Nijmegen School of Management
Department of Economics and Business Economics
Master's Thesis Economics (MAN-MTHEC)

The Moderating Effect of sustainability-linked CEO Compensation on the Relationship Between ESG Scores, Firm Performance.

By Fenne Rooijackers (s1072494)

Nijmegen, 30 June 2025

Generative AI tools (e.g., ChatGPT, Copilot) were used to assist in coding, data analysis, and/or refining the language of this thesis. Appendix A of this thesis provides a detailed account of the use of Generative AI tools during the development of this thesis. By submitting this thesis I declare that I am fully responsible for the accuracy and completeness of its content.

Table of Contents

Abstract

In recent years, Environmental, Social, and Governance (ESG) activities have become more common in business, aiming to build stakeholder trust and improve firm performance. One approach firms use is linking CEO compensation to sustainability goals, which may help improve ESG performance. However, it is still unclear whether this also improves financial performance. This study explores whether CEO compensation tied to sustainability influences the relationship between ESG performance (measured by ESG scores) and firm performance (measured by return on assets and return on equity). Because firm performance could also affect ESG scores, or both could be influenced by other factors, the study uses an instrumental variable (IV) regression method. Industry-average ESG scores and their interaction with CEO compensation are used as instruments to improve the reliability of the results. The findings show that while higher ESG scores do not always lead to better financial outcomes, firms with sustainability-linked CEO pay tend to perform better. Still, when ESG performance increases within those firms, it may reduce financial performance. This suggests that ESG goals need to be carefully aligned with business strategy to be financially effective.

1 Introduction

In the past decade the Environmental, Social and Governance (ESG) rating has attracted increased interest. It has become of high importance to the firm itself, their investors, and policymakers (Rau & Yu, 2023). As ESG issues such as carbon emissions, diversity and inclusion decisions and ethical conducts are pressuring firms more through regulatory and environment demands, firms need to act on these issues to remain competitive (Tarmuji et al., 2016). Companies can use ESG ratings to "outshine" their competitors for their market position, while also sustaining their business in the long run (Rath et al., 2020). A strategy for companies to increase their ESG performance, is to design executive compensation structures, which incorporates sustainability performance of the firm into the pay of executive personnel (Al-Shaer & Zaman, 2017). The question however remains whether this compensation structure imposes greater costs on the firm than the rewards it delivers them. Therefore, the question this study poses is: *"What is the effect of compensation linked to sustainability on the relationship between ESG performance and firm performance? "*

Despite the integration of ESG factors into financial decision-making since 1992 (Wang et al., 2023), most research has focused on the US and UK, with limited attention to Europe (Abu-Ali et al., 2024). Findings on the link between ESG performance and firm performance remain mixed; some report positive outcomes (Haque & Ntim, 2020; Tarmuji et al., 2016), while others report negative or insignificant relationships (Adu et al., 2022). Similarly, studies on CEO compensation linked to sustainability have largely explored its determinants rather than its moderating role (Winschel & Stawinoga, 2019). This study addresses these gaps by focusing on European firms and examining how CEO compensation linked to sustainability goals influences the ESG performance–firm performance relationship.

There is an increase in sustainability awareness among stakeholder groups of firms. For example, shareholders and investors can see ESG issues in firms as a concern which they should include in their risk management (Tarmuji et al., 2016). This results in pressures from these stakeholder groups to the firm. Firms also experience regulatory pressures from the government and policymakers, which have ensured that firms need to become more committed to goals

related to all three pillars of the ESG score (Popov & Makeeva, 2022). Consumers are becoming increasingly aware of the effect that their consumption has on the environment and are therefore becoming more careful in selecting the products they want to buy, and which company to buy them from (Buerke et al., 2016). These environmental pressures are influencing decision making processes of the firm (Popov & Makeeva, 2022).

Europe is leading the movement of investing in a sustainable future. Europe has some of the most detailed laws around ESG reporting and investing in the whole world, therefore gaining the nickname “ESG powerhouse” (Byrne, 2022). Through the Sustainable Finance Disclosure Regulation (SFDR), made official in 2021, the European Commission is trying to increase ESG transparency, making ESG performance information more accessible to the entire environment of the firm (Byrne, 2022).

These factors are all reasons for firms to manage their ESG score, as ignoring these interests of the diverse stakeholder groups could undermine their financial success (Rau & Yu, 2023).

A possible solution for managing the ESG score of the firm, could be through the impact their CEO has on the decision-making process, and therefore on decisions concerning ESG problems. To be sure that the CEO is willing to take the risks related to ESG decision-making, a company could offer the CEO compensation for these risks. This could make the CEO more willing to take on a long-term ESG view (Al-Shaer & Zaman, 2017).

1.1 ESG performance and firm performance

ESG scores can impact firm performance by for example creating cost efficient business processes (Kim & Li, 2021). The increase in firm performance can also be seen through investor behavior, as the increase in investor trust in the firm. Investors use ESG factors to consider the non-financial performance of companies. In a study by RBC Global Asset Management (2018) 72% of the respondents, who are active investors, in Europe stated that they incorporated ESG principles into their investment decision-making process. On the other hand, other stakeholders,

such as governments, customers and employees, are demanding more disclosure on corporate ESG information to increase their trust in the performance of the firm. This information is a measure for the sustainability of the firm (Wang et al., (2023). Therefore, transparent communication from the firm about their ESG performance can be important to increase stakeholder trust.

1.2 CEO compensation linked to ESG performance

The CEO is considered to be the most powerful person in a firm. They are the bridge between the firm and their stakeholders (Cai et al., 2011). CEOs are supposed to represent corporate social responsibility. This represents the efforts of the firm to create value for internal and external stakeholders. ESG disclosure is a measure for these activities. ESG disclosure can therefore be seen as a measure for management quality, from the perspective of the stakeholders (Rath et al., 2020). As ESG related activities are long-term strategies, they are perceived as risky by executive personnel. They are perceived as risky, as they need a lot of investments, while the benefits will only be seen after a longer amount of time. CEO compensation can be seen as a way to compensate the CEO for taking on these increased risks and therefore creating willingness to invest in long-term ESG activities (Al-Shaer & Zaman, 2017).

1.3 The European landscape

The European market is seen as a “single market” to increase the competitive edge of European companies against the other continents (Herranz-Surrallés et al., 2024). In this way, the European market became a developed market with strong political and legal systems. The importance of ESG disclosure has gradually reached governments. Therefore, regulations regarding ESG disclosure were developed (Shen, 2023). The Sustainable Finance Disclosure Regulation was introduced in 2021. This system was developed to create transparency in the EU taxonomy for the financing of sustainable activities (Cremasco & Boni, 2022). This framework, by enhancing sustainability transparency, prevents misleading ESG claims to relevant stakeholders. Therefore,

the market itself and regulations are already developed in the European market, pressuring the companies in the market to become more sustainable (Cremasco & Boni, 2022).

1.4 Structure

The structure of this thesis will be as follows: after this introduction, a review of the relevant literature will be discussed in chapter 2. Chapter 3 will describe the research methodology, discussing the variables. This is followed by the findings in chapter 4. The conclusion of the findings is discussed in chapter 5, which is followed by the discussion of the implications, limitations and further research in chapter 6.

2 Theoretical framework

2.1 ESG performance

As introduced in chapter 1, the abbreviation ESG stands for Environmental, Social and Governance. These are the three pillars, of which the ESG score is composed. The ESG score is used as a tool to evaluate the alignment of individual companies to the transition towards a sustainable economy. This ESG score is therefore a signal towards the ESG performance of a company. Companies which show higher ESG performance, and thus higher ESG scores, are said to better manage future non-financial risks and opportunities related to ESG activities (Duagaard & Ding, 2022). Thereby, the ESG score has become a key indicator for management competence, risk management and non-financial performance related to sustainability. As the ESG score captures environmental, social and governance risks, ESG performance captures a larger variety of non-financial indicators than for instance Corporate Social Responsibility (CSR) (Martiny et al., 2024). Therefore, there is increased interest in ESG performance from firms themselves, and related stakeholders' groups in the environment of the firm (Rau & Yu, 2023).

For ESG performance to become a quantitative measure, a rating agency first needs to set ESG indicators for each of the three pillars. These indicators then need to be measured from available

data to the rating agencies (Crace & Gehman, 2022). The next section will dive deeper into how this ESG score is developed. This is based on the method used by LSEG, as this score is used in the statistical model.

2.1.1 The ESG score

ESG scores are based on the three central pillars which present the commitment and effectiveness of a company towards sustainability. These three pillars are environment, social and governance. Within each of these three pillars, there is a whole list of factors which are not part of the traditional financial analysis of a company, but which do affect investor decision making (Duagaard & Ding, 2022). Nowadays we can observe three ESG scores (LSEG, 2024). First of all, we can observe the "normal" ESG score, which is the ESG of a company based on their self-published information on environmental, social and governance indicators. Secondly, we can observe the ESG controversy score. This score is based on media coverage on the activities of companies on the environmental, social and governance indicators. The ESG controversy score is corrected for companies' actions against these controversies and firm size. Lastly, we can observe the combined ESG score, which is the combination of the "normal" ESG score and the ESG controversy score, incorporating self-published information as well as press-based information. All three forms of the ESG score are presented as a score between 0 and 100. These scores can also be converted into an easier to understand letter grade These letter grades can be used in relation to the credit rating letter scores. In this research, the "normal" ESG score presented in the format of 0 to 100 will be used. LSEG (2024) uses a unique ESG magnitudes materiality weighting, which maps each ESG metric's materiality for each industry on a scale. This method therefore includes some industry relevant information into the score as well.

2.1.2 Environmental pillar

The environmental pillar holds 68 out of 186 indicators included in the ESG score. The environmental pillar is defined as the environmental matters that can positively or negatively impact the corporate performance of an entity (Li et al., 2021). This pillar reflects if companies

use the best environmentally sustainable methods in their production process (Chen et al., 2024). The categories integrated into the environmental pillar are resource use (including 20 out of 188 indicators), emissions (28 indicators) and innovation (20 indicators) (LSEG, 2024).

The resource use score of a company shows their performance and capacity to find more environmentally friendly solutions by improving their supply chain management. The emission score reflects the company's effectiveness in reducing emissions in its production and operational process. Lastly, the innovation score captures the companies' capability to create new market opportunities through technological or process related innovation, increasing their environmentally friendly performance (LSEG, 2024).

2.1.3 Social pillar

The social pillar is defined as the social matters that can positively or negatively impact the corporate performance of a firm (Li et al., 2021). The social pillar holds 62 out of 186 indicators included in the ESG score. This pillar reflects if the firm creates value for internal and external stakeholders, avoiding information asymmetry (Chen et al., 2024). The category scores for the social pillar includes the workforce score (30 indicators). This measures a company's effort and effectiveness in creating job satisfaction in a healthy and safe environment, while maintaining diversity and equality in their workforce. Companies are also scored on their respect of the fundamental human rights, which is captured in the human rights score (8 indicators). The next part of the social pillar score is the community score (14 indicators). This score measures the company's efforts to protect public health and to respect business ethics. Lastly, there is a score towards product responsibility (10 indicators), capturing the effectiveness of companies to produce qualitative good products and services, while also respecting customer's health, safety, integrity and data privacy (LSEG, 2024).

2.1.4 Governance pillar

The governance pillar is defined as the governance matters that can positively or negatively impact the corporate performance of a firm (Li et al., 2021). The governance pillar holds 56 out

of 186 indicators included in the ESG score. This pillar looks at the relationship between the company and their stakeholders, safeguarding their interests (Chen et al., 2024).

