intensive (Setyaningsih, Widjojo and Kelle 2023). Therefore, the substantial effort and resources allocated to developing the sustainability report may divert attention and investment away from implementing actual ESG initiatives, thereby potentially explaining the dampened sustainability performance observed among EU-based firms compared to their US-based counterparts, which are not subject to the same reporting burdens (Setyaningsih, Widjojo and Kelle 2023).

Moreover, Daugaard and Ding (2022) provide an additional lens, highlighting socially responsible investment companies as drivers of ESG performance. BlackRock, a US-based asset manager, demonstrated this influence in early 2020 when it announced its divestment from thermal coal mining companies due to their poor sustainability profiles. This announcement led to a significant decrease in the share prices of firms in this industry (Bassen, Kaspereit and Buchholz 2021). In 2022, BlackRock intensified its intentions, requesting their investees to “demonstrate how they are going to deliver on their responsibility to shareholders, including through sound environmental, social, and governance practices and policies” (Fink 2022). In light of the impact that BlackRock had on the coal mining industry, investees may have felt incentivized to significantly improve their ESG performance, aiming not to be divested (Pawliczek, Skinner and Wellman 2021). Given that the vast majority of BlackRock’s investees are US-based, a greater responsiveness in ESG ratings may be assumed (Statista 2023). Hence, especially when considering the timing of the announcement, the induced market forces by BlackRock may have impaired the relationship under investigation, providing a further possible explanation for the unexpected negative effects.

Lastly, a potential explanation for the discrepancies that applies to all conclusions may stem from the rating framework. As explained in Section 3.3.1, the ESG rating is highly dependent on the materiality of specific KIs. Hence, if the materiality or weightings of specific KIs

changed simultaneously to the introduction of the CSRD and with metrics more in favor of US-based firms, this could also explain their relatively higher performance. This possibility is especially relevant given Berg, Kölbel and Rigobon's (2022) research, in which they find that among the six largest rating agencies, the highest level of agreement with each other lies at a correlation of 0.71, with the average residing around 0.54. The discrepancy in ratings indicates the fluctuation of materiality across agencies and time, highlighting it as an additional potential explanation for the unexpected findings.

## **5.2 – Moderation Effect**

Contrary to hypothesis *H2*, the findings of this paper were not able to support R&D investments as a significant moderator in the relationship between CSRD and ESG performance. A first potential explanation may lie in the time lag of R&D outcomes. Whilst Paula and Silva (2018) indicate that a two-year lag is not sufficient to observe the positive effects of R&D investments on firm performance, a similar conclusion may be translated to ESG performance. This perspective is supported by Alam, et al. (2019, 409), who demonstrate that “investment in R&D requires time to influence the firm environmental performance”. Hence, given that this investigation only accounts for one year after the implementation of the CSRD, potential moderation effects may not yet be captured.

Another explanation may lie in the misalignment between R&D investments and the materiality of ESG ratings. While R&D investments are typically focused on product innovation, process efficiency, or technological advancements, these priorities may not directly align with ESG-specific criteria outlined by rating agencies, such as improving governance practices or reducing carbon emissions (Zaman and Tanewski 2024; MSCI 2024). Therefore, investments in R&D may not reflect significantly on ESG performance, indicating that no moderation role can be observed.

Moreover, Ramadhan, Mulyany and Mutia (2023) find that there is no significant relationship between R&D intensity and ESG disclosure, suggesting that higher R&D investments do not necessarily translate into improved transparency or reporting on sustainability practices. Hence, this lack of a direct relationship may further clarify the absence of any moderating role of R&D intensity in this study.

Finally, the narrow variation in R&D intensity, as demonstrated in Table 3, suggests limited differences in R&D intensity across firms, reducing its ability to explain variability in ESG performance. If most firms invest similarly in R&D, its moderating potential is unlikely to emerge, as evident in this paper.

### **5.3 – Policy and Business Implications**

The findings of this paper provide several implications for policymakers and managers. First and foremost, for European policymakers, the paper highlights that the ambition of leveraging a reporting directive as a catalyst to drive sustainable corporate practices and accelerate the transition to an environmentally friendly, socially inclusive, and equitable economy was not successful. Instead, the implementation of the CSRD appears to have dampened the sustainability performance of EU-based firms relative to their US counterparts. While environmental performance remained unimpacted by the directive, it led to significant drops in the social and governance dimensions of ESG ratings for EU-based firms. This indicates that the directive, rather than fostering sustainable advancements, may have unintentionally constrained the ability of EU-based firms to improve their ESG performance relative to the US-based firms. This suggests a need to refine or supplement the directive to ensure it also encourages measurable improvements rather than simply imposing strict compliance requirements. Such modifications could include providing clearer guidance on how firms can align their strategies with sustainability objectives, offering financial incentives or support for sustainability initiatives, or fostering knowledge-sharing platforms between firms, industries,

