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Assessing the Impact of ESG Performance on Financing Costs:

An Analysis of Nordic Firms

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Abstract

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Key words: ESG, cost of capital, Nordics, Socially responsible investing, financial theory.

Purpose: The motivation behind this study is to explore the relationship between ESG performance and the cost of capital in corporate finance. It aims to determine if firms with higher ESG scores have lower financing costs in the Nordics, filling a gap in sustainable finance literature. The study's contribution is to provide insights that inform investors, policymakers, and companies about the potential financial impacts of integrating sustainability into strategic decisions.

Methodology: Panel data regression methods; fixed effect regression method as the main modelling choice.

Theoretical perspectives: The fundamental financial theories that form the theoretical framework and build the analysis on are: agency theory, stewardship theory, stakeholder theory, legitimacy theory, and signaling theory.

Empirical foundation: The study consists of 2308 firm-year observations from 570 publicly listed Nordic firms from 2017 to 2022.

Conclusions: We conclude that the ESG score and cost of capital have a statistically significant but economically marginal relationship in the Nordic region. However, contrary to the predominant findings of the empirical literature reviewed in this study, this relationship is positive rather than negative. Additionally, the hypothesized key drivers—namely firm size, industry, and governance effects—did not demonstrate the expected influence. In fact, the findings and analysis suggest that these factors are either statistically insignificant or opposed to the proposed hypotheses.

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1. Introduction

“Every company and every industry will be transformed by the transition to a net zero world. The question is, will you lead or will you be led?” – Laurence D. Fink, 17 January 2022 (CEO letter, 2022). Climate change, accelerated by the human species, is arguably one of the most profound and acute global challenges for mankind (UN, 2024). There is an urgent need to address the climate crisis call for action from both individuals, corporations, and policymakers. Sustainable investments are a growing market due to increasing concern for ESG issues, as noted by KeyESG (2024). Hence, it is not a surprise that Corporate Social Responsibility (CSR), Socially Responsible Investing (SRI), and the later introduced concept of Environmental, Social, and Governance (ESG) have gained considerable popularity during the 21st century.

In response to the critical need for CSR, ESG reporting demands firms’ improved transparency regarding environmental (E), social (S), and governance (G) factors. This transparency is no longer driven solely by a few activist investors, now, a wide range of investors are insisting on comprehensive ESG reporting from companies (Nelson, 2022). As a consequence, firms have started to focus on non-financial performance disclosure to answer to the growing interest from investors, as revealed in a PwC Report (2021) – 79 percent of investors prioritize ESG reporting in their decisions. Another financing option, besides equity, is debt financing. In line with the increasing attention from investors to consider firm’s ESG performance, a Bloomberg article outlines that growing incentives from regulators urging banks to consider the ESG impacts. Namely their transactions have resulted in a large number of banks adopting more responsible principles for lending activities (Poh, 2022). Based on these trends from both equity investors and debt financiers, understanding the relationship between ESG performance and cost of capital can provide insights into the financial benefits of sustainable practices, potentially leading to lower costs of capital. This area of research holds significant relevance in today's market, where sustainable finance is becoming fundamental to corporate strategy and investor decision-making.

This study aims to investigate the relationship between ESG performance and the cost of capital in the Nordics – Denmark, Finland, Iceland, Norway, and Sweden. The Nordic region is particularly interesting due to its apparent commitment to sustainability and social responsibility (Nordic Co-operation, 2024), as all Nordic countries perform among the top ten in the world based on their total progress towards achieving all 17 Sustainable Development Goals (SDGs) (SDG, 2024). Nordics are considered role models and influence the rest of the world due to their high living standards, consisting of governance, equality, and social and economic policy (Brezis et al., 2018). These elements, accompanied by divergent findings throughout the empirical literature that will be reviewed, make the Nordics a viable population for this study. Europe, particularly the Nordics, is often at the forefront of implementing sustainability principles. For instance, Valtioneuvosto (2022) reported that Finland enacted the Climate Change Act in response to global climate concerns in 2022, as the country aims to be carbon neutral by 2035. Exploring the relationship between ESG performance and cost of capital within this context could provide insights that are both regionally relevant and globally applicable. ESG practices are often perceived as strategies for companies to enhance their appeal to stakeholders by responsibly contributing to shareholder value creation.

ESG performance has attracted significant academic interest and is widely discussed and debated in public forums. However, the specific impact of ESG performance on the cost of capital is an area with the possibility for further academic exploration. Understanding the relationship can show how sustainable practices influence financial metrics and investor decisions. Arguably, improving ESG scores is vital for a sustainable future and can potentially enhance value creation, aligning with the core nature of financial markets. This study problematizes whether ESG strategies can support both sustainability and financial performance. To address this, the study aims to critically examine ESG performance's complex relationship with the cost of capital in the Nordic region and identify how related economic theories could explain this relationship.

1.1 Background – ESG

ESG represents the three critical pillars through which CSR is assessed and rated. According to Li et al. (2021), the concept of ESG was formally proposed in 2004 when the United Nations (UN) Global Compact drafted a report encouraging companies to incorporate ESG into financial analysis, security brokerage, and asset management. Eccles et al. (2020) examined the evolution of ESG by outlining the journey of two large ESG data providers, KLD and Innovest. They argued that SRI and CSR have early roots in the late 19th century and have evolved over decades, with ESG emerging as a significant trend in 2004. Eccles et al. (2020) noted that the focus has shifted from value-driven SRI to financially value-driven ESG in the 21st century.

There is no single, widely accepted definition of ESG, highlighting the need to examine multiple interpretations of the concept. Xiao et al. (2022) defined ESG as rooted in CSR, emphasizing its performative nature compared to CSR. They argued that ESG denotes corporations' ability to remain stable during economic fluctuations and events. Li et al. (2021) emphasized the national-level implementation of ESG, deriving their definition from the UN Global Compact, which contextualizes ESG as managing risks and opportunities related to emerging environmental and social trends, combined with rising public expectations for better accountability and corporate governance.

Clément et al. (2023) provided a comprehensive review of how ESG is employed across the empirical literature. They found no widely recognized definition but identified five thematic definitions: sustainability, CSR, disclosure, finance, and ESG score analysis. Clément et al. (2023) cautioned that ESG scores, while offering a quantitative assessment of a company's efforts to protect its environment and social landscape, do not fully encapsulate all underlying issues regarding E, S, and G aspects.

The ESG score is a composite measure constructed from three distinct pillars: E, S, and G as outlined by Li et al. (2021). The E pillar assesses a company's impact on the environment, including factors like greenhouse gas emissions, pollution, waste management, energy consumption and efficiency, and green innovation. The S pillar evaluates a company's engagement with its stakeholders, such as employees, suppliers, shareholders, customers, and communities. It covers workforce-related issues, community impact, health and safety, and diversity concerns. The G pillar includes matters that affect a company's performance or solvency, such as board diversity, board composition, executive compensation, regulatory and compliance issues, accountability, transparency, and disclosure. By integrating these pillars, ESG provides a holistic view of a company's sustainable practices and governance, though it remains a complex and sometimes contentious framework.

In conclusion, ESG criteria provide a comprehensive framework for evaluating a firm's impact on its stakeholders, governance practices, and the broader world. However, ESG is an evolving concept under continuous evaluation, with recent controversies highlighted by Thomson Reuters (2022). These include ESG's stability under macroeconomic shocks, its politicization, the uneven international regulatory landscape, and greenwashing issues, which have been vital criticisms of socially responsible investing.

1.2 European Union Regulatory Influences on Sustainable Financing

When examining the relationship between ESG and the cost of capital in the Nordics, it is also important to consider the regulatory and compliance framework affecting governance practices and policies at the country, industry, and firm levels. To illustrate these regulatory influences, a timeline featuring the most important initiatives regarding the scope of this study is compiled.

The European Union's Non-Financial Reporting Directive (Directive, 2014) was put into practice in December 2014 with the strategy to motivate and encourage CSR in the European Union (EU). The Directive (2014) aims to provide stakeholders, including investors, consumers, and policymakers, with a clearer picture of the non-financial performance of large companies, thereby promoting sustainable economic growth. Subsequent to the Directive (2014), the UN published a report (2015a), which outlined the SDGs to act as objectives for countries, communities, and companies, which should be met before 2030.

The Paris Agreement (UN, 2015b), established under the UN Framework Convention on Climate Change, was adopted in 2015. It underlines the global commitment to preventing climate change and pursuing a sustainable, low-carbon future. The Agreement outlines national commitments to reduce greenhouse gas emissions, adapt to the impacts of climate change, and support developing countries in their climate change mitigation and adaptation efforts.

The European Green Deal (EGD) is a strategy proposed by the European Commission in 2019, which comprises several strategies, initiatives, and legislative acts that promote the sustainable and inclusive transformation of the European economy and society (Fetting, 2020). The EGD features eight key areas; their key areas/goals are meant to be achieved by revising the old and introducing new EU-level legislation.

1.3 Purpose

The purpose of this study is to gain more profound knowledge of corporate finance, specifically the relationship between ESG performance and the cost of capital. The authors are captivated by the evolving dynamics between sustainability and finance, which were historically viewed as exclusive entities but are now increasingly interrelated and a prominent focus in a financial context. Despite the growing importance of ESG factors, there remains a contentious debate on their impact on a company's cost of capital. Therefore, this study aims to identify if ESG performance influences financing costs in the Nordics and whether firms with higher ESG scores have a lower cost of capital compared to their counterparts.

Further, it seeks to fill a gap in the current literature in the area of sustainable finance, where the Nordics could be more represented. The findings are expected to enrich the academic discourse by providing evidence-based insights into the financial implications of ESG practices and contributing to the discussion regarding the complexity of ESG in relation to the cost of capital. Thereby informing investors, policymakers, and companies about the benefits of integrating sustainability into their strategic decisions. This study aims to answer the following research questions:

1. Is there an observable relationship between a firm's ESG score (performance) and its cost of capital in the Nordic region?

2. Do firms in the Nordic region with higher ESG scores benefit from lower financing costs compared to their counterparts, and what are the key drivers in this relationship?

1.4 Structure of the study

Table 1, Structure of the study

Chapter	**Description**
Introduction	The study's background and purpose are provided and motivated. Fundamental concepts of ESG and related regulatory frameworks are introduced.
Empirical Literature	The relevant findings from earlier research will be presented, and hypotheses will be formulated.
Theories	Relevant theories and the theoretical framework will be demonstrated to understand the connection to the study.
Methodology	A walkthrough of how the data is gathered, cleaned, and processed, as well as an explanation of the variables, will be carried out. The models and their validity and reliability will be evaluated through robustness checks. The conceptual framework will be presented.
Regression Results	A collection of the regression results are presented and the hypotheses will be tested.
Analysis	The results from the previous chapter and the findings from the theories and literature through the hypotheses will be interconnected, interpreted, and analyzed.
Conclusion	The study will be concluded and critically evaluated. Research questions will be answered.
Limitations and Future Research	The research limitations will be presented, and possible avenues for future research will be suggested.