The governance pillar includes the management. A part of the management is the board of directors, who make the corporate strategy. They are responsible for controlling the actions of the management when implementing the strategy (Popov & Makeeva, 2022). The management score (35 indicators) therefore measures the company's commitment to using the best corporate governance practices. The shareholder score (12 indicators) measures the equality of treatment of shareholders and the use of anti-takeover defenses. The last score included in the governance pillar is the CSR strategy score (9 indicators). This score captures the company's practices to communicate their ESG dimension they integrate into their everyday decision-making processes (LSEG, 2024).

2.2 Effects of ESG performance on firm performance

ESG performance can affect certain aspects of a company. In this research, the connection of ESG performance to firm performance will be discussed. Firm performance are the operating benefits and operating performance of a company during a certain period of operations (Shen, 2023). The relationship between a company's ESG score, in this research used as the indicator for ESG performance, and their firm performance shows how the ESG performance of a company affects their operational efficiency through several mechanisms. That are mechanisms such as changes in cost efficiency, stakeholder trust, employee productivity and retention, competitiveness and risk reduction (Shen, 2023; Porter and Van Der Linde, 1995; Dhaliwal et al., 2012).

Committing to ESG activities means that firms need to invest in acting on their ESG issues. Therefore, a key question raised by the firm is whether or not these investments make financial sense (Aydogmus et al., 2022). Environmental management by a company can lead to increases in costs for these companies, but it will also lead to improvements in operating efficiency of enterprises. Thus, these activities can possibly carry more benefits than costs for a company

(Shen, 2023). Additionally, disclosure of ESG information can lead to cost reductions, as investment risks for investors are reduced (Shen, 2023).

Moreover, these social responsibilities which are being fulfilled for stakeholders of the company (e.g. shareholders, employees, customers, government etc.) can positively impact the competitiveness of these companies (Shen, 2023). As Porter and Van Der Linde (1995) stated in their earlier research; ESG practices should be seen as a strategy to increase the competitiveness of their companies. The demands of the environment are changing, and therefore the company needs to keep up with these changes, thus ESG practices, to remain competitive.

Managers have a growing awareness towards the different categories of stakeholders their company affects (Landi & Sciarelli, 2018). The disclosure of ESG information to all stakeholders can enhance transparency of information and thereby reduced information asymmetry. This in return improves the trust of stakeholders in the company (Shen, 2023). This reduction in information asymmetry can then be seen in the mistakes in analysts' forecasts, which are then lower. Analysts are better at predicting future firm performance, which in turn can also increase shareholder trust (Dhaliwal et al., 2012).

Nowadays, investors are getting a better understanding on "the climate risk is investment risk". An increase in investors that consider the ESG performance of a company when creating their portfolio can be seen (Martiny et al., 2024). In a survey conducted by Krueger et al. (2020) including institutional investors, they saw that these investors believed that climate risk can have financial implication for their portfolios. These investors say that climate risk is also becoming investment risk. ESG scores can have a huge impact on a certain group of "green" investors and shareholders. Due to the increased awareness of these sustainability practices, the ESG practices a company takes, forms the investment attractiveness of the company to the interested group of "green" investors (Popov & Makeeva, 2022). Graves and Waddock (1994) in their study showed that institutional investors prefer ESG promoting practices in firms, therefore choosing to invest in responsible firms. Institutional investors are considered to be stocks that are held by investment firms, funds or other large entities, instead of individual shareholders (Kenton 2021).

These investors are driving up the stock prices of sustainable responsible companies (Zhou et al., 2022). Furthermore, the ESG performance of a company attracts ESG investors, who are attracted by the signal the company portrays by having a good ESG score. This can be considered in the relationship between news on ESG activities and the reaction of shareholders, as shareholders react positively to ESG news that is financially material to the firm (SeraFeim & Yoon, 2022).

Good ESG performance can be crucial to avoid reputational damage towards society and important investors (Tarmuji et al., 2016). Reasonable ESG disclosure and performance make it more likely that a company will create and retain a better reputation, therefore reducing reputation risks (Shen, 2023).

Firms with higher ESG performance are expected to show higher firm performance, measured by Return on Assets (ROA) and Return on Equity (ROE). There are however mixed results found on this relationship. These results are summarized in table 1.

TABLE 1: SUMMARY ON RESULTS ON STUDIES RELATED TO ESG PERFORMANCE AND OUTCOME ON RETURN ON ASSETS OR RETURN ON EQUITY

Title	**Year**	**Auth-or(s)**	**Industry**	**Country/ region**	**Tool**	**Period**	**Firm perfor-mance tool**	**Relatio-nship**	**Extra**
ESG and Firm Performance: A Literature Review	2023	Shen	Different	China	Literat-ure review	2005 - 2022	ROA and ROE	Positive	Effect significant for products, not for services
Impact of ESG performance on firm value	2022	Aydo-gmus et al.	Different	World wide	Fixed effects regres-sion	2013 - 2021	ROA	Positive	-

and profitability					analys-is				
Environment-al, social and governance performance and corporate innovation novelty	2024	Chen, Xie & He	Different	China	Regre-ssion analys-is	2011 - 2020	Innova-tion novelty	Positive	-
ESG disclosure and financial performance: Moderating role of ESG investors	2022	Chen & Xie	Different	China	Stagge-red differ-ence-in-differ-ence analys-is	2000 - 2020	Tobin's Q, ROA, ROE and liabiliti-es to assets ratio	Positive	Relationship is stronger for firms who cater to ESG investors and firms with high media coverage
Carbon performance, financial performance and market value: The moderating effect of pay incentives.	2022	Adu, Flynn & Grey	Non-financial firms	UK	Ordin-ary Least Squar-es regres-sion	2009 - 2018	ROA and ROE	Negative	-

Executive Compensation, Sustainable Compensation Policy, Carbon Performance and Market Value	2020	Haque & Ntim	Industrial	EU	Firm fixed effects regression analysis	2002 - 2016	Tobin's Q	Positive	-
ESG practices and corporate financial performance: Evidence from Borse Istanbul	2022	Saygili, Arslan and Birkan	Different	Turkey	Ordinary Least Squares regression	2007-2017	Tobin's Q and ROA	Negative	-
Good for the planet, good for the wallet: the ESG impact on financial performance in India	2023	Roa et al.	Different	India	Fixed-effects panel regression	2015 - 2022	ROE	Negative	E and G have a significant relationship, while S is non-significant
ESG impact on performance of US S&P 500-listed firms	2020	Alareeni and Hamdan	Different	US	Panel regression analysis	2009 - 2018	ROA and ROE	Mixed results	Positive relationship when considering ROA, but negative

									relationship when considering ROE

2.2.1 The greenwashing argument

Companies can exaggerate their sustainability efforts and achievements in their ESG or sustainable development reports (Shen, 2023). Therefore, the ESG controversies score is developed, including information picked up in the media, which may not be disclosed by the company itself. This score together with the "normal" ESG score gets joint into the combined ESG score (LSEG, 2024). Furthermore, improving the governance pillar, thus corporate governance, can improve supervision on the management of the company. Thereby reducing the chances of greenwashing occurring (Shen, 2023). Furthermore, CEOs can also use the ESG score for their own reputation. They could build social citizenship at the cost of shareholder wealth. This is not the purpose of ESG performance, as it should be beneficial to all stakeholders (Barnea & Rubin, 2010).

However, firms can also undertake strategic actions. For instance, by bribing the rating agencies for higher ESG scores than they actually show. This can eventually harm their long-term performance, to look better at present times (Chen & Xie, 2022). This can also be a part of a greenwashing strategy undertaken by the firm.

2.3 Sustainability-linked CEO compensation

There are several theories which can explain why a company feels the need to link ESG performance and sustainability goals to the compensation of the CEO, the definitions for these theories are given in table 2.

APPENDIX B: SUMMARY OF THE DIFFERENT THEORIES USED FOR THE SUSTAINABILITY-LINKED CEO COMPENSATION ARGUMENT

Theory	**Definition used for this study**	**Sources**
Agency theory	The goal of the agency theory is to align the interests of the shareholders and the CEO, resolving the underlying conflict and self-interest maximization of the CEO. The agency problem can be solved in numeral ways, such as incentive alignment through pay and monitoring, improving corporate governance performance.	Abu-Ali et al. (2024), Ntim et al. (2017)
Stakeholder theory	The stakeholder theory criticizes the agency theory by explaining that the shareholders are not the only important group to the company, but that all stakeholder groups should be considered when maximizing firm value. This theory argues that managers must have a positive link with stakeholders to be successful.	Abu-Ali et al. (2024)
Institutional theory	The institutional theory looks at the context the companies are embedded in, any how this context influences the needs of companies for social, institutional, and economic legitimacy. Establishing relationship between the society and a company takes time and needs continuous strengthening.	Meyer & Rowan (1977), Abu-Ali et al. (2024)
Signaling theory	By showing the outside that a company is tying CEO compensation to ESG performance, the company sends a signal to society that they are ready to invest in a socially responsible way. As this is a voluntary disclosure, it can attract investors that are ESG oriented, which can be the goal of the company with this strategy.	Abu-Ali et al. (2024)

The purpose is to change the view of the CEO from short-term performance for only shareholders, to long-term value creation for all stakeholders. This short-term performance thought process is explained by the so-called managerial opportunism hypothesis. This hypothesis states that when firm performance is strong, management will lack on social performance. This is hypothesized because the CEO can then increase short-term performance,

and any personal compensation that is tied to this short-term increase (Preston & O'Bannon, 1997). Therefore, a change in focus for the CEO is needed.

When compensation is granted in the form of equity, as explained by the agency theory, this could incentivize the CEO to consider long-term performance of the company, instead of short-term profit maximization, as this will benefit themselves as well. If these long-term goals are connected to ESG activities, this could increase ESG performance of the company, satisfying the wish of ESG investors (Abu-Ali et al., 2024).

When firms are aware of the relationship between ESG performance and firm performance, they could use sustainability-linked CEO compensation to change their firm performance through this form of incentivization of the CEO. In this way, the firm can send a credible signal to the stakeholders about their commitment to ESG activities. This could strengthen the relationship between the stakeholders and the company, as explained by the signaling theory (Abu-Ali et al., 2024). In this way firms can ensure that the relationship between ESG performance and firm performance stays stable. This is a credible signal, as the disclosure of the information on CEO compensation is voluntary (Abu-Ali et al., 2024).

Firms can use socially responsible expenditures, for instance in the form of CEO compensation linked to sustainability, as a form of stakeholder management. This leads to stakeholders holding a higher impression of the company, and can therefore moderate in the relationship between ESG performance and firm performance (Brammer & Millington, 2005).

Following the stakeholder theory, the CEO therefore must choose to not only maximize shareholder wealth when maximizing the profitability of the firm, but to also maximize stakeholder wealth (Aydogmus et al., 2022). When the stakeholders of the firm are interested in sustainability, the CEO must therefore include sustainability performance, when making decisions on the business practices (Abu-Ali et al., 2024).

However, the relationship with the stakeholder needs continuous strengthening, as explained by the institutional theory (Meyer & Rowan, 1977). Therefore the firm needs to ensure that the signal of CEO compensation linked to sustainability goals is continuous, satisfying the

stakeholders with a credible signal all the time, and therefore ensuring the relationship between ESG performance and firm performance.

2.4 Research problem and objectives

2.4.1 Research gap

ESG was incorporated in decision making processes in financial markets since 1992 (Wang et al., (2023). Meaning that there has already been a lot of research towards this incorporation of ESG factors into decision making. This research is however mostly conducted in for instance the USA and the UK, while Europe is left rather untouched (Abu-Ali et al., 2024). Therefore, by conducting this research with a focus on European companies, this research can provide this market with more information on the topic of ESG.

Furthermore, there are a lot of contradicting results described in research that is concerning ESG performance and firm metrics. Haque & Ntim (2020) found that there is a positive relationship between the Environmental pillar of ESG and market value of a company. Adu et al. (2022) however found the opposite relationship, stating that there is a negative relationship between the Environmental pilar and firm performance. Tarmuji et al. (2016) found a positive relationship between the Social and Governance pillar and economic performance, which results in economic benefits for the company, but no significant relationship between the Environmental pillar and economic performance.