and academia. By shifting from a compliance-driven approach to a more collaborative and goal-oriented framework, the CSRD could not only standardize reporting practices but also drive improvements in corporate sustainability performance, ultimately making the directive less of a burden to firms and more of a competitive advantage (Porter and Kramer 2011; Birkmann, et al. 2024). In addition, the findings could also indicate to policymakers that firms may be overwhelmed by the extensive reporting requirements, limiting their ability to implement meaningful sustainability initiatives alongside compliance efforts. This highlights the need for a more flexible approach to the CSRD, allowing reporting standards to adapt to the varying needs and capacities of firms, whilst also being implemented in a more gradual and timely manner. This implication is especially relevant for the upcoming phases of the CSRD's iterative rollout, given that firms with far fewer resources, such as SMEs, will also be subject to the directive.

For policymakers outside of the EU, the findings of this paper also yield valuable insights. For example, the findings imply that policymakers aiming to develop a similar sustainability reporting directive are encouraged to make use of co-creation opportunities in the development phase of the regulation. By doing so, policymakers can better align regulatory expectations with firms' operational realities, yielding more reasonable and effective outcomes that do not impair ongoing sustainability initiatives (Matti, et al. 2022). In addition, the negative impact of the directive on ESG performance implies that policymakers should adopt a pilot-and-refine approach, allowing for the flexibility to adjust frameworks based on initial results and stakeholder feedback. Thereby, unintended impacts can be reverted, and effectiveness ensured. A final call to policymakers globally would be to emphasize the importance of a harmonized approach. This stems from the rationale that the enactment of the CSRD significantly dampened the ESG performance of firms, indicating the influence that regulatory frameworks can have on corporate sustainability practices. Hence, without global alignment, such directives risk

creating fragmented standards that increase complexity for multinational firms and further draw away attention from sustainability initiatives.

Apart from implications for policymakers, the findings of this paper also add valuable insights for managers. Firstly, the results highlight that companies cannot simply rely on policy implementations, such as the CSRD, to drive improvements in their sustainability performance. Instead, firms need to go beyond meeting regulatory requirements by embedding sustainability into decision-making processes and actively pursuing ESG-related initiatives. Furthermore, the insignificance of R&D intensity as a moderator provides a key lesson for managers, indicating that for it to yield meaningful ESG improvements, R&D investments must be strategically aligned to sustainability goals. Additionally, establishing knowledge-sharing platforms with intra- and inter-industry peers, regulatory bodies, and academia may enable companies to exchange best practices, share innovative approaches to ESG challenges, and learn from one another's experiences in managing complex regulatory frameworks like the CSRD (Evans, Miklosik and Du 2023; Ankrah and Al-Tabbaa 2015). This collaborative approach not only strengthens individual firms but also accelerates the transition to a more sustainable and resilient economy, helping to achieve the ultimate goal of sustainability regulations.

Lastly, the paper is also insightful for academia, as it is among the first to empirically evaluate the CSRD and its impact on corporate sustainability performance. The results challenge assumptions of prior reporting directives by revealing a negative impact of the directive on ESG performance for subject firms relative to their unaffected counterparts. Furthermore, the disaggregated analysis of the ESG dimensions provides deeper insights into the role of regulation in shaping sustainability outcomes. These contributions not only enhance the scarce theoretical understanding of CSRD but also provide a foundation for future research to expand upon.

## **5.4 – Limitations & Future Research**

Despite this research's contributions to the understanding of the CSRD and its impact on corporate sustainability performance, several limitations should be acknowledged to provide a balanced interpretation of the presented findings. Addressing these limitations opens opportunities for refinements and promising paths for future research to further advance the understanding in the emerging field of sustainability reporting.

Firstly, whilst FactSet was deliberately selected as the sole database to ensure consistency in data collection and minimal data deviation, it is important to acknowledge that this approach also comes with limitations. FactSet alone may not capture the full spectrum of relevant firms or may have biases in the type of firms tracked, limiting the representativeness of the sample and the generalizability of results. Future research is therefore encouraged to explore the potential of a multi-database approach.