2. Empirical Literature

This chapter aims to give a detailed review of relevant empirical literature. The articles reviewed are compiled into a comprehensive table featuring key points relevant to this study. Ultimately, the hypotheses are presented based on previous studies examined in the literature review.

2.1. Literature Review

The empirical literature review is divided into three subchapters – weighted average cost of capital (WACC), cost of debt (kD), and cost of equity (kE) – to explore the academic discourse on ESG policies and practices for different pillars of firms' capital structure.

The relevance of CSR and ESG is continually increasing in both public discourse and academic research. Before the 21st century, the empirical research regarding the topic was mainly focused on CSR, and when ESG reporting was introduced at the beginning of the 21st century, academia got something tangible to measure the level of CSR with, driving the focus from CSR to more quantifiable ESG. In this study, ESG is interpreted to be a numerical representation of firms' implementation of CSR policies and practices. The selected literature will examine prior empirical literature on ESG disclosure and performance, focusing on the cost of capital perspective, while featuring other components like industry specifications and firm performance.

2.1.1 Cost of Capital

Sharfman and Fernando (2008) examined the relationship between environmental risk management and WACC. Due to inadequate data, the final sample only consisted of the year 2001. The dependent variables used in the study were WACC, kD, and kE, and the main independent variable was the environmental risk management score. They found that higher environmental risk level management lowers the sample firms' kE, subsequently increasing their ability to shift from debt financing to equity financing. Furthermore, contrary to their prior expectations, they suggested a statistically significant positive relationship between the kD and environmental risk management level. One interpretation that Sharfman and Fernando (2008) provided for this positive relationship is that debt markets might punish firms that engage in environmental risk management beyond the necessary compliance levels.

To gain a perception of ESG disclosure with the WACC from an industry perspective, Johnson (2020) examined the link between ESG disclosure and the WACC in South Africa, focusing on industry-level differences. Johnson (2020) argued that there are differences in ESG disclosure's effect on WACC, kD, and kE between industries. The author found that ESG disclosure has a significant positive relationship with WACC in the industrial sector. Furthermore, Johnson's (2020) findings suggest a significant negative relationship between ESG disclosure and WACC in the consumer goods and consumer services section. This industry-specific grouping is an interesting viewpoint, as it suggests that firms operating in the supply chain closer to the end customers benefit from increased ESG disclosure. At the same time, companies in the industrial sector have negative consequences from increased ESG disclosure. Although comparing emerging markets to developed markets directly does not offer many economically sound comparisons, it might provide context on how different industries are viewed in terms of capital providers.

To widen the ESG disclosure perspective, Gjergji et al. (2021) inspected the relationship between ESG disclosure and WACC in small- and medium-sized enterprises (SMEs) compared to large enterprises and with similar peers that are family firms. The findings were that SMEs do not benefit from non-financial disclosure, resulting in SMEs having a higher WACC than larger firms or SMEs with a family structure (Gjergji et al., 2021). Building on this, it could be argued that ESG performance has different implications based on the size of the firm and structure, and when examining the effects of ESG performance and WACC, the size and structure grouping should not be overlooked.

To understand the impact of the E on the composite ESG score in Europe, Mariani et al. (2021) studied the relationship between corporate environmental policies and the WACC in European companies. The environmental commitment was measured by emission scores derived from a firm's emission levels regarding its operations and processes. They found a significant negative relationship between environmental commitment and WACC, as a 10-point increase in the emission score accounts for, on average, a 4,4 basis point decrease in the WACC.

Narrowing the focus on a singular sector, Nazir et al. (2022) investigated the connection between the WACC and the ESG performance of global tech firms to gain a more profound understanding of the WACC, separating it into the variables of kE and kD. They found a significant positive relationship between ESG scores on the kE and the kD. Nazir et al. (2022) continued to extend their analysis of the positive relationship between ESG scores and WACC by pointing out that the ESG score is not a viable proxy for technology sector investors to evaluate a company due to information asymmetry problems and the demand for a higher return when investing in a riskier industry.

2.1.2 Cost of Debt

To investigate the ESG performance and disclosure for the kD, Yasser et al. (2021) empirically investigated whether lending institutions in the EU reward firms for their ESG practices and disclosure in terms of lowering their kD. Yasser et al. (2021) used kD as a dependent variable, and E, S, and G as the main independent variables. These pillars are featured in the regressions from the perspectives of performance (effective commitment to ESG strategies) and disclosure (an effort to construct an image of commitment for shareholders). Contrary to Sharfman and Fernando's (2008) findings of a positive relationship between ESG score and kD, Yasser et al. (2021) found a negative relationship - they argued that lending institutions reward firms with lower financing costs for increased ESG performance and disclosure. However, they could not distinguish this relationship from individual perspectives and stated that this finding can only be observed when coupling performance and disclosure.

To examine the relationship between the ESG score and the kD to broaden the depth of its impact, Alves and Meneses (2024) provided a statistically and economically significant negative relationship between the ESG score and the kD. They discussed that depending on how the risk is measured, a relationship between ESG score and financial risk and have different outcomes. Furthermore, Alves and Meneses (2024) highlighted that with volatility and Merton DD as a risk proxy, the higher the ESG score the firms have, the lower their kD is. However, with accounting information and Altman's Z-score as a proxy, a higher ESG score leads to increased financial risk, which concludes the unreliability to use ESG score as a substitute for measuring risk.

2.1.3 Cost of Equity

Investigating the kE solely and using CSR as a proxy, El Ghoul et al. (2011) examined how CSR affects the kE in the U.S. They hypothesized a negative relationship between CSR scores and WACC due to CSR's potential influence on investor perceptions and firm risk profiles. El Ghoul et al. (2011) found that firms posting higher CSR scores have significantly lower kE, indicating that investors value responsible corporate practices. They also found that there was a noticeable growth in the observed result during the period and that key drivers in the reduction of the kE were environmental performance, employee relations, and product strategies. These findings suggest that focusing on CSR practices is not only ethically desirable but also financially beneficial.

Providing an alternative perspective for measuring sustainability practices, Ng and Rezaee (2015) empirically investigated the relationship between economic sustainability disclosure (ECON) and ESG sustainability dimensions and the kE. The investigation shows a negative relationship between ECON, ESG, and the kE. However, the results also suggested some inconclusive aspects, as Ng and Rezaee (2015) noted that the social dimension of ESG only marginally affects the WACC. In addition, they found a positive relationship between operational efficiency denoted by ECON and kE. Ng and Rezaee (2015) argued that this positive relationship might stem from different types of economic efficiencies and market perceptions.

Understanding the relationship between ESG score and the kE is vital for this study and is supplemented with a perspective of non-linearity in the relationship. Pellegrini et al. (2019) analyzed the interplay between ESG performance, kE, and profitability, offering insight into their collective effect on the firm's financial health. The main dependent variables were kE and Return on Assets (ROA). The research of Pellegrini et al. (2019) differentiates from other related literature by utilizing the Easton Model (2004) to calculate the ex-ante kE of the firms. The findings of their research were two-fold. First, they have a negative relationship between ESG score score and kE. This observed relationship is in line with previous research (El Ghoul et al., 2011; Sharfman & Fernando, 2008).

Pellegrini et al. (2019) illuminate the non-linear relationship between ESG performance and kE. This interesting finding implies that when a firm reaches a certain threshold of total assets, its ESG investments start to yield a higher kE. They find a similar relationship between ESG performance and ROA, as higher ESG performance yielded lower ROA for the companies.

In a different perspective on ESG policies and kE, Rojo-Suárez and Alonso-Conde (2023) examined the short-run and long-run effects of ESG policies on value creation and the kE of listed firms in Germany, Italy, France, and Spain. Rojo-Suárez and Alonso-Conde's (2023) findings suggested that the effect of the ESG policy on value creation and kE is two-fold. Firstly, they discovered a positive relationship between the long-run kE and ESG scores, indicating that higher ESG scores are value-destroying in the long run. They argued that this could be due to the substitution effect, where the market adjusts for firms' sustainable practices with a higher discount rate. The short-run impact is inconclusive, as Rojo-Suárez and Alonso-Conde (2023) found almost no effect on the short-run value creation concerning ESG scores.

2.2 Summary of the Empirical Literature

Table 2, summary of the empirical literature

Author(s), Year	Scope of the Research	Population and Sample	Time period	Firm year observations	Primary data source(s)	Main modelling choice	Observed relationship: ***(-) = negative*** ***(+) = positive*** ***(i) = inconclusive***
A. Sharfman & Fernando, (2008)	Environmental Risk Management and WACC	U.S, 267 firms	1972-2000	546	KLD	Hierarchical regression methods	(-) kE (+) kD (-) WACC
B. El Ghoul et al., (2011)	Examines the effect of CSR on the kE	U.S, 2809 firms	1992-2007	12915	KLD	Multivariate regression, with IVs and GMM	(-) kE
D. Ng & Rezaee., (2015)	Examines the individual and combined effects of the ECON and ESG sustainability dimensions on the kE.	Over 3000 firms in multiple industries	1990–2013	N/A	MSCI ESG STATS. Compustat and the Center for Research in Security Prices	two-stage-least-square (2SLS) regression clustered at firm and industry level	(-) kE (i) Operational efficiency (+), Social ESG dimensions, marginal relation with kE
F. Pellegrini et al., (2019)	The effect of ESG scores on kE and prof. on Oil & Gas ind.	182 public firms (not disclosed more accurately)	2002-2018	3094	Thomson Reuters Datastream	FE regression model	(-) kE (-) ROA (i) kE has a U-shaped, non-linear relationship
G. Johnson, R. (2020)	The link between ESG disclosure and the WACC	South Africa, 68 firms from the Johannesburg stock exchange	2011-2018	478	Bloomberg	Panel data regression	(-) WACC for consumer goods and services (+) WACC for industrial sector
H. Yasser et al., (2021)	ESG practices and kD	European Union, firms in 15 countries (other countries excluded due to a low number of obs.)	2005-2016	6018	Thomson Reuters Datastream, Bloomberg	Newey and West's (1987) standard error pooled regression	(-) kD (i) in terms of distinguishing performance and disclosure
I . Gjergji et al. (2021)	Relationship between SMEs and WACC	87 SME companies listed in AIM Borsa Italiana	2018	87 (Cross-sectional data)	Bloomberg, PMI Capital	Cross-Sectional multivariate regression	(+) WACC, SME compared to counterparts
J . Mariani et al. (2021)	Examining the impact of corporate environmental policies on the WACC	577 European companies listed in the Stoxx Europe 600 Index	2014–2018	2627	Bloomberg, Thomson Reuters Datastream	Panel data regression	(-) WACC
K . Nazir et al. (2022)	Impact of ESG score on WACC	64 Global tech firms	2010-2017	512	Thomson Reuters Datastream	Panel data, Random effect, GMMregression	(+) kE (+) kD (+) WACC
L . Rojo‑Suárez & Alonso‑Conde., (2023)	Analyzing the effects of ESG policies on value creation and the kE	Listed companies in Germany, France, Italy, and Spain.	2016-2020	1846	Refitiv Eikon, Refitiv Eikon Datastream	Panel data with dynamic Ohlson's model utilizing economic profit	(+) on the kE in the long term (i) on the short-run effects, as the effect is very minimal
M . Alves & Meneses, (2024)	Relationship between ESG score and kD	768 global listed companies in 10 sectors	2013-2022	6988	Thomson Reuters Datastream	Panel data regression	(-) kD

Note: a) The table is provided in chronological order b) kE is the cost of equity, kD is the cost of debt, and WACC is the Weighted Average Cost of Capital

2.3 Hypothesis Formulation

The following hypotheses are formulated based on the empirical literature that was reviewed earlier in this chapter. These hypotheses[1] are used as a tool to fulfill the purpose of this study as well as to answer the research questions presented in Chapter 1.