The separate, direct relationship between CEO compensation linked to sustainability and firm performance has the same contradicting results as the relationship between sustainability and performance shows, as shown in the systematic review conducted by Abu-Ali et al. (2024). When looking at the moderating effect of CEO compensation linked to sustainability on the relationship between ESG performance and firm performance, there is still a lot of research needed to be done. The research conducted on ESG related CEO compensation is mostly focused on the determinants and effects of this compensation, instead of its moderating effect on the relationship between ESG scores and firm performance (Winschel & Stawinoga, 2019).

This research will try to fill this gap in the literature and try to define the true relationship between ESG scores and firm performance and the moderating effect of CEO compensation linked to sustainability.

2.4.2 Research objectives

The objective of this research is to examine the effect of ESG scores on firm performance. This will be done by looking into Return on Assets (ROA) and Return on Equity (ROE), as determinants for firm performance. The moderating effect of CEO compensation linked to sustainability on these two relationships will be reviewed, to assess whether this variable strengthens or weakens these relationships.

2.5 Research question and hypothesis

2.5.1 Research question

The research question that this study is tackling is the following:

"How does CEO compensation linked to sustainability moderate the relationship between ESG performance and firm performance?"

This research question will be answered by conducting an instrumental variable (IV) regression analysis, where firm performance is measured by return on assets (ROA) and return on equity (ROE).

2.5.2 Hypothesis

This research follows the following hypotheses, linked to the question of the research:

"CEO compensation linked to sustainability strengthens the positive relationship between ESG performance and firm performance."

2.6 Research scope and limitations

This research will focus on publicly listed firms headquartered in Europe. These firms should not have missing data on the binary variable CEO compensation linked to sustainability. The data is collected for the period from 2014 to 2023. This resulted in a sample of 713 firms. The data is used in this research is retrieved from LSEG Workspace.

The binary nature of the variable CEO compensation linked to sustainability brings a possible limitation to this study, as it prevents deeper analysis on which ESG goal the compensation is tied to, and which part of the compensation is actually linked to ESG practices. A study by Homroy et al. (2023) solved this by filling in this information themselves for their sample of firms. Therefore, adding information on the weight of CEO pay and what the compensation targets were. Information on these compensation schemes could be included via textual analysis from annual reports of listed companies, as done by Homroy et al. (2023).

Another possible limitation is the omitted variable bias, as unobserved variable such as corporate culture may also influence the firm performance through ESG performance. Corporate culture could influence how executives see ESG performance to begin with. Certain corporate cultures could praise ESG performance, pushing their personnel to achieve certain ESG goals. Information on corporate culture could be included via textual analysis from annual reports of listed companies, as done by Bai et al. (2024).

Lastly, different rating agencies use different methods to calculate the ESG score of a company. The information on which ESG score the company uses is not available to this research, which could be another limitation. A study by Homroy et al. (2023) manually checked the firms ESG scores in their sample compared to the ESG scores given out by other rating agencies, to see if these matched.

3 Methodology

3.1 Research design and approach

This study will use a quantitative approach. The method used will be an instrumental variable (IV) regression analysis. The data used will be from firms headquartered in Europe, analyzing the data from the period 2014 up until 2023. All data is captured from the LSEG workspace, with the requirement is that there is no missing data on the variables ESG score and CEO compensation linked to sustainability. The LSEG workspace has data on 16,000 public and private firms in their ESG database worldwide.

First of all, a sample was created, which consisted of firms, headquartered in Europe, with yearly available data on the variable CEO compensation linked to sustainability in the period 2014 until 2023. This selection led to a sample of 713 firms. Secondly, data on the dependent variable was analyzed, namely return on assets and return on equity. The requirement was made that there could not be more than four yearly points of data missing on these variables. This requirement resulted in a final sample of 691 firms. The firms left in the sample with less than four yearly point of missing data were adjusted for their missing data. The datapoints missing at the beginning or ending of the time period (e.g., 2014 or 2023) are adjusted using extrapolation. This is a technique to estimate values beyond the range of known data points. Datapoints missing in the middle of the time period (e.g., 2015-2022) are adjusted using interpolation, which estimates the values of missing datapoints using the range of known data points. The data will be analyzed with help of the software R.

An instrumental variable (IV) regression analysis is used for this research. This choice was made, because during the testing of the assumptions of the Ordinary Least Squares (OLS) regression model, the fifth assumption was violated. This assumption is connected to endogeneity. The assumption was violated, as the variable ESG_Score showed endogeneity with the dependent variables return on assets and return on equity. This assumption was fixed by creating an

instrumental variable on this variable. The testing of assumptions for the OLS regression model can be seen in appendix K.

An instrumental variable is a tool that helps to isolate the variation in the independent variable, so the regression analysis can identify the causal effects with the dependent variable. The instrumental variable regression analysis provides straightforward and therefore easy to interpret coefficients. These coefficients can then be used for interpretation of the relationship between ESG performance and firm performance and the moderating effect of CEO compensation linked to sustainability. The purpose of the IV regression is to recover unbiased and consistent estimates of the causal effect of a potentially endogenous variable, in this case ESG_Score on the dependent variables (Imbens, 2014).

3.2 Key variables

The dependent variables in this research are return on assets (ROA) and return on equity (ROE). These variables capture the performance of the firm for this research. Firm performance can be measured in many different ways, but to remain comparability with other research, return on assets (ROA) and return on equity (ROE) are chosen. These variables are the most used accounting-based and market-based variables to determine financial performance (Velte, 2019; Adu et al., 2022; Alareeni & Hamdan, 2020; Aydogmus et al.., 2022; Chen & Xie, 2022; Rao et al., 2023; Saygili et al., 2021; Shen, 2023). Return on assets is calculated as the net income divided by the average total assets of the company. Return on equity is calculated as the net income divided by shareholder equity. Both are shown as a percentage ranging from 0 to 100. These are the dependent variables in this research.

One of the independent variables in this research is the ESG score. The ESG score is calculated by using different indicators at which firms are rated with a score between 0 to 100, with different weights attached to these indicators. These indicators can be quantitative, like greenhouse gas emissions, or qualitative, like ethical business practices.

The indicators are calculated for three categories: environmental, social and governance. These scores get combined into the ESG score, presented as a number ranging from 0 to 100. The ESG score represents the performance of the company on the environmental, social and governance pillar combined. This research will use the normal ESG score instead of the combined ESG score, including the ESG controversies, as the expectation is that firms will base their compensation of the ESG score calculated only on self-reported data.

The summary of these key variables can be seen in table 3.

TABLE 3: DESCRIPTIVE STATISTICS KEY VARIABLES ESG SCORE, ROA AND ROE

Variable	Mean	Standard deviation	Median	IQR	Min	Max	Missing
ESG_Score	63.31	17.49	65.86	23.88	1.02	95.90	0
ROE	14.77	123.71	11.72	13.46	-979.74	8,905.61	0
ROA	5.50	12.58	4.60	6.78	-205.15	269.11	0

Number of observations = 691

In appendix B,C and D, an extended summary of the key variables over the years can be found. As can be seen in this table, return on equity has a high standard deviation. This could be because the profit the sample of firm generates from shareholder's equity varies over time and across firms. This is however not a problem for this research, as the dependent variables could explain this variation. Added to appendix D is a figure which shows how these key variables behave over time.

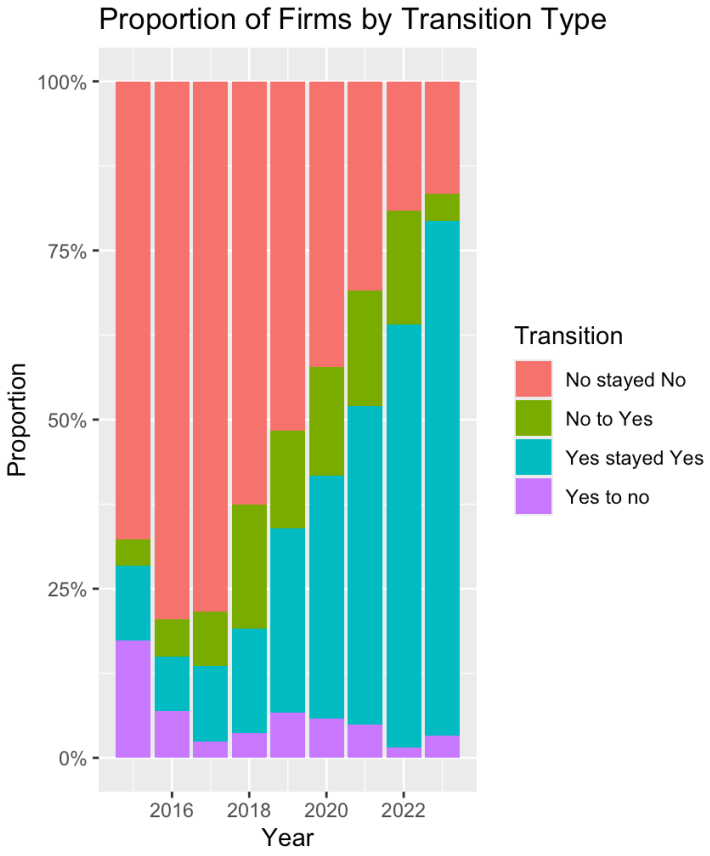
The other independent variable in this research is the variable CEO compensation linked to sustainability. The variable on CEO compensation linked to sustainability (CEO_compensation) is a binary variable with Y for Yes and N for No on the question if CEO compensation is tied to sustainability goals. In table 4 the variable for the sample of 691 firms is presented.

TABLE 4: DESCRIPTIVE STATISTICS KEY VARIABLE CEO COMPENSATION LINKED TO SUSTAINABILITY

CEO compensation linked to sustainability	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
Y (Yes)	196	103	94	132	234	288	359	443	548	553
Percentage	**28,36%**	**14,91%**	**13,60%**	**19,10%**	**33,86%**	**41,68%**	**51,95%**	**64,11%**	**79,31%**	**80,03%**
N (No)	495	588	597	559	457	403	332	248	143	138
Percentage	**71,64%**	**85,09%**	**86,40%**	**80,90%**	**66,14%**	**58,32%**	**48,05%**	**35,89%**	**20,69%**	**19,97%**
Total	**691**	**691**	**691**	**691**	**691**	**691**	**691**	**691**	**691**	**691**

As may be expected from the rise in importance of ESG issues, we can see an increase in the count for Y (Yes) on the question: Is the compensation of the CEO tied to sustainability metrics and goals? It does however show that there was a slight decrease from 2014 until 2016, and the rise in CEO compensation linked to sustainability goals started in 2016 for this sample of firms.

FIGURE 1: CEO COMEPENSATION VARIABLE LINKED OVER TIME



In figure 1, the transition of the variable CEO compensation linked to sustainability over time. It shows that there are some firms that choose to go from linking the compensation of their executives to ESG, choose to no link their compensation anymore. However, the figure also shows that the proportion of firms that choose to keep the compensation structure they have the same is larger.

3.2.1 Control variables

Board independence (Board_independence) is used as a control variable in this study. Board independence is categorized as the percentage of independent board members as reported by the company. Board independence is considered to be of positive influence on the monitoring function of the agency theory, thereby reducing the chance of CEO's misstating ESG information and partaking in greenwashing (Popov & Makeeva, 2022). Independent directors have a professional reputation to uphold, and are therefore committed to long-term performance, instead of short-term oriented, including long-term ESG performance (Romano et al., 2020).