Moreover, the analysis is also restricted to firms that are listed within the FactSet database and provide seamless data coverage for the selected period. As these criteria apply predominantly to large firms, the generalizability of the findings is restricted. Hence, future research could extend the conclusions drawn from this paper by investigating the impact that CSRD had on firms in step three of the EU's CSRD rollout plan (Section 3.2), thereby offering a broader view of the directive's effects across company sizes and structures.

A further constraint of this research is the inconsistency in the ESG rating framework adopted by MSCI, as highlighted in Section 3.3.1. The varying selection of KIs across time and industry may lead to measurement discrepancies over the years, potentially affecting interpretations and restricting the robustness of the findings. Future research may explore this field by adopting a multi-agency approach, using standardized KIs, or making industry-specific adjustments, as proposed by Bissoondoyal-Bheenick, et al. (2024).

Acknowledging that sustainability initiatives require time to be fully implemented, a further aspect to consider is that the observation period selected for this investigation may be too narrow to capture the comprehensive impact of the CSRD. Hence, future research could benefit from expanding the observation period to capture the long-term effects of the CSRD on corporate sustainability performance and assess how the directive influences ESG ratings beyond the initial implementation phase, exploring whether the impact concluded in this paper holds as firms fully align with the reporting requirements.

As a final note, future researchers could significantly enhance the understanding of this field through qualitative research. Such insights could contextualize the quantitative findings of this paper, specifically shedding light on the current pain points and complexities firms encounter under the CSRD. In turn, this would offer a richer, more holistic perspective on the role of regulation in advancing corporate sustainability performance.

## 6 – Conclusion

Previous literature has proven that sustainability reporting directives, such as the NFRD, have positively impacted the corporate sustainability performance of subject firms. This paper investigated whether a similar effect is observable for the newly enacted and more comprehensive CSRD and how this relationship might be moderated by a firm's R&D intensity. The investigation was built on a DiD research approach, which evaluates how the ESG performance of EU-based firms changed throughout the observation period from 2018 to 2023 and how this performance compares to US-based firms that were not subject to the reporting directive.

This paper contributes to existing research by being among the first to provide an empirical evaluation of the CSRD and its impact on corporate sustainability performance. The findings can be split into five main pillars. Firstly, contrary to hypothesis *H1*, the results indicate that the CSRD had a significant negative impact on the overall ESG performance of EU-based firms compared to their US-based counterparts. This unexpected outcome may be attributed to several factors, such as the directive's stringent transparency requirements, the pre-existing ESG strength of EU firms, and market dynamics potentially favoring ESG advancements in US firms. Secondly, the findings indicate that the CSRD had no significant impact on the firm's environmental performance (*H1a*), potentially due to the maturity of environmental policies in the EU and the inability to capture long-term practices within the study's timeframe. Thirdly, the results demonstrate that the directive dampened the social performance of EU-based firms compared to US-based ones (*H1b*), possibly because EU firms already possess strong stakeholder-oriented approaches, leaving less room for observable improvement post-CSRD. Fourthly, governance ratings were also negatively impacted (*H1c*), which may similarly stem from a pre-existing solid governance foundation limiting further progress. Lastly, the study found no evidence to support R&D intensity as a significant moderator (*H2*), potentially due to

time lags in R&D outcomes, misalignment with ESG criteria, and limited variation in R&D investments across firms.

The findings present valuable insights to a variety of stakeholders of the CSRD. For EU policymakers, the results shed light on how firms respond to a strict sustainability reporting directive, offering guidance on potential refinements, such as adapting more flexibility for the upcoming iterations of the rollout. For non-EU policymakers, the results emphasize the importance of co-creating regulatory frameworks with stakeholders and implementing pilot phases to adjust policies based on observed outcomes and feedback. Lastly, managers are reminded that compliance alone is insufficient to drive ESG improvements, indicating that instead, firms must integrate sustainability into decision-making and align R&D efforts with ESG goals.

Finally, the paper acknowledges some limitations in data sources, sample representativeness, and ESG rating consistency, which may affect generalizability and robustness. Future research could address these limitations by adopting multi-database and multi-agency approaches, extending the observation period, and exploring qualitative insights to deepen the understanding of the role of regulation in advancing corporate sustainability performance.