The first hypothesis looks at WACC. Since the WACC is a by-product of kE and kD, the logic behind H1 is built around H2 and H3, and the first hypothesis is written as follows:

H1: Firms in the Nordic countries with higher overall ESG scores demonstrate a lower weighted average cost of capital compared to their counterparts.

The second hypothesis investigates the relationship between ESG scores and the kD. Sharfman and Fernando (2008) found a positive relationship between environmental risk management and the kD. Yasser et al. (2021) found a negative relationship between the ESG score and the kD. However, they were unable to distinguish the separate effects of performance and disclosure scores. Nazir et al. (2022) found a positive relationship, while Alves and Menezes (2024), on the contrary, found a negative relationship. The most comparable studies to this study based on sampling and time period, respectively, are Yasser et al. (2021) and Alves and Menezes (2024). Based on the empirical literature and the public initiatives to promote sustainability at a governmental level, denoted by the Paris Agreement (UN, 2015b) and the EGD, analyzed by Fetting (2020), the second hypothesis is written as follows:

H2: Firms in the Nordic countries with higher overall ESG scores demonstrate a lower cost of debt compared to their counterparts.

The third hypothesis investigates the overall relationship between ESG performance and kE. Based on previous findings (Sharfman & Fernando, 2008; El Ghoul et al., 2011; Ng & Rezaee 2015; Pellegrini et al. 2019), a negative relationship between CSR and/or ESG performance and/or disclosure and kE was found. Contrary implications are provided by Nazir et al. (2022), who argued for a positive relationship between ESG performance and kE, and Rojo-Suárez and

[1] Null hypotheses are not presented; for clarity, alternative hypotheses are presented.

Alonso-Conde (2023), who found a positive relationship with the long-run kE. Building on the findings from empirical literature coupled with the presented financial theory and regulatory framework, the third hypothesis is written as follows:

H3: Firms in the Nordic countries with higher overall ESG scores demonstrate a lower cost of equity capital compared to their counterparts.

The fourth hypothesis investigates a potential research gap by examining polluting industries in the Nordic region. Pellegrini et al. (2019) research focused on the oil and gas industry by itself but did not provide any comparison between different industries. Mariani et al. (2021) investigated the impact of corporate environmental policies on WACC in Europe and found that environmental commitment lowered firms' WACC for both high and low-polluting industries. In addition, Johnson (2020) investigated how ESG disclosure affects the WACC, varying by industry, using a regional sample. Johnson (2020) argued that the relationship between ESG disclosure scores and the WACC is negative for consumer goods and services and positive for the industrial sector. The interpretation of stakeholder and legitimacy theories suggests that firms that focus on their ESG performance in polluting industries[2] would have more WACC benefits than firms operating in non-polluting sectors. The fourth hypothesis is written as follows:

H4: Firms in industries with higher inherent environmental risks demonstrate a stronger negative relationship between ESG score and WACC than their lower-risk counterparts. This effect is particularly pronounced in sectors such as energy, manufacturing, and transportation, where ESG practices can significantly mitigate operational and regulatory risks.

The fifth hypothesis is derived from the findings of Gjergji et al. (2021), who discovered that SMEs did not gain similar advantages in terms of reductions in the WACC to large enterprises when reporting comparable ESG scores. Similar findings are also noted by El Ghoul et al. (2011), who discussed that larger, more mature firms with higher analyst coverage may benefit from lower kE when putting emphasis on socially responsible behavior and CSR activities. In the

[2] The industries, denoted by TRBC industry sector code, were selected based on the listing of European Environment Agency (2024) and are following: Oil & Gas, Machinery, Tools and Heavy Equipment, Construction, Transportation Infrastructure, Metals & Mining, Freight & Logistics, Chemicals, and Construction materials

Nordic public company context, it would be intuitive that larger companies would reap more benefits from similar ESG scores than their smaller counterparts due to the potentially higher impact on E, S, and G issues. Furthermore, Alves and Meneses (2024) found statistically and economically significant evidence that the relationship between the ESG score and kD depends on the proxy selection. They found that when using the Altman Z-score, a proxy for predicting the likelihood of bankruptcy, the ESG score and kD have a positive relationship. Building on this, it would also be intuitive to think that larger firms have lower financial distress costs due to their capital adequacy. However, based on the inconsistent findings presented in the literature review, the fifth hypothesis is written as follows:

H5: In the Nordic countries, larger firms with higher ESG scores benefit from lower costs of capital more significantly than smaller firms with comparable ESG scores.

Ng and Rezaee (2015) examined an interesting viewpoint on how different ESG pillars affect the kE. To extend this analysis to the Nordic region, we will look at the cost of capital to capture the potential implications for all of the dependent variables used in the models. Furthermore, mirroring the regulatory influences, which all represent a relatively strong commitment to environmental issues. Achieving these goals or objectives imposed at a government level could be argued to be mostly governance-related matters at the firm level. This means that there could be potential misalignments in the environmental goals and the actual practices and policies undertaken in the governance structures of firms to achieve them. Based on this logic, the sixth hypothesis is written as follows:

H6: The governance pillar is the key driver in the relationship between environmental, social, and governance performance and the cost of capital in the Nordic region.

3. Theories

This chapter will present relevant financial theories. Firstly, the theories are visualized in a theoretical framework, further, each of the three layers – internal dynamics, external engagement, and market interactions – will be elaborated on. This theoretical framework serves as a foundation for further analysis in this study.

3.1. Theoretical Framework

The financial theory chapter is structured into three sections to highlight how the theories assigned to different sections try to predict organizational behavior and the associated outcomes. The internal dynamics explain the relationship between the shareholders and the management. Proceeding with the external engagement, highlighting the interactions beyond the core management-shareholder framework and engaging with a broader set of stakeholders. Lastly, the market interactions investigate how to align with societal expectations of the firms. This can be seen in Figure 1 and will be revisited in the analysis.

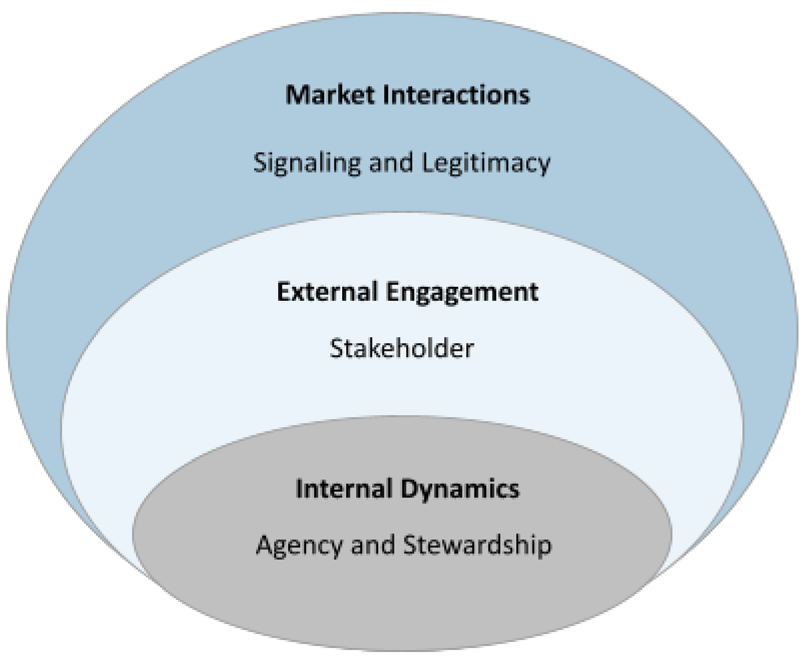

Figure 1. Interrelations among core financial theories in the context of ESG and cost of capital.

3.2 Financial Theories

3.2.1 Agency Theory

By investigating internal dynamics and governance issues, agency theory sets an understanding of the fundamental conflicts between shareholders and management. The agency theory was first mentioned by Jensen and Meckling (1976), which indicates the relationship between principals (shareholders) and agents (management) within the firm, where the management are engaged to perform tasks on behalf of the shareholders. Jensen and Meckling (1976) explain the definition of agency theory and the potential conflict of interest that can arise between management and shareholders, as well as the information asymmetry between shareholders and management. The management may have personal interests and goals that do not align with the interests and goals of the shareholders, and if a conflict occurs, the management does not make optimal decisions regarding the shareholders' viewpoint, which leads to agency costs. However, agency costs are a complex mechanism, and according to Jensen and Meckling (1976), zero agency costs is generally impossible.

Jensen and Meckling (1976) mention that the lack of trust from the conflict of interests might increase agency costs. Firstly, there might be an increase in monitoring expenditures by the shareholders, trying to monitor and control the management's actions. Secondly, by restricting the management investment opportunities and other bonding expenditures, for example, tightening the budget to ensure that the management has less excess cash to invest in value-destroying projects. Lastly, residual losses are the losses the shareholders make through management decisions. Adding to the agency theory, Srivastava and Anand (2023) exemplify that when the management makes investments in ESG activities that might not maximize the shareholders' value or do not align with the shareholders' interests, a conflict of interest might occur.

Based on agency theory, misaligned interests between management and shareholders on sustainability can lead to higher monitoring costs and increased agency costs. These costs can raise both the kE and, indirectly, the kD. Significant agency problems may cause management to shift financial and operational risks to avoid conflicts, affecting the company's financing, investment, and operations.

3.2.2 Stewardship Theory

To continue within the internal dynamics, the stewardship theory has a contradictive perspective from the agency theory, where Donaldson and Davis (1991) suggest that under certain psychological and situational conditions, managers act like stewards of the company. Therefore, they are motivated to act in the best interests of the principals, prioritizing organizational goals over personal gains. Furthermore, this alignment can lead to an increase in effectiveness and productivity and a decrease in information asymmetry (Donaldson & Davis, 1991). Adding and highlighting a different dimension of management behavior, the shareholders assume the managers act in the best interests of the shareholders, increasing the understanding of the internal dynamics.