Another control variable is board size (Board_size), which is categorized as the total number of board members at the end of the fiscal year. Board size is believed to have two connections to the relationship between ESG scores and corporate performance. Firstly, it is stated that larger boards include a wider range of interests of stakeholders. However, a larger board also leads to difficulties due to size in the decision-making and controlling process (Popov & Makeeva, 2022).

R&D expenditures (Research) are included in the control variables, as the increase In ESG score of a company can be dependent on investments in new, more environmentally friendly business practices. Therefore, firms who are financially constrained to innovate, can show lower ESG score increases as firms who are unconstrained in R&D expenditures (Chen et al., 2024). R&D expenditures are measured as all direct and indirect costs included in the development of new processes, techniques and products with commercial possibilities (Refinitiv, 2022, p.707). These expenditures are all converted to the Euro currency for comparability purposes.

Research by Gracia and Orsato (2020) about the relationship between ESG performance and financial performance found that institutional settings in a country can affect this relationship, and therefore the country variable is included in this research. By the inclusion of this dummy variable in the instrumental variable regression analysis, fixed country effects are controlled for. The country variable is shown as the abbreviation of the country, e.g., The Netherlands is NL. The distribution of firms per country can be seen in table 5.

TABLE 5: THE DISTRIBUTION OF FIRMS PER COUNTRY

Country	**Number of firms**	**Percentage**
Austria (AT)	14	2,03%
Belgium (BE)	22	3,18%
Bermuda (BM)	1	0,14%
Switzerland (CH)	48	6,95%
Cyprus (CY)	1	0,14%
Czech Republic (CZ)	2	0,29%
Germany (DE)	68	9,84%
Denmark (DK)	20	2,89%
Spain (ES)	33	4,78%
Finland (FI)	23	3,33%
France (FR)	77	11,14%
The United Kingdom (GB)	188	27,21%
Greece (GR)	10	1,45%
Hungary (HU)	4	0,58%
Ireland (IE)	9	1,30%
Italy (IT)	27	3,91%
Jersey (JE)	1	0,14%
Luxembourg (LU)	4	0,58%
The Netherlands (NL)	27	3,91%
Norway (NO)	15	2,17%
Poland (PL)	22	3,18%
Portugal (PT)	6	0,87%
Russia (RU)	3	0,43%
Sweden (SE)	41	5,93%
Turkey (TR)	24	3,47%
South Afrika (ZA)	1	0,14%

Total	**691**	**100,00%**

As shown in the table, a large part of the firms are headquartered in France (11,14%) and the United Kingdom (27,21%), which is something to be taken into account when interpreting the results. The South Africa count can be explained by the fact that this company called “Old Mutual Limited” was originally established in Cape Town, but now also has a head office in London, and is considered to have a significant European presence (Old Mutual Limited, 2020).

Each industry has their own material issues and therefore are taking on the importance of ESG performance differently. Therefore, this research will control for industry differences by adding industry categories to the control variables. By adding this industry dummy variable to the instrumental variable regression analysis, industry fixed effects will be controlled for.

Industry data from LSEG workspace is categorized in the following order: sector (e.g., industrials), industry group (e.g., transportation), industry (e.g., passenger transportation services), sub-industry (e.g., airlines) and lastly a very specific subgroup in the sub-industry description (e.g., regional airlines). The industry variable used in this study will be categorized at the industry level, as this captures the most important characteristics of the sample groups, where the subgroup from sub-industry level would bring extra unnecessary noise into the regression analysis. The distribution of firms per industry can be seen in table 6.

TABLE 6: THE DISTRIBUTION OF FIRMS PER INDUSTRY

Industry	**Number of firms**	**Percentage**
Aerospace & Defense	12	1,74%
Automobiles & Auto Parts	15	2,17%
Banking Services	58	8,39%
Beverages	13	1,88%
Biotechnology & Medical Research	4	0,58%
Chemicals	31	4,49%
Coal	1	0,14%

Collective Investments	2	0,29%
Communications & Networking	5	0,72%
Computers, Phones & Household Electronics	3	0,43%
Construction & Engineering	22	3,18%
Construction Materials	5	0,72%
Consumer Goods Conglomerates	3	0,43%
Containers & Packaging	6	0,87%
Diversified Industrial Goods Wholesalers	1	0,14%
Diversified Retail	2	0,29%
Electrical Utilities & IPPs	18	2,60%
Electronic Equipment & Parts	6	0,87%
Food & Drug Retailing	11	1,59%
Food & Tobacco	20	2,89%
Freight & Logistics Services	11	1,59%
Healthcare Equipment & Supplies	12	1,74%
Healthcare Providers & Services	5	0,72%
Holding Companies	9	1,30%
Homebuilding & Construction Supplies	17	2,46%
Hotels & Entertainment Services	13	1,88%
Household Goods	5	0,72%
Insurance	30	4,34%
Investment Banking & Investment Services	27	3,91%
Machinery, Equipment & Components	42	6,08%
Media & Publishing	16	2,32%
Metals & Mining	30	4,34%
Multiline Utilities	11	1,59%
Natural Gas Utilities	1	0,14%
Oil & Gas	21	3,04%

Oil & Gas Related Equipment and Services	17	2,46%
Paper & Forest Products	3	0,43%
Passenger Transportation Services	7	1,01%
Personal & Household Products & Services	6	0,87%
Pharmaceuticals	17	2,46%
Professional & Commercial Services	26	3,76%
Real Estate Operations	17	2,46%
Renewable Energy	1	0,14%
Residential & Commercial REITs	21	3,04%
Semiconductors & Semiconductor Equipment	6	0,87%
Software & IT Services	18	2,60%
Specialty Retailers	20	2,89%
Telecommunications Services	26	3,76%
Textiles & Apparel	8	1,16%
Transport Infrastructure	7	1,01%
Water & Related Utilities	3	0,43%
Total	**691**	**100,00%**

As can be seen in the table, there are no large deviations between the number of firms per industry in this sample.

Firm size (Log_Firm_Size) is categorized as the total assets of the company. This variable is chosen as a control variable as the size of the firm can influence financial performance outside of ESG performance due to influences such as market power, economies of scale and the availability of resources (Kuncová et al., 2016). The value of the total assets is converted to the Euro currency for comparability purposes.

Leverage is categorized as the ratio of total debts divided by total assets. It is chosen as a control variable, because this can also impact firm performance by the provision of financial

resources with greater debt, or the risk which comes with the including of more debt to the firm (Danilov, 2024).

Firm age (Age) is measured in years from the point of origin of the company until the year of the observation. It is included as a control variable because firm age can impact the operational efficiency, and therefore firm performance through experience and accumulated knowledge on the production process (Tao, 2023).

Firm profitability (EBITDA_Margin) is measured as the EBITDA margin of the company, which is a measure the operating profit of a company divided by its revenues. It is included as a control variable, because this margin is an indicator for financial health of the company, and can therefore impact strategic decision making on ESG initiatives and CEO compensation. Therefore, influencing firm performance through the dependent variables in this study (Zhu et al., 2024).

TABLE 7: SUMMARY STATISTICS OF CONTROL VARIABLE

Variable	Mean	Standard deviation	Missing
Board_ Independence	58.38	23.70	9
Board_Size	10.99	3.74	9
Firm_Size	54,648,155.94	194,584,877.53	3
Leverage	58.57	22.63	21
Research	520,576.20	1,444,859.27	4,033
EBITDA_ Margin	13.90	297.56	10

Number of observations = 691

Considering the summary statistics, a high number of missing's can be spotted for the research variable. Which could be concerning for the regression model. Therefore, the decision is made to remove this variable from the statistical model, as the testing of assumptions also showed a lot of problems for this variable, as can be seen in appendix K.

Furthermore, a high standard deviation can be seen for the variable firm size, therefore this variable will be log-transformed, to decrease the variability and thereby impact on the statistical model.

TABLE 8: RENEWED SUMMARY STATISTICS FOR LOG TRANSFORMED VARIABLE FIRM SIZE

Variable	Mean	Standard deviation	Missing
Log_Firm_Size	16.06	1.75	3

Number of observations = 691

This high standard deviation is also seen for the EBITDA margin, which is logical, as it is calculated using revenue, which is a variable looking similar to firm size (total assets). The choice is made however to not adjust this variable, as this is not done in previous research on the topic (Adu et al., 2023; Haque & Ntim, 2020). In appendix E until J, the variables are summarized over the years of this research.

3.3 Statistical model

To capture the relationship between ESG performance and firm performance, with mediator CEO compensation linked to sustainability goals, the following regression models will be used:

Relationship specified in return on assets (ROA):

$$ROA_{it} = \alpha + \beta_1 ESG_{it} + \beta_2 CEO\_compensation_{it} + (\beta_3 CEO\_compensation_{it} * ESG_{it}) + \beta_4 Board\_independence_{it} + \beta_5 Board\_size_{it} + \beta_6 Country_{it} + \beta_7 Industry_{it} + \beta_8 Log\_Firm\_Size_{it} + \beta_9 Leverage_{it} + \beta_{10} Age_{it} + \beta_{11} EBITDA\_Margin_{it} + \varepsilon$$

Relationship specified in return on equity (ROE):

$$ROE_{it} = \alpha + \beta_1 ESG_{it} + \beta_2 CEO\_compensation_{it} + (\beta_3 CEO\_compensation_{it} * ESG_{it}) + \beta_4 Board\_independence_{it} + \beta_5 Board\_size_{it} + \beta_6 Country_{it} + \beta_7 Industry_{it} + \beta_8 Log\_Firm\_Size_{it} + \beta_9 Leverage_{it} + \beta_{10} Age_{it} + \beta_{11} EBITDA\_Margin_{it} + \varepsilon$$

To address the endogeneity in the variable ESG score, and in the interaction with the variable CEO compensation linked to sustainability, these variables are instrumented. These instruments are thus created, as firm performance could affect ESG performance, or because ESG performance could be affected by other variables, thus creating endogeneity. The endogeinity is addressed using instruments, by creating the industry-level average ESG score (Industry_ESG_Avg) and its interaction with CEO compensation (Industry_ESG_CEO_interaction). The industry level average is chosen because it is a relevant variable in connection with ESG. Firms in industries with higher average ESG scores are likely to face the same pressures, therefore the industry can predict the ESG score well. Secondly, the industry variable is uncorrelated with error term and therefore controls for the endogeneity in the variable ESG score.

In these regression models, the betas will capture the effect of the ESG score, the CEO compensation, the interaction effect of the ESG score and CEO compensation and the control variables on firm performance. The interaction effect will capture the moderating effect of CEO compensation linked to sustainability on the relationship between ESG performance and firm performance.

This statistical model is based on earlier research on the topic of CEO compensation linked to sustainability goals (Adu et al., 2023; Haque & Ntim, 2020).

3.4 Assumptions of the model

To make sure the data gathered could be correctly used in an Ordinary Least Squares (OLS) regression model, the data was tested on the basic assumptions of the OLS model. The detailed

results of these test can be reviewed in appendix K. The assumptions were not all met, which is why the decision was made to choose for the instrumental variable (IV) regression analysis.

4 Results

The hypothesis of this research is that there is a positive relationship between ESG performance and firm performance, which is strengthened by the variable CEO compensation linked to sustainability. The results however show that there is a negative relationship between ESG performance and firm performance, and that the linkage of CEO compensation to sustainability goals has a negative effect on this relationship. CEO compensation which is linked to sustainability goals on its own shows a strong positive effect on firm performance. This leads to the most important result of this research; when ESG performance is near zero, the linkage of CEO compensation to sustainability goals improves firm performance. However when ESG performance is at the higher end of the spectrum, this relationship seems to turn negative.

After running the instrumental variable regression models, as shown in chapter 3.3, results were gathered which are summarized in table 9. The statistical significance is assessed by the p-value, choosing statistical significance at the 1% level, thus p-value < 0.01. These levels are marked by the three stars (***).