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# 8 – Appendices

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### Appendix C: Differences between NFRD and CSRD

	NFRD	CSRD
<b>Scope and Coverage</b>	Large public entities	Large companies, small and medium businesses, Non-EU business with significant EU ties
<b>Reporting Standards and Frameworks</b>	No restriction on method of reporting	European Single Electronic Format (ESEF/iXBRL) with data tags
<b>Assurance and Audit Requirements</b>	Flexibility and non-binding guidelines	Independent audit to determine ESRS compliance
<b>Level of Detail in Disclosure</b>	Information on environmental and societal impacts	Information on a comprehensive list of general, environmental, societal and governance impacts according to the European Sustainability Reporting Standards (ESRS)

\*Information derived from (Russel, 2024; European Parliament, 2022)

### Appendix D: ESRS Requirements

Cross cutting standards	Environmental	Social	Governance
ESRS 1 - General requirements	E1 - Climate change (220 datapoints) E2 - Pollution (68 datapoints)	S1 - Own workforce (202 datapoints) S2 - Workers in the value chain (72 datapoints)	G1 - Business conduct (53 datapoints)
ESRS 2 - General disclosures (195 datapoints)	E3 - Water and marine resources (48 datapoints) E4 - Biodiversity and ecosystems (120 datapoints) E5 - Resource use and circular economy (84 datapoints)	S3 - Affected communities (71 datapoints) S4 - Consumer and end-users (70 datapoints)	

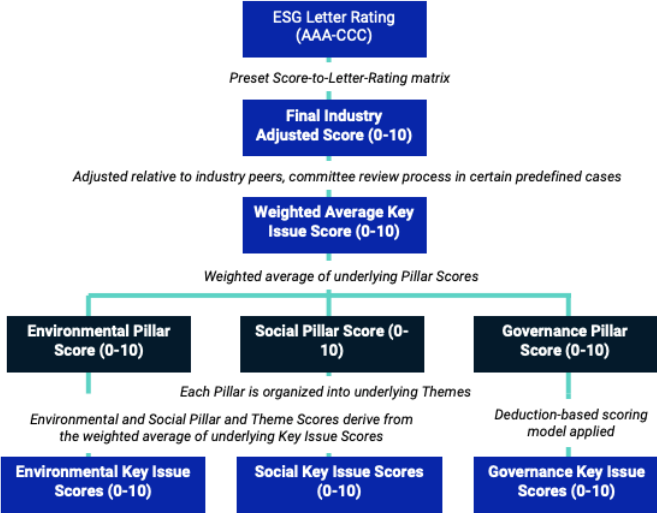
(EFRAG 2024)

### Appendix E: MSCI ESG Key Issues

3 Pillars	10 Themes	33 ESG Key Issues
Environment	Climate Change	Carbon Emissions
		Climate Change Vulnerability
		Financing Environmental Impact
		Product Carbon Footprint
	Natural Capital	Biodiversity & Land Use
		Raw Material Sourcing
		Water Stress
	Pollution & Waste	Electronic Waste
		Packaging Material & Waste
		Toxic Emissions & Waste
	Environmental Opportunities	Opportunities in Clean Tech
		Opportunities in Green Building
Opportunities in Renewable Energy		
Social	Human Capital	Health & Safety
		Human Capital Development
		Labor Management
		Supply Chain Labor Standards
	Product Liability	Chemical Safety
		Consumer Financial Protection
		Privacy & Data Security
		Product Safety & Quality
	Stakeholder Opposition	Responsible Investment
		Community Relations
	Social Opportunities	Controversial Sourcing
		Access to Finance
Access to Health Care		
Governance	Corporate Governance	Opportunities in Nutrition & Health
		Board
		Pay
		Ownership & Control
	Corporate Behavior	Accounting
		Business Ethics
		Tax Transparency

(MSCI 2024)

### Appendix F: MSCI ESG Rating Framework



(MSCI 2024)

## Appendix G: Interpretations of Coefficients for Moderation Model

- $\alpha_0$ : The intercept represents the baseline ESG performance when all independent variables are zero → Average ESG performance of US-based firms before CSRD
- $\alpha_1$ : The difference between US- and EU-based firms before the CSRD.
- $\alpha_2$ : The overall effect of the period on ESG performance.
- $\alpha_3$ : The DiD estimate showing the impact that the CSRD.
- $\alpha_4$ : The direct effect of R&D intensity on ESG performance.
- $\alpha_5$ : The interaction effect of R&D intensity and treatment, showing how R&D intensity influences ESG performance in EU-based firms.
- $\alpha_6$ : The interaction effect of R&D intensity and the period, showing how R&D intensity influences ESG performance over time.
- $\alpha_7$ : The triple interaction term, capturing how R&D intensity moderates the treatment effect over time (i.e., how the CSRD's impact on ESG performance depends on R&D intensity).
- $C_{it}$ : A vector of control variables (e.g., firm size, leverage, industry) that account for other factors influencing ESG performance
- $\epsilon_{it}$ : The error term, capturing unobserved factors affecting ESG performance.

# Appendix H: Linear Regression Assumptions