Davis et al. (1997) add several insights into the stewardship theory and strengthen the perspective of the psychological and situational condition of the managers and the shareholders of how they behave and act. Davis et al. (1997) continue to talk about the relationship based on their behavior. If the management and shareholders have joint behavior and act in a mutual stewardship relationship, trust, involvement, collectivism, a lower power distance, and performance enhancements are increased.

In terms of WACC, stewardship theory implies that managers and shareholders with mutual behavior towards their relationship may change the capital structure due to an increase in trust and a performance enhancement, which may influence the WACC. This is discussed by Dumay et al. (2019), who argue that by adopting stewardship principles and practices, companies can influence their capital structure, investment attractiveness, and WACC through enhanced timeliness, fairness, trust, and a commitment to sustainable and responsible business practices.

Based on the prior analysis, it could be argued that the potential agency costs can be mitigated in firms where stakeholders see managers more as stewards than agents. In fact, the increased trust between the firm and its individual investors might lower the premium warranted by the shareholders, thus potentially lowering the kE. This phenomenon can be linked to ESG, where the stewardship interplay between parties positively affects not only non-financial reporting but also increases the freedom of management to choose mutually beneficial investment strategies.

3.2.3 Stakeholder Theory

The stakeholder theory expands the view beyond internal dynamics towards external engagement to understand the different dimensions of factors that may affect a firm. Freeman and McVea (2001) explain that the stakeholder theory enlightens the importance of management in addressing and emphasizing the interests of all stakeholders in a company, not just its shareholders. Furthermore, Freeman and McVea (2001) mentioned that research based on stakeholder management shows that firms achieve better outcomes, including sustainable success and ethical performance. These findings contradict the fundamental distinction of the stakeholder theory that Smith (2003) mentions as a probability to reduce the firms' profitability due to prioritizing all stakeholders and the long-term goals instead of capturing short-term profit that may harm the shareholders.

The stakeholder theory could be argued to help contextualize the firm within its broader network of relationships and responsibilities. By including the preferences of all the stakeholders in the firm, not only could the financial performance that is beneficial for the shareholders increase, but also the environmental, social and governmental preferences of other stakeholders be considered. This might then have a positive influence on general ESG performance. Examining ESG through the lens of stakeholder theory also contributes to the comprehension of why the individual pillars play an important role in the composite ESG score

3.2.4 Signaling Theory

The outer layer of the framework is the market interaction, where the interaction of the firms with the market and societal expectations is discussed and where the firm's value, societal norms, and integrity in the markets are crucial. The signaling theory is explained by Spence (1973) in terms of an information asymmetry between the signalers and the receivers through discussing a recruiting process. During this recruitment process, there is always an information asymmetry between the individual and employer, and decisions are made according to which signals have been given about the individual's productive capabilities. Connelly et al. (2011) interpret the signaling theory from a managerial perspective, with the managers as the signalers and the shareholders as the receivers, and the importance of how to communicate and how to interpret the signals to mitigate the informational gap between the two parties.

However, Spence (1973) highlights that managers may manipulate some of their signals to achieve a greater or lesser fit, which Uyar et al. (2020) discuss in the logistics sector, as well as the connection between signaling and greenwashing. They discuss the relationship between the firms' CSR performance and their CSR reporting frequency, and these findings can also be connected to the legitimacy theory.

The signaling theory elucidates how and why firms disclose their ESG performance, aiming to reduce the information asymmetry between investors and firms. Moreover, it assists in closing the gap between firm’s operations and the investor expectations, trying to ensure that the firm's actual ESG practices align with what investors anticipate and require, thereby enhancing transparency and trust in the firm's market interactions and adherence to societal norms and integrity.

3.2.5 Legitimacy Theory

Furthermore, to maintain a positive public image and operational license through societal norms and values, the legitimacy theory gives a dimension to the market interaction perspective. Dowling and Pfeffer (1975) explain the legitimacy theory that firms constantly strive to establish legitimacy by aligning themselves with the norms and values of broader society, organizations, and stakeholders in general from their actions and activities, and that the stakeholders perceive their firms as legitimate. Dowling and Pfeffer (1975) identify a continuous threat the firms face where the broader society, the organizations, and the stakeholders through legal, economic, and social sanctions force the firms to change their strategies to maintain being seen as legitimate.

Van Der Laan (2009) and Dumay et al. (2019) discuss the connection between legitimacy theory and stakeholder theory but the differences in operational levels. Van Der Laan (2009) mentions that stakeholder theory operates at a lower level, an internal level of the organization and its stakeholders, while legitimacy theory operates on a higher level, with the relationship between different stakeholders, broader society, and organizations.

The legitimacy theory can be connected to this study through the firms behaving in a specific manner to align themself with norms and values for the stakeholders to eventually gain greater access to capital and reputation. The legitimacy theory could also be one of the drivers for firms' sustainability reporting since it warrants the public's acceptance of the deliberate choices made by a firm.

4. Methodology

In this chapter, the authors outline the decisions regarding the data collection, sampling and population selection, and the variables used in the regression models are defined. The models applied will be presented, along with the conceptual framework and robustness checks made to ensure validity.

4.1 Data Collection

The primary data source was Refitiv Eikon Datastream[3] (Datastream). According to LSEG (2023), Datastream offers 70 years of financial time series data across all major asset classes. Datastream provides comprehensive ESG data, covering over 80 percent of the global market cap with more than 450 ESG metrics. The final unbalanced panel dataset consists of 2308 firm-year observations from firms in the Nordic region, starting with 138 firms in 2017 and ending with 570 in 2022. The region selection was filtered by the country of exchange to capture the effects of both the regulatory environment that the firm is operating in and to obtain firms within a market that share similar characteristics.

4.1.1 Sample Construction

The sample was constructed in three main steps. Firstly, the firm has reported ESG data during the respective year. Secondly, the company must be listed on one of the Nordic Stock Exchanges, and lastly, the firm must feature all other relevant data, most importantly WACC, kD, and kE.

[3] Formerly known as Thomson Reuters Eikon

During the recent growth of popularity in ESG data reporting, the number of individual firms disclosing their ESG performance has increased year over year, leading to unbalanced panel data. All of the data is reported at the end of a respective fiscal year, thus, the dataset has one observation per year for a firm. The time period was selected to begin from 2017 because of the growth in ESG reporting in the EU after the introduction of the Directive (2014) and the subsequent presentation of the Paris Agreement (UN, 2015b). Both of these developments increased the emphasis on sustainability and ESG reporting requirements for European companies. The year 2023 was excluded from the sample because it had mainly similar entries for each observation to those in 2022, leading to a potential increment in skewness in the data if included.

4.2 Variable Definitions

In this subchapter, the variables used in the models are categorized, and the rationale behind selecting these variables is provided. All of the variables are also briefly defined, and the definitions are derived from the Datastream filtering tool if not mentioned otherwise.

Table 3, Summary of the variables

Model name	Variable name	Variable level	Proxy
Dependent	Cost of Capital	WACC	WACC
	Cost of Debt	kD	Marginal cost of issuing new debt
	Cost of Equity	kE	CAPM
Independent	ESG Score	ESGscore	Datastream
	Environmental pillar	E	Datastream
	Social pillar	S	Datastream
	Governance pillar	G	Datastream
Control	Board Size	BS	Total number of board members
	CEO involvement	CEO	Dummy — CEO present on the board of directors
	Return on Assets	ROA	$Net\ income/Total\ assets$
	Market-to-book ratio	MTB	$(Total\ Assets\ +\ MarketCap\ -\ Total\ Equity)/Total\ Assets)$
	Beta	Beta	Datastream
	logarithmic total of assets	logassets	Natural logarithm of the total of assets
	Leverage	leverage	$Total\ debt/Total\ assets$

4.2.1 Dependent Variables as Measurements of the Cost of Capital

All of the proxies to estimate the cost of capital are derived from Datastream. The dependent variables are kD, kE, and WACC. A robust overview of a firm's financing cost levels is attempted to be achieved by employing these variables as the dependent variables throughout the models. kD and kE are fundamental base metrics for understanding a firm’s capital structure and the cost associated with its capital. The kD proxy represents the marginal cost to the company of issuing new debt now, and it is calculated by adding the weighted costs of short-term and long-term debt based on appropriate 1-year and 10-year credit curves. This can be expressed as a formula:

$$kD = (Ws * Cs) + (Wl * Cl)$$

Using short-term and long-term yield curves and weighing the costs helps to account for volatility and risk associated with different durations of debt. This approach can provide a nuanced view of the cost of debt that reflects both current market conditions and the compounding factor of debt with different maturities.

The kE variable is calculated by multiplying the equity risk premium with the beta of the stock plus an inflation-adjusted risk-free rate. The equity risk premium is the expected market return minus the inflation-adjusted risk-free rate. This methodology stems from the Capital Asset Pricing Model (CAPM). CAPM is a cornerstone of modern financial theory that provides a quantitative framework for assessing risk and deriving expected returns on assets. To tie together the financial aspects discussed in the other theories from a quantitative and market-based perspective and link the firm’s financial practices to market expectations and investor behavior. For decades, academia has debated how to estimate the kE accurately.

CAPM was introduced by William F. Sharpe (1964), who argued that before the introduction of CAPM, the existing theories and models failed to capture the effect of risk on valuing capital assets and financial transactions. The theory was later elaborated by Lintner (1965). The individual authors (Sharpe, 1964; Lintner, 1965) provide different steps for valuing capital assets by addressing the associated risk, from which the following CAPM formula can be derived:

$$E(Ri) = Rf + \beta i(E(Rm) - Rf)$$

Lastly, the WACC is calculated by proportionally weighing the firm's cost of capital, including common stock, preferred stock, and debt. WACC demonstrates a firm's overall cost of capital when accounting for the weights of the kD and kE components described above. Furthermore, the WACC can be argued to be instrumental in evaluating the financial efficiency and strategic viability of investment decisions by quantifying the minimum return that a company must earn on its existing asset base to satisfy its creditors, owners, and other capital providers.

4.2.2 Main Independent Variables

The main Independent variables used in the models are ESGscore, E, S, and G. These variables work as a proxy to evaluate and rank firms' Environmental, Social, and Governance performance. The composite ESG Score, along with the individual scores of the three pillars, are ranked from 0 to 100. Moreover, these scores are weighted by the Thomson Reuters Business Classification (TRBC) industry group code. Refinitiv provides a simple overview of the ESG Rating methodology in their document (Refinitiv, 2022). In accordance with the brochure (LSEG, 2023), the ESG Scores are obtained from over 630 company-level ESG measures, of which a subset of 186, most prominent regarding comparability and materiality regarding the industry that the company operates in, are used as drivers to assess and rank the companies. After the initial process, these measures are grouped into ten categories that reformulate the three pillars and the final ESGscore. The ESGscore is a reflection of the company's ESG performance, commitment, and effectiveness based on publicly reported information.