TABLE 9: INSTRUMENTAL VARIABLE REGRESSION RESULTS FOR ROA

Variable	Estimate	Std. Error	P-value	Significance
(Intercept)	-19.7632	4.3163	0.0000	***
ESG_Score	-0.0514	0.0517	0.3208	
CEO_comp_dummy	18.3625	4.9249	0.0002	***
ESG_CEO_interaction	-0.2533	0.0688	0.0002	***
Log_Firm_Size	1.1820	0.3130	0.0002	***

Variable	Estimate	Std. Error	P-value	Significance
Leverage	0.0744	0.0137	0.0000	***
Board_Size	-0.1180	0.0710	0.0965	*
Board_Independence	0.0395	0.0140	0.0049	***
EBITDA_Margin	0.0331	0.0011	0.0000	***
Age	0.0017	0.0040	0.6684	

$R^2 = 0.5026$

Number of observations = 691

* Statistical significance at 10% level

** Statistical significance at 5% level

*** Statistical significance at 1% level

When looking at the key variables, ESG_score itself does not have a statistically significant effect on return on assets. However, when looking at the interaction effect between the ESG score and the CEO compensation linked to sustainability goals, a statistically significant effect can be seen. These coefficients suggests that firms without sustainability linked CEO compensation see no meaningful impact of ESG scores on return on assets. Firms with sustainability linked CEO compensation do see a meaningful impact of ESG scores on return on assets, namely a negative effect (-0.25). This suggest that there are potential costs or misalignments when sustainability goals and CEO compensation are linked.

It is difficult to interpret the CEO compensation dummy in isolation, as it is unrealistic to interpret the ESG score as being zero. It can however be assumed that when ESG scores are at the lower end of the spectrum, firms that have CEO compensation linked to sustainability goals tend to have to higher return on assets. This effect however can turn negative when the ESG score increases.

The Industry and Country dummy variables are included in a table in appendix L. These dummy variables show statistically significant results. This means that return on assets differs systematically among different industries and countries, which is now controlled for in the model, because of the industry and country control variable. For the industry control variable, 35% percent of the sectors are statistically significant, varying between positive and negative impacts on return on assets. For the country variable, only 15% of the countries have a statistically significant impact on return on assets. These impacts are all positive impacts.

Board independence was expected to be of positive influence on ROA, as this independence is expected to result in better controls on management and commitment to long-term goals of the company. In table 9, we can see that this expectation is also seen in the sample of firms chosen. The effect is however considered to be small (0.04).

Furthermore, a positive and significant effect of leverage and firm profitability (EBITDA_Margin) can be seen in table 9. This effect of the firm profitability measure is as expected, as this measurement shows the financial health of the company. The expectation is that when a firm has better financial health, their return on assets is higher. These results agree with this expectation. The effect of profitability on return on assets is however considered to be small (0.03). The leverage measurement shows that higher leverage is positively associated with return on assets. This was to be expected, as there are more resources to finance the needs of the firm. The effect however is small (0.07). This is expected to be connected to the risk that comes with taking higher debts and thus having a higher leverage ratio.

The control variable firm size does have a large positive (1.18) and statistically significant impact on return on assets, as was to be expected. The higher the firm size, thus the total assets a firm has, the higher their influences on the market. These firms can possess more economies of scale, and better access to resources. This leads to higher profits with the use of less resources, and therefore a higher return on assets.

The effects of these control variables are now all covered because of their inclusion in the model. Board size and firm age are both statistically insignificant factors in this relationship.

Table 10 displays the results for ROE, here the Industry and Country dummy variables are included in the table in appendix M. The statistical significance is assessed by the p-value, choosing statistical significance at the 1% level, thus p-value < 0.01. These levels are marked by the three stars (***).

TABLE 10: INSTRUMENTAL VARIABLE REGRESSION RESULTS FOR ROE

Variable	Estimate	Std. Error	P-value	Significance
(Intercept)	-101.3235	25.2303	0.0001	***
ESG_Score	-0.2493	0.3024	0.4098	
CEO_comp_dummy	117.2474	28.7876	0.0000	***
ESG_CEO_interaction	-1.5894	0.4020	0.0001	***
Log_Firm_Size	8.0651	1.8295	0.0000	***
Leverage	-0.3402	0.0799	0.0000	***
Board_Size	-1.0203	0.4150	0.0140	**
Board_Independence	0.1735	0.0821	0.0347	**
EBITDA_Margin	0.0322	0.0062	0.0000	***
Age	-0.0161	0.0234	0.4921	

$R^2 = 0.03615$

Number of observations = 691

* Statistical significance at 10% level

** Statistical significance at 5% level

*** Statistical significance at 1% level

The ESG score on its own again has no statistically significant impact on the dependent variable, return on equity. In the interaction term with CEO compensation, we do see a statistically significant impact, with a negative coefficient (-1.59). This suggests that when CEO compensation is linked to sustainability goals, higher ESG scores are associated with lower return on equity. This same relationship was seen in the regression with return on assets. CEO compensation linked to sustainability goals itself however has a high positive impact on return on equity, suggesting the same relationship as was with return on assets; when firm are scoring lower on ESG performance, but they have CEO compensation linked to sustainability goals, firms tend to have to higher return on equity. The effect however seems to turn negative, when ESG scores increase.

When looking at the results for the industry and country dummy variables for the instrumental variable regression for the dependent variable return on equity, it can be seen that only one country has a statistically significant effect on this regression. The country that has an effect on return on equity is Turkey, and it shows a large effect of 26.6. This could be the case, as Turkey has experienced high inflation (Trading Economics, 2025), which can inflate the return on equity variable, as this regression analysis does not account for inflation. For the industry variable, we can again see some industries with statistically significant effects. For the return on equity variable, this is 35%. The majority of these industry sectors which are statistically significant, are the same sectors which were statistically significant for the dependent variable return on assets. These effects are both positive and negative effects.

When looking into the other control variables, the first notable thing is that the variables board size and board independence are both not statistically significant for return on equity. This implies that board independence has another effect on return on equity than it does on return on assets, as this variable is statistically significant in relationship with return on assets. Firm age is again not statistically significant either.

Firm size, firm leverage and profitability are all extremely significant in their relationship with return on equity with a p-value of 0.000. The effects of leverage and firm profitability are however

small, respectively -0.34 and 0.03, therefore not impacting return on equity strongly. Firm size however has a strong impact on return on equity, with a coefficient of 8.07.

5 Conclusion

This study is set out to investigate the relationship between the sustainability performance of a company, as captured by ESG scores, and firm financial performance, specifically return on assets and return on equity. The study focused on how these relationships are influenced by CEO compensation structures, specifically the structure where CEO compensation is linked to sustainability goals.

One consistent finding across both the relationship with return on assets and the relationship with return on equity is that the variable ESG score, and thus ESG performance of the company, by itself does not have a statistically significant effect on firm performance. The statistically significance of the ESG score can only be seen in the interaction effect with CEO compensation linked to sustainability goals. This suggests that firms who engage in sustainability efforts, but do not embed them into the incentives of their executives, do not experience measurable improvements or declines in their return on asset or return on equity, and therefore firm performance, relative to firms that do include sustainability efforts into the compensation of their executives. This could be possible, because in the absence of strong strategic alignment and internal control mechanisms, sustainability efforts may function more as a symbolic gesture than as a driver of firm value.

CEO compensation linked to sustainability goals by itself did show a statistically significant effect on both return on assets and return on equity. The effect on both firm performance measures shows a strong positive association. Firms that tied CEO compensation to sustainability goals performed significantly better on average, than firms that do not. This suggests that the integration of sustainability goals into the compensation of executives may serve as a sign of long-term orientation and strong corporate governance, raising firm value. This inclusion of ESG

activities in determinants of executive pay could also be seen as a signaling strategy. Firms could use this compensation scheme as a signal of commitment to earn trust of stakeholders, thereby raising their performance.

The positive effect of CEO compensation linked to sustainability goals in relationship to firm performance however does not show in the statistically significant interaction effect between ESG performance and CEO compensation linked to sustainability goals. When looking into the interaction effect, both models showed a negative relationship, implying that firms that have CEO compensation that is tied to sustainability activities, when increasing their ESG score, decline in firm financial performance. For return on assets, each one-point increase in ESG score would lead to a reduction of around 0.30 percentage points in return on assets. For return on equity, the incline of one-point in ESG score is linked to a reduction of 1.59 percentage points, therefore a more substantial decline in financial performance. This result suggests a potential misalignment between ESG performance tied to CEO compensation and financial efficiency. Executives may pursue ESG goals too aggressively, leading to the inefficient use of resources, increasing costs and therefore decreasing financial performance of the firm. Another possible explanation for these results is that the height of the ESG score is prioritized over the quality of the actions taken to achieve the score. This concern is in line with reasonings like the greenwashing argument, where executives try to influence the ESG metric without actually improving the underlying fundamentals of the score permanently. When this behavior is caught by the public, it could explain the dropping financial performance.

When these results are looked at together, the role of ESG performance on financial performance can be explained. These results show that when CEO compensation is linked to sustainability goals, the firm presents higher financial performance. However, when the intensity of ESG activities increases, and therefore ESG performance, this introduces financial strain, as these activities could be cost heavy for their outcomes. The results imply that when firms show a ESG score that is at the lower end of the spectrum, the tie of CEO compensation to sustainability goals could financially benefit the firm, but as the ESG score increases, the results show that

financial performance is deteriorating instead of improving. These findings deny the hypothesis, which was formed in the beginning of the research, namely that the interaction effect of CEO compensation linked to sustainability goals and ESG performance would have a positive influence on financial performance.

The research also revealed some important insight in the control variables. Firm size, board independence (only for return on assets), firm profitability and leverage behaved as was expected, positively influencing financial performance.

Furthermore, country and industry effects showed the importance of institutional and sectoral context added to research, as certain countries and industries consistently across both return on assets and return on equity outperformed or underperformed in firm performance compared to other countries or industries. This result suggests that the relationship between ESG performance and the financial performance of that firm may depend on where and in what industry the ESG activities are implemented.

While ESG performance does not always lead to higher financial performance, this research shows that connecting CEO compensation to sustainability goals can be a good start for a firm to increase their ESG performance without decreasing their firm performance, but only when ESG performance is at the lower end of the scale. Firms with CEO compensation linked to sustainability goals tend to perform better, but increasing ESG scores within these firms can reduce profitability. This tells firms that for sustainability to be financially effective, these activities must be integrated strategically and be managed carefully.

6 Discussion

6.1 Implications results

This research contributes to the question on the financial implications of ESG activities a firm undertakes, and the role sustainability linked CEO compensation has in this relationship. The

results showed a surprising relationship. The main conclusion of this research is that ESG performance on its own has no significant relationship with firm performance. The research also shows that the efforts of firms to incentivize their executives to focus on sustainability can be important in the early stages of developing ESG activities, having positive effects on firm performance in these early stages. In later stages of ESG performance, firm performance can decrease when CEO compensation in linked to sustainability and ESG performance increases. The main take away for firms is therefore that they need to integrate ESG incentives in a way that aligns with their firm performance. This means that they should integrate ESG activities in the broader strategic and financial objectives of the firm. Management should consider the possible loss in financial performance for the increase in ESG performance, which could be worth more to the company in the longer term.

These findings reinforce the importance of transparency in corporate governance, in this case CEO compensation structures, as CEO compensation linked to sustainability on its own boosts return on equity and return on assets.

The results on the interaction effect between CEO compensation and firm performance are in line with previous research. Haque & Ntim (2020) and Adu et al. (2022) both looked into carbon performance of the company, with the influence of CEO pay structures, and their effect on market value, showing that the CEO pay structures were used more as symbolic mechanisms, without actually improving the market value through their carbon performance. These main conclusions are in line with the main conclusion of this research. There are however some interesting differences in results. This research showed a positive relationship between firm performance and sustainability linked CEO compensation, indicating that when the ESG score of a firm is at the lower end of the spectrum, sustainability linked CEO compensation has a positive effect on firm performance.

6.2 Limitations research

A study by Berg et al. (2022) shows that ESG scores can differ between different rating agencies. In this study the score as made up by Refinitiv, now called LSEG, is used. It could however be that the companies that are looked at used another ESG rating agencies score to determine CEO compensation. Therefore, the results could be wrong, as ESG scores used by the company could be higher or lower, than the ESG scores used in this research, and therefore compensation is based on different metrics. Because of these differences between rating agencies, it could be possible that different ESG ratings from different rating agencies could bring different results. This could have been fixed by looking into these other rating agencies and comparing their ESG scores to the ESG score used by LSEG. These rating agencies however require a paid subscription to look into historical ESG data, which the research institute (Radboud University Nijmegen) did not have access to. Therefore, this limitation could not be avoided in this research.

Secondly, the binary nature of the variable CEO compensation linked to sustainability brings a possible limitation to this study, as it prevents deeper analysis on which ESG goal the compensation is tied to, and which part of the compensation is actually linked to ESG practices. The answers to this research could be different for firms with 80% of compensation linked to sustainability versus firms with 20% of compensation linked to sustainability. Therefore, this research cannot answer the question how much compensation should be linked to sustainability to become profitable in measures of firm performance.

Another possible limitation is the omitted variable bias, as an unobserved variable such as corporate culture may also influence the firm performance through ESG performance. It could be that certain corporate cultures value ESG performance more than others and therefore do not need compensation structures to incentivize their personnel to take on ESG activities. This could bias the results for companies who do not have compensation structures tied to sustainability.

6.3 Further research

First of all, further research connected to the topic of corporate culture could be interesting, replicating this research, but looking at the mediating effect of corporate culture instead of CEO compensation structures. It would be fascinating to see different corporate cultures and their different approaches in this ESG trend. Different cultures could have different ideas on how much ESG performance is needed Bai et al. (2024). This could result in certain corporate culture reinforcing ESG performance, which may reinforce firm performance as well. One difficulty in this research however would be the measurement of corporate culture, as it is more of a feeling in the firm, and therefore difficult to measure.

Secondly, it would be interesting to capture the effects of each different pillar of ESG on firm performance. Each pillar (environment, social and governance) has different influences on the firm, and can therefore influence the firm performance differently. For example, environmental activities can have high costs, but benefit the company in long term savings, while social investments may improve productivity, immediately showing increases in firm performance. These different effects would be interesting to capture and explore.

Lastly, and most connected to this study, it would be intriguing to explore the sustainability linked compensation structures in the firms more closely, seeing the differences that more or less compensation towards sustainability goals would make for ESG performance and firm performance. This study would explicitly look at the buildup of the compensation structures, and their direct effect on both firm performance and ESG performance.

REFERENCES

Abu-Ali, B. O., Al-Jamal, D., & El-Masry, A. (2024). The Relationship between Executive Compensation, Sustainability, and Performance: A Systematic Review. *Open Journal of Business and Management*, *12*(05), 3020–3083. https://doi.org/10.4236/ojbm.2024.125155

Adu, D. A., Flynn, A., & Grey, C. (2022). Carbon performance, financial performance and market value: The moderating effect of pay incentives. *Business Strategy and the Environment*, *32*(4), 2111–2135. https://doi.org/10.1002/bse.3239

Alareeni, B. A., & Hamdan, A. (2020). ESG impact on performance of US S&P 500-listed firms. *Emerald Publishing*, *20*(7), 1409–1428. https://doi.org/10.1108/CG-06-2020-0258

Al-Shaer, H., & Zaman, M. (2017). CEO Compensation and Sustainability Reporting Assurance: Evidence from the UK. *Journal of Business Ethics*, *158*(1), 233–252. https://doi.org/10.1007/s10551-017-3735-8

Aydoğmuş, M., Gülay, G., & Ergun, K. (2022). Impact of ESG performance on firm value and profitability. *Borsa Istanbul Review*, *22*, S119–S127. https://doi.org/10.1016/j.bir.2022.11.006

Bai, F., Shang, M., & Huang, Y. (2024). Corporate culture and ESG performance: Empirical evidence from China. *Journal of Cleaner Production*, *437*, 140732. https://doi.org/10.1016/j.jclepro.2024.140732

Barnea, A., & Rubin, A. (2010). Corporate social responsibility as a conflict between shareholders. *Journal of Business Ethics*, *97*(1), 71–86. https://doi.org/10.1007/s10551-010-0496-z

Berg, F., Kölbel, J. F., & Rigobon, R. (2022). Aggregate confusion: the divergence of ESG ratings. *Review of Finance*, *26*(6), 1315–1344. https://doi.org/10.1093/rof/rfac033

Brammer, S., & Millington, A. (2005). Corporate Reputation and Philanthropy: An Empirical analysis. *Journal of Business Ethics*, *61*(1), 29–44. https://doi.org/10.1007/s10551-005-7443-4

Buerke, A., Straatmann, T., Lin-Hi, N., & Müller, K. (2016). Consumer awareness and sustainability-focused value orientation as motivating factors of responsible consumer behavior. *Review of Managerial Science*, *11*(4), 959–991. https://doi.org/10.1007/s11846-016-0211-2

Byrne, D. (2022, December 9). *ESG in Europe - The Corporate Governance Institute*. The Corporate Governance Institute. https://www.thecorporategovernanceinstitute.com/insights/news-

analysis/the-esg-landscape-in-europe/?srsltid=AfmBOorgHjQ7rYmqzieICjDB3mn_vf96bIBxyYYwetjA1XysLxhkZPU3

Cai, Y., Jo, H., & Pan, C. (2011). Vice or virtue? The impact of corporate social responsibility on executive compensation. *Journal of Business Ethics*, *104*(2), 159–173. https://doi.org/10.1007/s10551-011-0909-7

Chen, W., Xie, Y., & He, K. (2024). Environmental, social, and governance performance and corporate innovation novelty. *International Journal of Innovation Studies*, *8*(2), 109–131. https://doi.org/10.1016/j.ijis.2024.01.003

Chen, Z., & Xie, G. (2022). ESG disclosure and financial performance: Moderating role of ESG investors. *International Review of Financial Analysis*, *83*, 102291. https://doi.org/10.1016/j.irfa.2022.102291

Crace, L., & Gehman, J. (2022). What really explains ESG performance? disentangling the asymmetrical drivers of the triple bottom line. *Organization & Environment*, *36*(1), 150–178. https://doi.org/10.1177/10860266221079408

Cremasco, C., & Boni, L. (2022). Is the European Union (EU) Sustainable Finance Disclosure Regulation (SFDR) effective in shaping sustainability objectives? An analysis of investment funds' behaviour. *Journal of Sustainable Finance & Investment*, *14*(4), 1018–1036. https://doi.org/10.1080/20430795.2022.2124838

Danilov, G. (2024). The impact of corporate governance on firm performance: panel data evidence from S&P 500 Information Technology. *Future Business Journal*, *10*(1). https://doi.org/10.1186/s43093-024-00376-8

Daugaard, D., & Ding, A. (2022). Global Drivers for ESG performance: the body of knowledge. *Sustainability*, *14*(4), 2322. https://doi.org/10.3390/su14042322

Dhaliwal, D. S., Radhakrishnan, S., Tsang, A., & Yang, Y. G. (2012). Nonfinancial Disclosure and Analyst forecast accuracy: International Evidence on Corporate Social Responsibility Disclosure. *The Accounting Review*, *87*(3), 723–759. https://doi.org/10.2308/accr-10218

Garcia, A. S., & Orsato, R. J. (2020). Testing the institutional difference hypothesis: A study about environmental, social, governance, and financial performance. *Business Strategy and the Environment*, *29*(8), 3261–3272. https://doi.org/10.1002/bse.2570

Graves, S. B., & Waddock, S. A. (1994). Institutional owners and corporate social performance. *Academy of Management Journal*, *37*(4), 1034–1046. https://doi.org/10.5465/256611

Haque, F., & Ntim, C. G. (2020). Executive Compensation, Sustainable Compensation Policy, Carbon Performance and Market Value. *British Journal of Management*, *31*(3), 525–546. https://doi.org/10.1111/1467-8551.12395

Herranz-Surrallés, A., Damro, C., & Eckert, S. (2024). The geoeconomic turn of the single European market? Conceptual challenges and empirical trends. *JCMS Journal of Common Market Studies*, *62*(4), 919–937. https://doi.org/10.1111/jcms.13591

Homroy, S., Mavruk, T., & Nguyen, V. D. (2023). ESG-Linked compensation, CEO skills, and shareholder welfare. *The Review of Corporate Finance Studies*, *12*(4), 939–985. https://doi.org/10.1093/rcfs/cfad012

Imbens, G. W. (2014). *Instrumental Variables: An Econometrician's Perspective. In NBER Working Paper Series (No. 19983). NATIONAL BUREAU OF ECONOMIC RESEARCH. https://www.nber.org/system/files/working_papers/w19983/w19983.pdf*

Kenton, W. (2021, May 26). *Institutional ownership defined and explained*. Investopedia. https://www.investopedia.com/terms/i/institutional-ownership.asp

Kim, S., & Li, Z. (2021). Understanding the impact of ESG practices in corporate finance. *Sustainability*, *13*(7), 3746. https://doi.org/10.3390/su13073746

Krueger, P., Sautner, Z., & Starks, L. T. (2019). The importance of climate risks for institutional investors. *Review of Financial Studies*, *33*(3), 1067–1111. https://doi.org/10.1093/rfs/hhz137

Kuncová, M., Hedija, V., & Fiala, R. (2016). Firm size as a determinant of firm performance: the case of swine raising. *Agris On-line Papers in Economics and Informatics*, *08*(03), 77–89. https://doi.org/10.7160/aol.2016.080308

Landi, G., & Sciarelli, M. (2018). Towards a more ethical market: the impact of ESG rating on corporate financial performance. *Social Responsibility Journal*, *15*(1), 11–27. https://doi.org/10.1108/srj-11-2017-0254

Li, T., Wang, K., Sueyoshi, T., & Wang, D. D. (2021). ESG: Research progress and Future Prospects. *Sustainability*, *13*(21), 11663. https://doi.org/10.3390/su132111663

LSEG. (2024). Environmental, Social and Governance scores from LSEG. In *CORPORATE* (pp. 3–6).