4.2.3 Control Variables

The control variables used across the models can be categorized into three groups. These are the governance, performance, and size variables, to control for different aspects of firms' financing costs. For the governance group, the variables are board size (BS) and CEO involvement. The number of board members denotes BS at the end of the fiscal year. CEO involvement is a dummy variable that takes the value of 1 when the CEO is present on the board during the examined fiscal year. For the performance category, the controlling variables are ROA, market-to-book ratio (MTB), and beta. ROA denotes the firm's management's ability to generate earnings from its assets, and it reflects the performance and operational efficiency of the company. MTB represents a firm's market value of equity relative to its book value of equity, and it can be used as a proxy to measure investors' perceptions of a firm's growth potential and estimated profitability. Beta measures a firm's stock volatility relative to the overall market.

Lastly, the size control variables in the models are the logarithmic number of assets (logassets) and leverage. Logassets measure the firms' size compared to their assets, making the comparison between firms more meaningful. Leverage is essentially the debt-to-assets ratio of a firm. This metric can be understood as a size variable since it can potentially show important nuances regarding a firm's capital structure and the amount of debt financing the firm has outstanding. Thus, leverage is not just a proxy for the risk exposure of a firm, but also provides insight into the strategic approach to managing resources and growth opportunities.

4.3 Summary Statistics

The summary statistics found in Appendix 1.1 provide a comprehensive overview of the dataset utilized in this study. The data for summary statistics are provided in a raw - unwinsorized form - to reveal potential issues in outliers, skewness, and kurtosis. The variable ESGscore has a mean of 47,20 and a standard deviation of 20,80, meaning that most of the firms in the dataset post an ESGscore between 27 and 67. The minimum value for ESGscore is 1,20 and the maximum is 92,88, indicating that there are both very low and very high ESG performers in the dataset. From the individual pillars, the S has the highest median, and the E has the lowest, meaning that sample firms generally perform better in social and governance responsibilities than environmental actions. However, the differences are not substantial, varying within a range of 13 percentage points. Furthermore, the different pillars drive the composite ESGscore, varying by industry; thus, the importance of individual pillar scores must not be overinterpreted when examining these values.

The median board size is 7, and the CEO is involved in the board for 21,6 percent of the observations. For the variable Beta, the minimum value is -1,15, and the maximum value is 4,41, indicating a large variability in volatility in the firms' stock prices. For the dependent variables, WACC has a mean of 7 percent, kE a mean of 8,4 percent, and kD a mean of 2,4 percent. The explanation for this could be that listed firms operating in the Nordic region experience a proportionally lower kD than kE due to the region's stable economic environment, which indirectly affects the creditworthiness of the companies within the region. The noticeable positive skewness for both kD and kE suggests that most of the firms post a lower-than-mean value for the variables, while some observations drag the mean to the right, creating a longer tail on the higher end of the distribution, potentially introducing bias to the sample.

The variables ROA, leverage, and MTB exhibit very high kurtosis values, indicating the presence of extreme outliers and a peaked distribution. However, this can be understood to be normal in a dataset having financial values, as some of the firms might experience financial distress, higher growth opportunities, or substantially higher (lower) returns on their assets than other firms in the dataset.

4.4 Models

The main models in the study consist of WACC, kD, and kE as the dependent variable, followed by all of the independent and control variables for each model. The models indicate the dependent variable's relationship with the different independent ESG variables and the effect of the control variables of governance, performance, and size groups to get an overall understanding of the relationship without excluding different variables that may influence the result. For each firm "i" and for each time period "t" all the observations for the variables will be included if not mentioned otherwise.

The model equation for WACC:

$$WACC_{i,t} = \beta_0 + \beta_1 ESGscore_{i,t} + \beta_2 BS_{i,t} + \beta_3 CEO_{i,t} + \beta_4 ROA_{i,t} + \beta_5 MTB_{i,t} + \beta_6 BETA_{i,t} + \beta_7 logassets_{i,t} + \beta_8 leverage_{i,t} + \varepsilon_{i,t} \quad (1)$$

The model equation for Cost of Debt:

$$kD_{i,t} = \beta_0 + \beta_1 ESGscore_{i,t} + \beta_2 BS_{i,t} + \beta_3 CEO_{i,t} + \beta_4 ROA_{i,t} + \beta_5 MTB_{i,t} + \beta_6 BETA_{i,t} + \beta_7 logassets_{i,t} + \beta_8 leverage_{i,t} + \varepsilon_{i,t} \quad (2)$$

The model equation for Cost of Equity:

$$kE_{i,t} = \beta_0 + \beta_1 ESGscore_{i,t} + \beta_2 BS_{i,t} + \beta_3 CEO_{i,t} + \beta_4 ROA_{i,t} + \beta_5 MTB_{i,t} + \beta_6 BETA_{i,t} + \beta_7 logassets_{i,t} + \beta_8 leverage_{i,t} + \varepsilon_{i,t} \quad (3)$$

As secondary models, firstly, a Pooled Ordinary Least Square (POLS) model was applied. Pollution models were used to observe the effect of polluting industries on WACC.

The model equation for Pollution:[4]

$$WACC_{i,t} = \beta_0 + \beta_1 ESGscore_{i,t} + \beta_2 E_{i,t} + \beta_3 S_{i,t} + \beta_4 G_{i,t} + \beta_5 BS_{i,t} + \beta_6 CEO_{i,t} + \beta_7 ROA_{i,t} + \beta_8 MTB_{i,t} + \beta_9 BETA_{i,t} + \beta_{10} logassets_{i,t} + \beta_{11} leverage_{i,t} + \varepsilon_{i,t}$$

(4-6)

Followed by FE models with the interaction term ESGscorexLarge to inspect the effect of firm size.

The model equation for size, WACC:

$$WACC_{i,t} = \beta_0 + \beta_1 ESGscore_{i,t} + \beta_2 Large_{i,t} + \beta_3 ESGscorexLarge_{i,t} + \beta_4 BS_{i,t} + \beta_5 CEO_{i,t} + \beta_6 ROA_{i,t} + \beta_7 MTB_{i,t} + \beta_8 BETA_{i,t} + \beta_9 logassets_{i,t} + \beta_{10} leverage_{i,t} + \varepsilon_{i,t}$$

(7)

The model equation for size, kD:

$$kD_{i,t} = \beta_0 + \beta_1 ESGscore_{i,t} + \beta_2 Large_{i,t} + \beta_3 ESGscorexLarge_{i,t} + \beta_4 BS_{i,t} + \beta_5 CEO_{i,t} + \beta_6 ROA_{i,t} + \beta_7 MTB_{i,t} + \beta_8 BETA_{i,t} + \beta_9 logassets_{i,t} + \beta_{10} leverage_{i,t} + \varepsilon_{i,t}$$

(9)

[4] Model (4) features the full sample, in model (5), the sample features only polluting industries, and in model (6) the sample excludes polluting industries

The model equation for size, kE:

$$kD_{i,t} = \beta_0 + \beta_1 ESGscore_{i,t} + \beta_2 Large_{i,t} + \beta_3 ESGscorexLarge_{i,t} + \beta_4 BS_{i,t}$$
$$+ \beta_5 CEO_{i,t} + \beta_6 ROA_{i,t} + \beta_7 MTB_{i,t} + \beta_8 BETA_{i,t} + \beta_9 logassets_{i,t} + \beta_{10} leverage_{i,t} + \varepsilon_{i,t}$$

(10)

Lastly, models[5] featuring individual pillars are examined to observe potential nuances in the relationship between individual E, S, and G factors and the cost of capital.

The model equation for the governance factor, WACC:

$$WACC_{i,t} = \beta_0 + \beta_1 E_{i,t} + \beta_2 BS_{i,t} + \beta_3 CEO_{i,t} +$$
$$\beta_4 ROA_{i,t} + \beta_5 MTB_{i,t} + \beta_6 BETA_{i,t} + \beta_7 logassets_{i,t} + \beta_8 leverage_{i,t} + \varepsilon_{i,t}$$

(11-13)

The model equation for the governance factor, kD:

$$kD_{i,t} = \beta_0 + \beta_1 E_{i,t} + \beta_2 BS_{i,t} + \beta_3 CEO_{i,t} +$$
$$\beta_4 ROA_{i,t} + \beta_5 MTB_{i,t} + \beta_6 BETA_{i,t} + \beta_7 logassets_{i,t} + \beta_8 leverage_{i,t} + \varepsilon_{i,t}$$

(14-16)

The model equation for the governance factor, kE:

$$kE_{i,t} = \beta_0 + \beta_1 E_{i,t} + \beta_2 BS_{i,t} + \beta_3 CEO_{i,t} +$$
$$\beta_4 ROA_{i,t} + \beta_5 MTB_{i,t} + \beta_6 BETA_{i,t} + \beta_7 logassets_{i,t} + \beta_8 leverage_{i,t} + \varepsilon_{i,t}$$

(17-19)

[5] All models between 11-19 use E, S, and G as the main independent variable. For clarity, only models featuring E are presented here. See Appendix 5.13 for the full illustration of all models.

4.5 Conceptual Framework

4.5.1 Panel Data

Panel data, also called longitudinal data, is a set of two dimensions with the same cross-sectional units observed for a given time period over the data set (Wooldridge, 2016). Using the same cross-sectional units over a given period of time enables analysis to control for unobserved heterogeneity, dynamic changes, improved casual interference, and data richness. Observing the same units over a given period makes it possible to identify characteristics and dynamic changes for each firm and causal relationships to certain events. The dataset will be more informative when applying two dimensions, which will enhance the robustness of the conclusions drawn from the data analysis (Wooldridge, 2016).

As the dataset is comprised of unbalanced panel data, Appendix 1.2 provides insights into how the observations are distributed between the six periods for the individual firms. Appendix 1.2 shows that the median number of firm-year observations per individual firm is 4, and the mean for the firm-year observations is 4,03, indicating that over half of the dataset extends over the period of four years. In addition, the 75th percentile has data extending over three years, and the 95th percentile is at two years. This variability indicates that while most of the firms are observed for 4 years, there is a significant portion of firms with shorter observation periods, which might impact the robustness and generalizability of the results.

4.5.1.1 Fixed Effects

According to Brooks (2008), fixed effect (FE) models allow different intercepts in the regression for the cross-sectional units but not over time, while the slope estimates are fixed for both over time and cross-sectional observations. The FE model is used to control for unobserved heterogeneity variables that may correlate with the observed variables by having different intercepts for each unit (Brooks, 2008). Despite its strengths, the FE model may not fully account for all endogeneity issues. Future research could explore alternative approaches to address potential biases.

4.5.1.2 Pooled Ordinary Least Square

POLS was used as a comparative model to validate the robustness of the results. The regression was applied for models (4-6) to test the H4. POLS is a simple panel data estimation method and can provide unbiased estimates when multiple linear regression assumptions are met (Wooldridge, 2016). The selection of POLS over FE for these models is motivated by the nature of hypothesis H4, where the clustering for firm level (observation-specific factor) and time period (time-invariance factor) are not of the highest level of interest to observe the impact of polluting industries.

4.6 Robustness Checks

The robustness checks to verify the validity of the main FE models implemented were the Wald test, the Hausman test, the Pearson pairwise correlation, and the winsorizing of some of the variables. The Wald test is used to detect groupwise heteroscedasticity in the variables in a FE model. Heteroscedasticity occurs when the variance of the errors in a regression model is not constant across the observations, which may affect the hypothesis and confidence interval because of the inefficient and biased standard error estimates (Wooldridge, 2016).

The Hausman test determines if there are significant differences in the coefficients estimated by the FE and Random effects (RE) models. If such differences exist, it suggests that the RE model estimators are biased, making the FE model preferable due to its ability to control for unobserved heterogeneity variables that may correlate with the observed variables. Winsorizing of the variables is conducted to exclude outliers that may skew the results, and the results are examined by conducting a skewness and kurtosis test (Wooldridge, 2016).

Lastly, a Pearson correlation coefficient test is used to observe potential multicollinearity in the model. The correlation between the variables in a regression model and highly correlated variables will have a negative impact on the quality of a regression. If collinearity is above the ± 0,8 threshold, a variable should be discarded from the model (Brooks, 2008).

4.7 Diagnostic Tests

4.7.1 Wald Test

The Wald tests for the dependent variables WACC, kD, and kE had a P-value of 0,0000, which is a significant level (Appendix 2.1, 2.2, and 2.3), indicating that the null hypothesis (assumption of homoscedasticity) will be rejected, suggesting that there is heteroscedasticity present in all of the observations in the model. The degrees of freedom are according to the observations in the model; 570 firms, and the chi-square values are $3,3e^{33}$, $1,1e^{34}$ and $1,8e^{35}$ which are arguably high, indicating that the variances of the errors are not constant across the different groups in the panel data.

$H0\colon \sigma_i^2 = \sigma^2\ for\ all\ i$

4.7.2 Hausman Test

The Hausman test P-value is 0,00 (Appendix 3), which indicates that the chi-squared test is significant, therefore, the null hypothesis of differences in coefficients between fixed effects and random effects is not systematic and will be rejected, and the FE model is to be considered.

$Test\ of\ H0\colon\ Difference\ in\ coefficients\ not\ systematic$

4.7.3 Multicollinearity Test

The Pearson correlation coefficient matrixes, provided in appendices 4.1, 4.2, and 4.3, show the collinearity between different variables used in the models. The correlation between the dependent variables WACC, kD, and kE and the main independent variable ESGscore shows a small negative, small negative, and small positive correlation, respectively. Throughout the models, the ESGscore and the individual pillars are very highly positively correlated, which is intuitive since the pillar scores make up the composite ESG score. Based on observing high multicollinearity, the E, S, and G variables were excluded from the models where ESGscore is the main independent variable, as suggested by Brooks (2008), to avoid skewing the regression results. The Pearson correlation matrixes for the models applied in this study are according to appendices 4.4, 4.5 and 4.6.

Table 4, Pearson correlation coefficient matrixes

Variables	(1) WACC	(2) ESG Score	(3) E	(4) S	(5) G
(1) WACC	-	-0.05	-0.10	-0.06	0.026
(2) ESGScore	-0.05	-	0.856	0.910	0.752
(3) E	-0.10	0.856	-	0.759	0.454
(4) S	-0.06	0.910	0.759	-	0.505
(5) G	0.026	0.752	0.454	0.505	-

4.7.4 White Test for the POLS Models

For the models (4-6), a White test was conducted to check for unobserved heteroscedasticity. Results from the test suggested a high level of unobserved heteroscedasticity in the models, and to account for that, robust standard errors were applied for all three models.

5 Regression Results

This chapter will present the results, beginning with the findings from the respective regression models. Additionally, diagnostic tests will be used to validate the regression outcomes.

The results from the main regression models exhibit correlations that are both negative and positive for all of the variable types. For a majority of the variables, the correlation coefficients are close to zero. Throughout the models, the significance levels for the variables range from statistically insignificant to statistically significant at the highest confidence level. The correlation between variables can be observed from the coefficient and the significance level from the p-values associated with each variable. A negative correlation indicates that if one variable increases, the other variable decreases, while a positive correlation means that if one variable increases, so does the other variable accordingly. A zero correlation indicates that the two variables do not have a relationship with each other and do not affect the outcome of the different variables' fluctuation. The regressions only show a weak relationship between the variables, meaning that the relationship between the variables only slightly explains the fluctuation. The confidence interval shows that, with 95 percent confidence or certainty, it contains the true mean of the dependent and independent variables.

The fit of the models can be examined through various parameters provided in the regression output. The standard error is the estimation of the standard deviation in the model, the standard deviation of its sampling distribution. The standard error is zero or close to zero on all variables for every regression, which indicates that the coefficient accurately estimates the true effect of the variables on the dependent variable. The standard deviation measures the variation from the mean of the dependent variable. A lower standard deviation indicates that the values are more clustered around the mean, which facilitates understanding of the distribution of the dependent variable. The R-square, or coefficient of determination, measures how close the data points are to the fitted regression line. The range for R-squared is 0 to 1, and the higher the R-squared (closer to 1), the better the model's fit to the data. The R-squared value indicates how much the independent and the control variables in the model explain the changes in the dependent variable.

The F-test value and the associated Prob > F are robustness indicators that serve as a metric to assess the overall statistical significance of a model. The p-value given for the regression model (Prob > F) indicates the overall significance of the model by addressing the differences in means. The Prob > F value of 0,00 in the main models suggests that there is statistically significant evidence to reject this null hypothesis that none of the model coefficients are significantly different from zero, suggesting that the model effectively captures the relationship between the independent and dependent variables.

5.1 Weighted Average Cost of Capital

The regression for the following findings is according to Appendix 5.2. The regression result with the WACC as the dependent variable shows an insignificant correlation with the independent variable ESGscore. The correlation coefficient indicates a marginally positive relationship between ESGscore and WACC. Furthermore, there is a significant correlation between the control variables, leverage, beta, and logassets at a one percent level. The leverage has a negative correlation, and beta and logassets have a positive correlation. The low standard errors for the coefficients in the model indicate that the estimates are precise, indicating that there is less variability in the estimated coefficients if the model were to be replicated with different samples. The observed R-squared is 0,3810, indicating that the model explains approximately 38 percent of the variability in the dependent variable. This means that the model is somewhat poor in predicting changes in the dependent variable since a lot of the unexplained variability is not captured by the model.

Table 5, Regression result: WACC

Regression results, Model 1

WACC	Coef.	St.Err.	p-value	Sig
ESGScore	.0001	.0001	.3293	
leverage_win	-.0384	.0061	0	***
BS	-.0006	.0005	.2425	
CEO	.0017	.0019	.3773	
Beta	.0412	.0025	0	***
ROA_win	-.003	.0088	.7324	
MTB_win	-.0002	.0001	.131	
logassets	.0051	.0015	.0009	***
Constant	-.0325	.0205	.1139	
R-squared		0.3810	Number of obs	2308

*** *p<.01*, ** *p<.05*, * *p<.1*

According to H1: "Firms in the Nordic countries with higher overall ESG scores demonstrate a lower weighted average cost of capital compared to their counterparts."

The hypothesis will be rejected, as the findings indicate that the relationship between ESG score and WACC is statistically insignificant.

5.2 Cost of Debt

The regression for the following findings is according to Appendix 5.3. The regression with kD as the dependent variable shows significance at the highest confidence level with the ESGscore. The relationship is positive yet marginal, as denoted by the correlation coefficient. The control variables logassets and MTB are significant at a one percent level. The variable logassets has a positive correlation, and MTB has a negative correlation with kD. The control variable leverage has a negative correlation at a ten percent significance level. The standard error and the standard deviation for the model are very low, indicating that the estimation from the coefficient is close to the true value. The R-squared is 0,1268, which can be considered low, meaning that the independent variables have a weak influence on the kD as the dependent variable.

Table 6, Regression result: kD

Regression results, Model 2

kD	Coef.	St.Err.	p-value	Sig
ESGScore	.0003	.0001	0	***
leverage_win	-.0147	.0084	.0801	*
BS	-.0003	.0005	.515	
CEO	-.0025	.0017	.1563	
Beta	-.0002	.0014	.9116	
ROA_win	-.0095	.0114	.401	
MTB_win	-.0008	.0001	0	***
logassets	.0104	.0017	0	***
Constant	-.1246	.0222	0	***
R-squared		0.1268	Number of obs	2308

*** *p<.01,* ** *p<.05,* * *p<.1*

According to H2: "Firms in the Nordic countries with higher overall ESG scores demonstrate a lower cost of debt compared to their counterparts."

The hypothesis will be rejected, as the regression model suggests a statistically significant and very marginally positive relationship between the ESG score and the kD. When ESGscore increases by one unit, the kD increases by 0,0003 percent, underlining the marginality of the effect.

5.3 Cost of Equity

The regression for the following findings is according to Appendix 5.4. The kE regression shows a positive correlation at a five percent significance level with the ESGscore. For control variables, the regression implies a negative correlation at a five percent significance level for leverage, a positive correlation at a one percent significance level for logassets and Beta, and a negative correlation with MTB at a five percent significance level. The standard error and the standard deviation for the model are very low, indicating that the estimations from the coefficients are close to the true value. The R-squared is 0,5045, which is relatively low but can be considered acceptable, meaning that the model fits mediocrely on the data using kE as the dependent variable. Comparing the R-squared values between the three main models, it can be argued that the set of variables used in the models are better at estimating the WACC and kE than they are at estimating the kD.

Table 7, Regression result: kE

Regression results, Model 3

kE	Coef.	St.Err.	p-value	Sig
ESGScore	.0002	.0001	.0335	**
leverage_win	-.0134	.0068	.0477	**
BS	-.0002	.0007	.7473	
CEO	.0017	.0019	.3716	
Beta	.0579	.0022	0	***
ROA_win	.0028	.0078	.7247	
MTB_win	-.0003	.0001	.021	**
logassets	.0051	.0019	.0074	***
Constant	-.0495	.0236	.0361	**
R-squared		0.5045	Number of obs	2308

*** *p<.01,* ** *p<.05,* * *p<.1*

According to H3: "Firms in the Nordic countries with higher overall ESG scores demonstrate a lower cost of equity capital compared to their counterparts."

The hypothesis will be rejected. The findings indicate a statistically significant, slightly positive relationship between the ESGscore and the kE. An one unit increase in a firm's ESG score is associated with a 0,0002 percent increase in the firm's kE.