Martiny, A., Taglialatela, J., Testa, F., & Iraldo, F. (2024). Determinants of environmental social and governance (ESG) performance: A systematic literature review. *Journal of Cleaner Production*, *456*, 142213. https://doi.org/10.1016/j.jclepro.2024.142213

Meyer, J. W., & Rowan, B. (1977). Institutionalized organizations: formal structure as myth and ceremony. *American Journal of Sociology*, *83*(2), 340–363. https://doi.org/10.1086/226550

Ntim, C. G., Lindop, S., Thomas, D. A., Abdou, H., & Opong, K. K. (2017). Executive pay and performance: the moderating effect of CEO power and governance structure. *The International Journal of Human Resource Management*, *30*(6), 921–963. https://doi.org/10.1080/09585192.2017.1282532

Old Mutual Limited. (2020). *Mutual: 175 years of doing great things*. oldmutual.com. Retrieved April 1, 2025, from https://www.oldmutual.com/about/175-birthday/

Popov, K., & Makeeva, E. (2022). Relationship between Board Characteristics, ESG and Corporate Performance: A Systematic Review. *cfjournal.hse.ru*. https://doi.org/10.17323/j.jcfr.2073-0438.16.4.2022.119-134

Porter, M. E., & Van Der Linde, C. (1995). Green and competitive: Ending the stalemate. In *Harvard Business Review*. https://kentlundgren.se/artiklar/vetenskapliga/Porter_Linde_1995.pdf

Preston, L. E., & O'Bannon, D. P. (1997). The Corporate Social-Financial Performance Relationship. *Business & Society*, *36*(4), 419–429. https://doi.org/10.1177/000765039703600406

Rao, A., Dagar, V., Sohag, K., Dagher, L., & Tanin, T. I. (2023). Good for the planet, good for the wallet: The ESG impact on financial performance in India. *Finance Research Letters*, *56*, 104093. https://doi.org/10.1016/j.frl.2023.104093

Rath, C., Kurniasari, F., & Deo, M. (2020). CEO Compensation and Firm Performance: The Role of ESG Transparency. *Indonesian Journal of Sustainability Accounting and Management*, *4*(2), 278. https://doi.org/10.28992/ijsam.v4i2.225

Rau, P. R., & Yu, T. (2023). A survey on ESG: investors, institutions and firms. *China Finance Review International*. https://doi.org/10.1108/cfri-12-2022-0260

RBC Global Asset Management. (2018). Investing Survey. In *Fixed Income Summary*. https://www.rbcbluebay.com/globalassets/documents/responsible-investing-executive-summary_2018_fixedincomesupplement.pdf

Refinitiv. (2022). REFINITIV WORLDSCOPE FUNDAMENTALS DATABASE DATA DEFINITIONS GUIDE (ISSUE 17). In *REFINITIV WORLDSCOPE DATABASE* (pp. 2–911).

Romano, M., Cirillo, A., Favino, C., & Netti, A. (2020). ESG (Environmental, Social and Governance) performance and Board Gender Diversity: The moderating role of CEO duality. *Sustainability*, *12*(21), 9298. https://doi.org/10.3390/su12219298

Saygili, E., Arslan, S., & Birkan, A. O. (2021). ESG practices and corporate financial performance: Evidence from Borsa Istanbul. *Borsa Istanbul Review*, *22*(3), 525–533. https://doi.org/10.1016/j.bir.2021.07.001

Serafeim, G., & Yoon, A. (2022). Which corporate ESG news does the market react to? *Financial Analysts Journal*, *78*(1), 59–78. https://doi.org/10.1080/0015198x.2021.1973879

Shen, Y. (2023). ESG and Firm Performance: A Literature Review. In *BCP Business & Management FMEME 2023* (Vol. 46, pp. 283–284). https://pdfs.semanticscholar.org/d2c7/6d0d228bed6c80495471124e5b54372a1eb1.pdf

Tao, J. (2023). Study on the impact of ESG performance on firm performance. *SHS Web of Conferences*, *165*, 01016. https://doi.org/10.1051/shsconf/202316501016

Tarmuji, I., Maelah, R., & Tarmuji, N. H. (2016). The Impact of Environmental, Social and Governance Practices (ESG) on Economic Performance: Evidence from ESG Score. *International Journal of Trade Economics and Finance*, *7*(3), 67– TRADING ECONOMICS. (2025). *Turkey inflation rate*. Retrieved June 6, 2025, from https://tradingeconomics.com/turkey/inflation-cpi 74. https://doi.org/10.18178/ijtef.2016.7.3.501

Velte, P. (2019). Does CEO power moderate the link between ESG performance and financial performance? *Management Research Review*, *43*(5), 497–520. https://doi.org/10.1108/mrr-04-2019-0182

Wang, N., Pan, H., Feng, Y., & Du, S. (2023). How do ESG practices create value for businesses? Research review and prospects. *Sustainability Accounting Management and Policy Journal*, *15*(5), 1155–1177. https://doi.org/10.1108/sampj-12-2021-0515

Winschel, J., & Stawinoga, M. (2019). Determinants and effects of sustainable CEO compensation: a structured literature review of empirical evidence. *Management Review Quarterly*, *69*(3), 265–328. https://doi.org/10.1007/s11301-019-00154-9

Zhou, G., Liu, L., & Luo, S. (2022). Sustainable development, ESG performance and company market value: Mediating effect of financial performance. *Business Strategy and the Environment*, *31*(7), 3371–3387. https://doi.org/10.1002/bse.3089

Zhu, C., Liu, X., Chen, D., & Yue, Y. (2024). Executive compensation and corporate sustainability: Evidence from ESG ratings. *Heliyon*, *10*(12), e32943. https://doi.org/10.1016/j.heliyon.2024.e32943

APPENDIX

APPENDIX A: USE OF AI TOOLS

For this thesis I used Chat GPT to make the data practices in R more understandable. ChatGPT assisted me in understanding errors which were given during the testing of the data, write code for cleaning up the data, and made written code on testing the assumptions more clear.

APPENDIX B: SUMMARY ESG SCORE OVER THE YEARS

Year	Mean	Standard deviation	Median	IQR	Min	Max	Missing
2014	53.61	19.74	53.58	30.38	1.02	92.89	0
2015	56.50	19.16	57.28	27.88	3.55	93.51	0
2016	58.27	18.50	59.26	25.90	3.82	92.21	0
2017	60.95	17.22	62.05	23.11	7.00	95.68	0
2018	63.80	16.79	65.13	23.30	6.84	94.95	0
2019	65.83	15.64	67.28	21.32	9.09	95.27	0
2020	68.04	15.07	70.19	19.27	9.51	95.00	0
2021	68.73	14.68	71.37	18.59	10.05	94.71	0
2022	69.04	14.36	71.22	18.53	8.29	95.90	0
2023	68.34	14.29	70.31	18.22	9.92	94.70	0

APPENDIX C: SUMMARY ROE OVER THE YEARS

Year	Mean	Standard deviation	Median	IQR	Min	Max	Missing
2014	15.11	81.62	11.70	14.00	-712.28	1,692.88	0
2015	17.91	120.36	11.73	13.58	-209.69	2,409.86	0
2016	15.58	71.00	12.14	13.07	-334.54	1,765.00	0
2017	30.01	342.10	13.31	12.44	-420.26	8,905.61	0
2018	14.60	48.84	12.13	12.25	-506.31	1,078.07	0
2019	13.80	31.74	11.33	12.21	-90.23	641.97	0
2020	4.05	38.00	7.11	14.22	-366.14	265.79	0
2021	12.81	31.02	12.89	14.67	-268.12	189.07	0
2022	11.45	47.87	12.38	14.57	-979.74	282.17	0
2023	12.37	39.35	11.79	13.30	-348.48	703.78	0

APPENDIX D: SUMMARY ROA OVER THE YEARS

Year	Mean	Standard deviation	Median	IQR	Min	Max	Missing
2014	6.10	12.69	4.68	6.82	-53.22	269.11	0
2015	5.62	13.37	4.85	7.08	-122.06	266.67	0
2016	5.84	13.25	5.04	6.40	-137.45	267.24	0
2017	6.80	13.38	5.34	6.58	-138.23	241.29	0
2018	6.07	12.16	4.70	6.55	-51.03	253.09	0
2019	5.88	11.48	4.55	6.59	-57.59	221.72	0
2020	2.76	9.11	2.50	5.70	-68.17	86.95	0
2021	5.94	10.53	5.20	7.44	-109.60	139.40	0
2022	5.41	14.21	4.59	6.82	-205.15	190.43	0
2023	4.60	14.24	4.41	6.02	-204.40	196.57	0

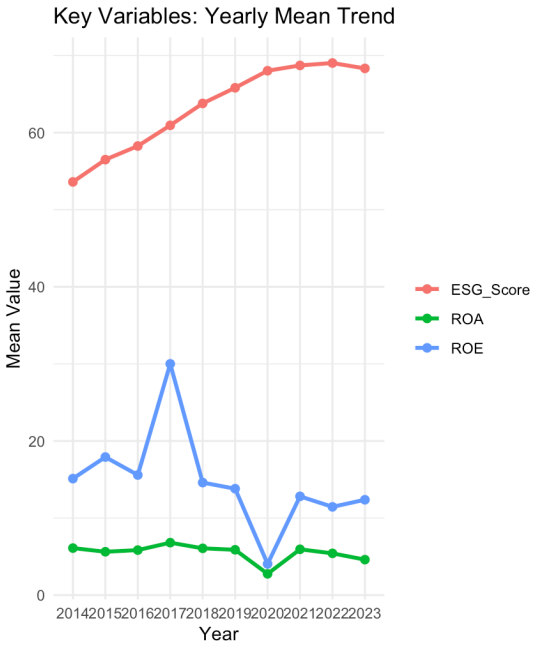


FIGURE 2: VISUALIZATION OF THE MAIN TREND OF THE KEY VARIABLES

In figure 2 the key variable trends are visualized. The visualization is made in R.

APPENDIX E: SUMMARY BOARD INDEPENDENCE OVER THE YEARS

Year	Mean	Standard deviation	Missing
2014	52.16	24.57	3
2015	53.98	24.39	3
2016	55.96	24.07	2
2017	58.23	24.00	1
2018	59.49	23.82	0
2019	60.07	23.32	0
2020	59.92	23.29	0
2021	60.73	22.66	0
2022	61.64	22.35	0
2023	61.61	22.49	0

APPENDIX F: SUMMARY BOARD SIZE OVER THE YEARS

Year	Mean	Standard deviation	Missing
2014	11.18	4.12	3
2015	11.07	3.99	3
2016	11.03	3.87	2
2017	11.05	3.84	1
2018	11.03	3.76	0
2019	10.90	3.61	0
2020	10.94	3.60	0
2021	10.89	3.57	0
2022	10.92	3.53	0
2023	10.86	3.43	0

APPENDIX G: SUMMARY FIRM SIZE OVER THE YEARS

Year	Mean	Standard deviation	Missing
2014	15.83	1.79	1
2015	15.92	1.76	0
2016	15.96	1.77	0
2017	15.98	1.75	0
2018	16.01	1.73	0
2019	16.09	1.73	1
2020	16.11	1.74	1
2021	16.19	1.75	0
2022	16.27	1.73	0
2023	16.25	1.75	0

APPENDIX H: SUMMARY LEVERAGE OVER THE YEARS

Year	Mean	Standard deviation	Missing
2014	58.09	22.17	2
2015	58.24	22.05	0
2016	58.04	22.37	0
2017	58.43	22.50	3
2018	58.70	22.23	3
2019	59.43	21.99	3
2020	59.54	22.61	4
2021	58.60	22.75	0
2022	58.04	22.85	2
2023	58.62	24.74	4

APPENDIX I: SUMMARY R&D EXPENDITURE (RESEARCH) OVER THE YEARS

Year	Mean	Standard deviation	Missing
2014	470,067.7	1,534,947	403
2015	509,144.5	1,653,902	401
2016	488,242.8	1,355,899	399
2017	467,653.3	1,241,764	402
2018	480,326.7	1,269,999	401
2019	507,911.3	1,339,694	400
2020	503,428.1	1,341,402	403
2021	535,672.1	1,402,294	408
2022	611,032.7	1,610,054	408
2023	637,264.6	1,642,611	408

APPENDIX J: SUMMARY EBITDA_MARGIN OVER THE YEARS

Year	Mean	Standard deviation	Missing
2014	25.89	102.11	4
2015	24.57	84.73	2
2016	25.57	105.33	0
2017	15.79	325.64	0
2018	9.49	326.50	0
2019	12.82	294.44	1
2020	0.10	422.64	1
2021	3.46	507.14	0
2022	13.14	212.14	1
2023	8.22	276.31	1

APPENDIX K: TESTING OF ASSUMPTIONS OF THE OLS MODEL

The first assumption of the OLS model is: dependent variables must be measured at interval level. When data handling for the measurement of variables, the notion was made that the variable year is currently a character vector, which should be a numeric vector for time-based analysis. This was adjusted. Furthermore, another possible problem is the research (R&D expenditures) variable, because of the large amount of missing, which is why this variable should be used with caution. The rest of the data is appropriate for the OLS model.