5.4 Polluting Industries

To test H4, three different POLS regressions were conducted. For all of the regressions, model (1) is used as a baseline. The models differ in observations, where model (4) features the full sample, model (5) only the polluting industry sample, with 526 firm-year observations, and model (6) excludes the polluting industry observations from the sample, totaling 1726 firm-year observations (Appendix 5.5). In model (4), a statistically significant positive relationship between the WACC and ESGscore is observed. Similarly, the model (6) suggests a statistically significant positive relationship. However, the model (5), containing the "polluting" sample, suggests a statistically insignificant, very marginally negative relationship.

According to H4: "Firms in industries with higher inherent environmental risks demonstrate a stronger negative relationship between ESG score and WACC than their lower-risk counterparts. This effect is particularly pronounced in sectors such as energy, manufacturing, and transportation, where ESG practices can significantly mitigate operational and regulatory risks."

The hypothesis will be rejected because the p-value for the variable ESGscore in the model (5) is greater than the conventional confidence interval threshold of statistical significance. However, the three models combined provide interesting economic implications, which will be discussed in the analysis.

Table 8, Regression result: polluting industries

Regression results with WACC, Polluting

	Model_4	Model_5	Model_6
	WACC	WACC	WACC
ESG Score	0.0001**	-0.0000	0.0001**
	(0.0000)	(0.0001)	(0.0000)
leverage	-0.0418***	-0.0263***	-0.0443***
	(0.0026)	(0.0045)	(0.0029)
BS	0.0002	0.0003	0.0002
	(0.0002)	(0.0004)	(0.0002)
CEO	0.0038***	0.0046***	0.0031***
	(0.0008)	(0.0016)	(0.0009)
Beta	0.0421***	0.0413***	0.0417***
	(0.0017)	(0.0024)	(0.0020)
ROA	0.0054*	-0.0014	0.0061**
	(0.0033)	(0.0234)	(0.0031)
MTB	0.0003***	0.0005***	0.0003***
	(0.0001)	(0.0001)	(0.0001)
logassets	-0.0029***	-0.0009	-0.0032***
	(0.0003)	(0.0007)	(0.0003)
_cons	0.0769***	0.0395***	0.0809***
	(0.0036)	(0.0079)	(0.0041)
Observations	2308	526	1782
R-squared	0.6986	0.6624	0.7077
Standard errors	robust	robust	robust
Method	POLS	POLS	POLS

Robust standard errors are in parentheses

**** p<.01, ** p<.05, * p<.1*

5.5 Size Factor

Statistically insignificant results from the models with the interaction term suggest that the size does not have statistically significant implications for the relationship between a firm's ESGscore and WACC, kD, and kE (Appendix 5.9). To observe this relationship, additional control variable large, and an interaction term variable ESGscorexLarge were applied to the models. However, when taking the mean of total assets as a dividing factor between large and small in the sample, large only accounts for 14,99 percent of the observations. The relatively small number of observations for variable large coupled with little variability within the interaction term can potentially skew the result.

According to H5: "In the Nordic countries, larger firms with higher ESG scores benefit from lower costs of capital more significantly than smaller firms with comparable ESG scores."

The hypothesis will be rejected because the regression suggests a statistically insignificant result in the interaction term variable ESGScorexLarge for all of the examined models.

Table 9, Regression result: Size

Regression results, Model 7, 8, and 9

	Model_7 WACC	Model_8 kD	Model_9 kE
ESG Score	0.0001	0.0003***	0.0001**
	(0.0001)	(0.0001)	(0.0001)
large	-0.0107	0.0033	-0.0108
	(0.0141)	(0.0107)	(0.0146)
ESGScorexLarge	0.0001	-0.0001	0.0001
	(0.0002)	(0.0001)	(0.0002)
leverage	-0.0386***	-0.0151*	-0.0135*
	(0.0060)	(0.0084)	(0.0069)
BS	-0.0006	-0.0003	-0.0002
	(0.0005)	(0.0005)	(0.0007)
CEO	0.0018	-0.0025	0.0018
	(0.0019)	(0.0017)	(0.0019)
Beta	0.0412***	-0.0002	0.0579***
	(0.0025)	(0.0014)	(0.0022)
ROA	-0.0028	-0.0094	0.0029
	(0.0088)	(0.0114)	(0.0078)
MTB	-0.0002	-0.0008***	-0.0002**
	(0.0001)	(0.0001)	(0.0001)
logassets	0.0056***	0.0106***	0.0055***

	(0.0016)	(0.0018)	(0.0019)
_cons	-0.0385*	-0.1274***	-0.0540**
	(0.0211)	(0.0231)	(0.0237)
Observations	2308	2308	2308
R-squared	0.3823	0.1275	0.5051
Standard errors	Clustered	Clustered	Clustered
Method	FE	FE	FE

Standard errors are in parentheses
**** p<.01, ** p<.05, * p<.1*

5.6 Governance Factor

The models (11-19) were applied to investigate the hypothesized amplified effect of the Governance Pillar score on a firm's WACC, kD, and kE. The results suggest that there is a statistically significant positive relationship between all the dependent variables and E and S. Also, a weakly statistically significant negative relationship exists between WACC and G. The variable G is insignificant for kD and kE (Appendix 5.13).

The results derived from the individual pillar analysis in models (11-19) suggest that E and S are the key drivers in the relationship between individual pillars and cost of capital, denoted by statistical significance as well as sharing the positive relationship observed in the main models (1-3). However, it is interesting that in model (13), the weakly statistically significant relationship between WACC and G is negative, while the relationship (although statistically insignificant) was positive for model (1) when using the ESGscore as the independent variable.

Table 10, Regression results, WACC with individual Pillars

Regression results, Model 11-19

	Model_11 WACC	Model_12 WACC	Model_13 WACC	Model_14 kD	Model_15 kD	Model_16 kD	Model_17 kE	Model_18 kE	Model_19 kE
E	0.0001***			0.0003***			0.0001***		
	(0.0000)			(0.0000)			(0.0001)		
S		0.0001**			0.0002***			0.0002***	
		(0.0001)			(0.0001)			(0.0001)	
G			-0.0001*			0.0001			-0.0000
			(0.0000)			(0.0000)			(0.0000)
leverage	-0.0389***	-0.0384***	-0.0375***	-0.0147*	-0.0136	-0.0135	-0.0134*	-0.0132**	-0.0123*
	(0.0061)	(0.0062)	(0.0061)	(0.0083)	(0.0083)	(0.0083)	(0.0069)	(0.0066)	(0.0068)
BS	-0.0006	-0.0007	-0.0006	-0.0004	-0.0004	-0.0003	-0.0002	-0.0003	-0.0002
	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0007)	(0.0007)	(0.0007)
CEO	0.0018	0.0017	0.0010	-0.0029*	-0.0031*	-0.0030*	0.0015	0.0016	0.0010
	(0.0018)	(0.0019)	(0.0019)	(0.0017)	(0.0017)	(0.0018)	(0.0019)	(0.0019)	(0.0020)
Beta	0.0409***	0.0411***	0.0416***	-0.0002	0.0003	0.0005	0.0578***	0.0578***	0.0584***
	(0.0024)	(0.0025)	(0.0025)	(0.0014)	(0.0015)	(0.0014)	(0.0022)	(0.0022)	(0.0022)
ROA	-0.0033	-0.0029	-0.0030	-0.0100	-0.0092	-0.0093	0.0025	0.0029	0.0028
	(0.0088)	(0.0088)	(0.0088)	(0.0115)	(0.0115)	(0.0114)	(0.0078)	(0.0078)	(0.0078)
MTB	-0.0002	-0.0002	-0.0001	-0.0008***	-0.0008***	-0.0008***	-0.0003**	-0.0002**	-0.0002**
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
logassets	0.0045***	0.0049***	0.0059***	0.0102***	0.0112***	0.0116***	0.0050***	0.0050***	0.0062***
	(0.0016)	(0.0015)	(0.0015)	(0.0016)	(0.0016)	(0.0017)	(0.0018)	(0.0018)	(0.0019)
_cons	-0.0263	-0.0332	-0.0379*	-0.1190***	-0.1329***	-0.1320***	-0.0465**	-0.0521**	-0.0563**
	(0.0208)	(0.0205)	(0.0206)	(0.0221)	(0.0219)	(0.0224)	(0.0236)	(0.0231)	(0.0236)
Observations	2308	2308	2308	2308	2308	2308	2308	2308	2308
R-squared	0.3839	0.3825	0.3819	0.1320	0.1231	0.1163	0.5053	0.5076	0.5034
Standard errors	Clustered	Clustered	Clustered	Clustered	Clustered	Clustered	Clustered	Clustered	Clustered
Method	FE	FE	FE	FE	FE	FE	FE	FE	FE

Standard errors are in parentheses

**** p<.01, ** p<.05, * p<.1*

According to H6: “the governance pillar is the key driver in the relationship between environmental, social, and governance performance and WACC in the Nordic region.”

The hypothesis will be rejected, as all of the models posit varying significance levels in the main independent variable. In contrast, the variables E and S provide the most statistical support for the positive relationship between the initially observed positive relationship between cost of capital and ESG score.

5.7 Hypothesis Results

Table 11. Summary of the hypothesis results

Hypothesis		Result	Significance level
H1	Firms in the Nordic countries with higher overall ESG scores demonstrate a lower weighted average cost of capital compared to their counterparts.	Rejected	Insignificant
H2	Firms in the Nordic countries with higher overall ESG scores demonstrate a lower cost of debt compared to their counterparts.	Rejected	$***p < .01$
H3	Firms in the Nordic countries with higher overall ESG scores demonstrate a lower cost of equity capital compared to their counterparts.	Rejected	$**p < .05$
H4	Firms in industries with higher inherent environmental risks demonstrate a stronger negative relationship between ESG score and WACC than their lower-risk counterparts. This effect is particularly pronounced in sectors such as energy, manufacturing, and transportation, where ESG practices can significantly mitigate operational and regulatory risks.	Rejected	Insignificant
H5	In the Nordic countries, larger firms with higher ESG scores benefit from lower cost of capital more significantly than smaller firms with comparable ESG scores.	Rejected	Insignificant
H6	The governance pillar is the key driver in the relationship between environmental, social, and governance performance and the cost of capital in the Nordic region.	Rejected	$***p < .01$, $**p < .05$

6. Analysis

This analysis will build on the theoretical framework presented in Chapter 3.1 (Figure 1) and connect the theories to the results. The analysis will include connections between the theories and existing literature to get a comprehensive understanding of the importance of the topic, what has been found before, and what was found in this study. The findings are related to the six hypotheses that have been tested. The first three (H1 to H3) are derived from the dependent variables WACC, kD, and kE in relation to the firms' ESG score (independent variable). Hypotheses H4 to H6 look at the relationship between the firm's cost of capital and ESG score through hypothesized key drivers (firm size, polluting industry effect, and the governance). These relationships are visualized in Figure 2.