The second assumption of the OLS model is that for each value of the independent variables, the mean value of the error term should be 0. This assumption looks at the model itself, seeing if it is correctly specified, there are no omitted variables, and the independent variables do not systematically predict the error. The assumption can't be tested. This means that theoretically speaking the model should make sense. The model used in this research is based on models used in other research (Adu et al., 2023; Haque & Ntim, 2020). As this research is successful, and the variables in this research look appropriate, this assumption is deemed appropriate.

The third assumption of the OLS model is homoscedasticity. Here the check is made if the variance of the residuals are constant across all levels of the independent variables. The following are the test results:

TABLE K.1: BREUSCH–PAGAN TEST FOR HETEROSCEDASTICITY

Model	BP Statistic	df	p-value
ROA	577.471	70	0.0000
ROE	80.900	70	0.1754

As can be seen here, the ROA model has heteroscedasticity, while the ROE model is correct. The test is also conducted for the models without the variable research:

TABLE K.2: BREUSCH–PAGAN TEST FOR HETEROSCEDASTICITY WITHOUT RESEARCH

Model	BP Statistic	df	p-value
ROA	667.064	84	0
ROE	258.556	84	0

As can be seen in this table, now both models have heteroscedasticity in them. This problem is fixed by adding heteroscedasticity-robust standard errors.

The fourth assumption of the OLS model is: there is no autocorrelation. This assumption tests if the error terms of observations are not correlated. The test was first conducted for the models with the variable Research included:

TABLE K.3: DURBIN–WATSON TEST FOR AUTOCORRELATION

Model	DW Statistic	p-value
ROA	1.201	0
ROE	1.271	0

As can be seen in this table, both models show positive autocorrelation, which should be fixed. The test was conducted for the models without the variable Research as well:

TABLE K.4: DURBIN–WATSON TEST FOR AUTOCORRELATION WITHOUT RESEARCH

Model	DW Statistic	p-value
ROA	0.701	0
ROE	1.751	0

Both these models also display positive autocorrelation. This is adjusted by using Newey-

West heteroscedasticity- and autocorrelation- consistent (HAC) robust standard errors.

The fifth assumption of the OLS model is: each independent variable is uncorrelated with the error term. This assumption is connected to possible omitted variable bias, and therefore more of a theoretical assumption, but there are some tests you can run to check the assumption none the less. The Wu–Hausman test confirms that ESG_Score is endogenous ($p < 0.001$). The instrument, Industry_ESG_Avg, is strong ($F = 956.51$). We therefore rely on the IV model to estimate the causal effect of ESG on firm performance.

APPENDIX L: INDUSTRY AND COUNTRY DUMMY VARIABLE RESULTS FOR ROA TEST

Variable	Estimate	Std. Error	P-value	Significance
IndustryAutomobiles & Auto Parts	3.9451	1.2307	0.0014	***
IndustryBeverages	-0.9515	1.6336	0.5603	
IndustryBiotechnology & Medical Research	-18.8554	2.0506	0.0000	***
IndustryChemicals	3.6808	1.1407	0.0013	***
IndustryCommunications & Networking	4.9090	1.9198	0.0106	**
IndustryComputers, Phones & Household Electronics	1.4123	1.8690	0.4499	
IndustryConstruction & Engineering	1.8283	1.4982	0.2224	
IndustryConstruction Materials	1.6389	1.7517	0.3496	
IndustryConsumer Goods Conglomerates	-1.9800	2.1234	0.3512	
IndustryContainers & Packaging	4.5082	1.6737	0.0071	***
IndustryDiversified Retail	-11.7677	4.9158	0.0167	**
IndustryElectrical Utilities & IPPs	0.6026	1.5728	0.7016	
IndustryElectronic Equipment & Parts	2.9987	1.5536	0.0537	*
IndustryFood & Tobacco	2.8331	1.3097	0.0306	**
IndustryHealthcare Equipment & Supplies	4.2022	1.3939	0.0026	***
IndustryHealthcare Providers & Services	1.8823	1.9743	0.3405	
IndustryHolding Companies	-4.6329	2.0169	0.0217	**
IndustryHomebuilding & Construction Supplies	5.2617	1.7163	0.0022	***
IndustryHotels & Entertainment Services	-1.7263	1.9429	0.3743	

Variable	Estimate	Std. Error	P-value	Significance
IndustryHousehold Goods	4.3183	2.0061	0.0314	**
IndustryMachinery, Equipment & Components	3.8344	1.0688	0.0003	***
IndustryMedia & Publishing	2.0897	1.9944	0.2948	
IndustryMetals & Mining	1.1780	1.1898	0.3222	
IndustryMultiline Utilities	-1.7846	1.5820	0.2594	
IndustryOil & Gas	0.7318	1.3566	0.5897	
IndustryOil & Gas Related Equipment and Services	-2.5004	1.4640	0.0878	*
IndustryPaper & Forest Products	14.8439	3.1119	0.0000	***
IndustryPassenger Transportation Services	2.3273	2.9598	0.4318	
IndustryPersonal & Household Products & Services	4.5590	1.4750	0.0020	***
IndustryPharmaceuticals	5.5164	1.2683	0.0000	***
IndustryProfessional & Commercial Services	3.8659	1.4051	0.0060	***
IndustryReal Estate Operations	1.1157	5.0303	0.8245	
IndustryRenewable Energy	-5.7230	2.9603	0.0533	*
IndustrySemiconductors & Semiconductor Equipment	5.3711	1.5887	0.0007	***
IndustrySoftware & IT Services	3.6785	1.2668	0.0037	***
IndustrySpecialty Retailers	1.8998	2.3166	0.4122	
IndustryTelecommunications Services	0.4730	1.2918	0.7143	
IndustryTextiles & Apparel	4.1294	1.4880	0.0056	***
IndustryTransport Infrastructure	2.0426	2.0002	0.3072	

Variable	Estimate	Std. Error	P-value	Significance
IndustryWater & Related Utilities	-3.2632	1.7837	0.0674	*
CountryBE	1.8795	1.6077	0.2425	
CountryCH	1.2153	1.3728	0.3761	
CountryCZ	1.9292	3.6471	0.5969	
CountryDE	0.8979	1.3434	0.5039	
CountryDK	10.6017	1.6097	0.0000	***
CountryES	2.0763	1.5321	0.1755	
CountryFI	1.0867	1.3202	0.4105	
CountryFR	0.1186	1.3484	0.9299	
CountryGB	2.3003	1.2510	0.0661	*
CountryGR	4.3701	3.1676	0.1678	
CountryHU	1.0893	2.6033	0.6757	
CountryIE	2.3747	1.8958	0.2105	
CountryIT	-1.4635	1.5595	0.3481	
CountryLU	6.6528	2.5101	0.0081	***
CountryNL	0.2637	1.4479	0.8555	
CountryNO	1.8647	1.6215	0.2503	
CountryPL	-3.1054	2.5349	0.2207	
CountryRU	-2.7134	3.3760	0.4216	
CountrySE	2.1684	1.4134	0.1251	

Variable	Estimate	Std. Error	P-value	Significance
CountryTR	9.2040	1.7526	0.0000	***

$R^2 = 0.5026$

Number of observations = 691

* Statistical significance at 10% level

** Statistical significance at 5% level

*** Statistical significance at 1% level

APPENDIX M: INDUSTRY AND COUNTRY DUMMY VARIABLE RESULTS FOR ROE TEST

Variable	Estimate	Std. Error	P-value	Significance
IndustryAutomobiles & Auto Parts	26.0821	7.1939	0.0003	***
IndustryBeverages	11.8210	9.5491	0.2159	
IndustryBiotechnology & Medical Research	-17.2770	11.9863	0.1496	
IndustryChemicals	22.6782	6.6679	0.0007	***
IndustryCommunications & Networking	35.3441	11.2220	0.0017	***
IndustryComputers, Phones & Household Electronics	14.8795	10.9250	0.1733	
IndustryConstruction & Engineering	5.0465	8.7572	0.5645	
IndustryConstruction Materials	18.8310	10.2394	0.0660	*
IndustryConsumer Goods Conglomerates	-0.4433	12.4117	0.9715	
IndustryContainers & Packaging	29.0445	9.7831	0.0030	***
IndustryDiversified Retail	-21.6365	28.7342	0.4515	
IndustryElectrical Utilities & IPPs	14.8716	9.1936	0.1059	
IndustryElectronic Equipment & Parts	17.9562	9.0814	0.0481	**
IndustryFood & Tobacco	20.3100	7.6553	0.0080	***
IndustryHealthcare Equipment & Supplies	27.4946	8.1480	0.0007	***
IndustryHealthcare Providers & Services	16.9934	11.5402	0.1410	
IndustryHolding Companies	-0.0866	11.7895	0.9941	
IndustryHomebuilding & Construction Supplies	28.6719	10.0321	0.0043	***

IndustryHotels & Entertainment Services	-0.9394	11.3569	0.9341	
IndustryHousehold Goods	29.5585	11.7261	0.0118	**
IndustryMachinery, Equipment & Components	20.9402	6.2476	0.0008	***
IndustryMedia & Publishing	22.1584	11.6578	0.0574	*
IndustryMetals & Mining	14.0475	6.9550	0.0435	**
IndustryMultiline Utilities	-5.7093	9.2474	0.5370	
IndustryOil & Gas	12.2345	7.9300	0.1230	
IndustryOil & Gas Related Equipment and Services	7.5338	8.5578	0.3788	
IndustryPaper & Forest Products	55.9325	18.1898	0.0021	***
IndustryPassenger Transportation Services	7.0086	17.3009	0.6854	
IndustryPersonal & Household Products & Services	18.8227	8.6218	0.0291	**
IndustryPharmaceuticals	31.5643	7.4135	0.0000	***
IndustryProfessional & Commercial Services	15.4364	8.2133	0.0603	*
IndustryReal Estate Operations	-1.7240	29.4038	0.9532	
IndustryRenewable Energy	-8.7769	17.3038	0.6120	
IndustrySemiconductors & Semiconductor Equipment	29.2969	9.2867	0.0016	***
IndustrySoftware & IT Services	24.6720	7.4046	0.0009	***
IndustrySpecialty Retailers	17.1154	13.5412	0.2064	
IndustryTelecommunications Services	50.0025	7.5508	0.0000	***
IndustryTextiles & Apparel	25.6367	8.6980	0.0032	***
IndustryTransport Infrastructure	26.6892	11.6919	0.0225	**

IndustryWater & Related Utilities	5.4280	10.4260	0.6027	
CountryBE	9.5826	9.3978	0.3080	
CountryCH	6.6808	8.0243	0.4052	
CountryCZ	0.3360	21.3183	0.9874	
CountryDE	5.1359	7.8527	0.5131	
CountryDK	21.4124	9.4090	0.0229	**
CountryES	10.2977	8.9554	0.2503	
CountryFI	-2.9724	7.7172	0.7001	
CountryFR	1.4873	7.8817	0.8503	
CountryGB	13.2777	7.3127	0.0695	*
CountryGR	14.2715	18.5159	0.4409	
CountryHU	11.2836	15.2169	0.4584	
CountryIE	11.7098	11.0816	0.2907	
CountryIT	-13.1510	9.1156	0.1492	
CountryLU	22.6580	14.6723	0.1226	
CountryNL	-2.2830	8.4636	0.7874	
CountryNO	1.7931	9.4783	0.8500	
CountryPL	-26.9897	14.8176	0.0686	*
CountryRU	-12.6536	19.7339	0.5214	
CountrySE	5.4876	8.2615	0.5066	
CountryTR	26.5702	10.2442	0.0095	***

$R^2 = 0.03615$

Number of observations = 691

* Statistical significance at 10% level

** Statistical significance at 5% level

*** Statistical significance at 1% level