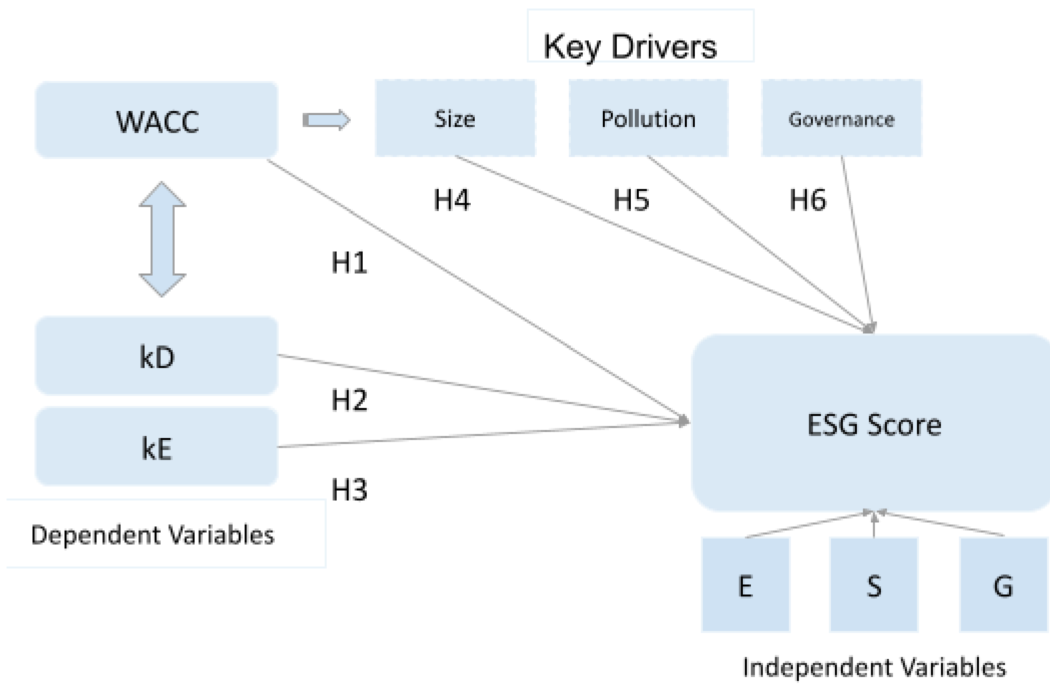

Figure 2, Hypothesis Relationship.

6.1 Internal Dynamics

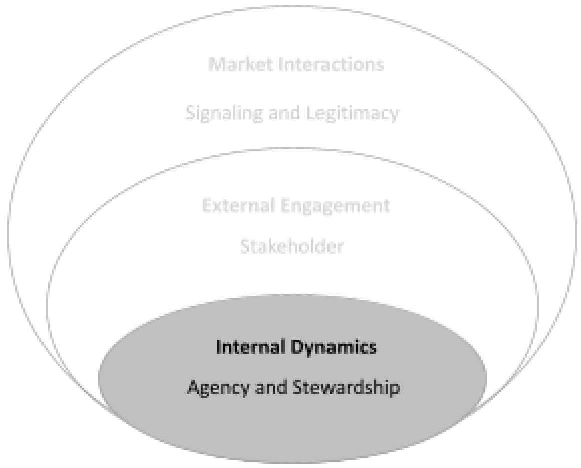

Figure 3, Theoretical framework, Internal Dynamics.

Internal dynamics, the inner layer of the theoretical framework (Figure 3), including agency theory and stewardship theory, will be used to analyze the findings in this section. Agency theory explains the problems and costs that occur when the shareholders and the managers have different agendas. As discussed by Srivastava and Anand (2023), the interest conflict when managers invest in ESG projects is contradictory to what the investors want, as the agency costs increases due to the need for control and monitoring. The agency problem is directly connected to the kD and the kE and, therefore, to the WACC. If the shareholders and debt lenders trust the managers, they are in a greater position to have lower return requirements on the invested capital. When interpreting the theories in this section, H1 to H3 and H6 will be prioritized to gain a deeper understanding of the interconnection of the internal dynamics with the ESG score and WACC.

To connect the agency theory to our findings, from H1, the Nordic firms with a higher ESG score demonstrated a higher WACC with statistical insignificance. Drawing from these findings, it can be argued that the ESG score is not a viable proxy for estimating changes in a firm's WACC. In H2 and H3, the connection between the kD and the kE showed positive relationships while being statistically significant at one and five percent significance levels, respectively. These findings could indicate that investors and debt lenders perceive higher ESG contributions as red flags regarding firms' operations, thus warranting a higher premium for their investment.

A positive relationship between kD and environmental risk management was found by Sharfman and Fernando (2008), and they argue that this relationship potentially stems from lending institutions penalizing firms that invest in risk management over compliance levels. This is also one potential explanation for this study, as achieving higher ESG scores usually requires extensive policies and practices from firms. Furthermore, Nazir et al. (2022) found a positive relationship between the cost of capital and ESG performance for global firms in the tech sector. They concluded that the general investor avoids volatile and risky sectors, such as the tech sector, due to information asymmetry and adverse selection. Investors that invest in these types of sectors have a higher risk premium, which increases the cost of capital in general.

If the managers act in the best interest of the investors, the stewardship theory could explain this study's findings. The potential agency costs are mitigated due to the actions of the managers that align with the investors, resulting in a lower WACC. Alves and Meneses (2024) dissect the relationship between agency costs and kD, as they argue that the presence of agency costs raises the kD for firms, although the overall relationship between ESG score and kD is negative. However, enterprises with higher agency costs still reap benefits from heightened ESG performance regarding their kD. Alves and Meneses (2024) conclude that debt lenders do not see ESG activities as a waste of corporate resources.

From the agency problem point of view, the observed contradictory positive relationship between kD and ESG score in this study could imply that the agency costs in Nordic firms outweigh the impact of heightened ESG performance, resulting in a positive relationship. Consequently, the positive relationship between kD and ESGscore in Nordic firms might indicate that the benefits of ESG activities are insufficient to fully offset the additional costs introduced by market frictions, information asymmetry and adverse selection discussed by Nazir et al. (2022), and agency costs discussed by Alves and Menezes (2024).

Whether managers are seen as agents or stewards in the scope of this study can be examined through the research questions. Firstly, the CEO's involvement in the board and board size are statistically insignificant factors throughout the models, indicating that management’s direct role is not a good proxy for predicting the impact on the cost of capital. However, when examining the individual pillar effect on the kD and kE, the E and S pillars seem to be the key drivers explaining the positive relationship between the cost of capital and socially responsible practices. However, the findings do not align with Ng and Rezaee's (2015) results, which found that E and G were the key kE drivers with a negative relationship.

It could be argued that management has a high degree of involvement in the governance issues of a firm, as hypothesized in H6. This could lead to management having more extensive information about the firm's operations than the shareholders, potentially impacting the cost of capital due to information asymmetry. Economically interpreted, these findings suggest that the involvement of management, whether direct, as indicated by the mentioned control variables, or indirect, as represented by the governance pillar, is not as pivotal to a firm’s cost of capital as initially hypothesized.

However, when analyzing different pillars independent of the ESG score, it must be noted that multiple varying parameters affect the interpretation of the individual pillars and the composite score for both perspectives; thus, any conclusive remarks can not be drawn from these findings.

6.2 External Engagement

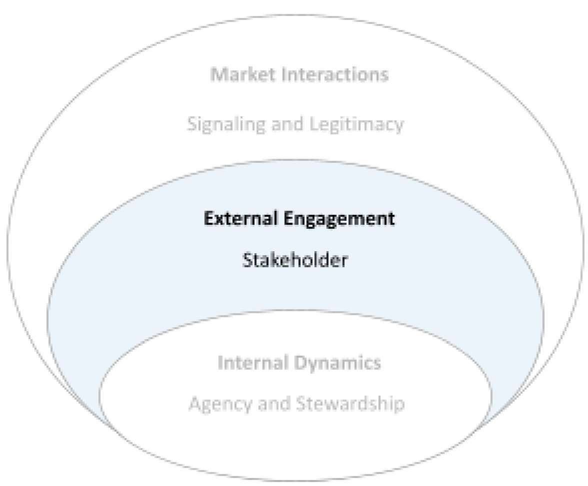

Figure 4, Theoretical framework, External Engagement.

After analyzing the internal dynamics with the theories and the findings, the next layer in the theoretical framework is external engagement, where the stakeholder theory is the central part. As discussed in the theory chapter, the stakeholder theory could be argued to help contextualize the firm within its broader network of relationships and responsibilities. Incorporating the preferences of all stakeholders within the firm could enhance not only the financial performance that benefits shareholders but also address the social, governance, and potential environmental preferences of other stakeholders. Addressing these factors might consequently positively influence general ESG performance. Examining ESG through the lens of stakeholder theory contributes to the comprehension of why the individual pillars play an important role in the composite ESG score. When interpreting the stakeholder theory, H4 to H6 will be prioritized due to their connection to the external engagements.

To connect the stakeholder theory to the findings regarding Environmental risk and Size, the findings display statistical insignificance. To connect these findings to H4 and H5, it can be argued that the ESG score does not have an impact on the cost of capital, depending on the sector the firm operates in or its size. This could be explained by the findings of Alves and Meneses (2024), who argue that while there is a negative relationship between ESGscore and kD, the magnitude depends on the selected risk proxy. They note that the ESG score itself is not a viable proxy for risk. Consequently, in the case of polluting industries, the ESG score may fail to adequately reflect the heightened inherent risks, as other significant risk factors not accounted for by the ESG scoring methodology could overshadow the ESG score's impact on the cost of capital. This analysis opens up a discussion about the ESG rating agencies' industry-specific weighing and whether the region where the firm operates should be more thoroughly regarded.

Mariani et al. (2021) found a negative relationship between environmental commitment and WACC when examining a European sample. As discussed in Chapter 1.5, the EU has an extensive governmental-level regulatory framework to establish aligned compliance with environmental issues at the Union level. This finding from the study can be attributed to the complexity of the ESG framework, where environmental commitment constitutes only a portion of the overall ESG score. As a result, its impact on the cost of capital may be diluted, making the relationship unobservable. When examining the relationship between ESG disclosure score and

WACC, Johnson (2020) found that sectors with higher environmental risk experienced drawbacks for disclosing higher ESG scores, indicating that firms in said industries could be exposed to a higher level of criticism from investors. Connecting Johnson's (2020) findings to our study and the stakeholder theory, it can be acknowledged that when discussing polluting industries, the analysis should include both ESG score and disclosure to understand the dynamic between environmental performance and stakeholder perceptions.

Regarding the size factor, Gjergji et al. (2021) point out that larger firms are seen as less risky than SMEs in terms of the premium warranted by investors. However, when coupling the size with the ESG score, other more prominent factors could affect the relationship to the cost of capital than just the firm size. However, it is important to underline that the findings in this study regarding H4 and H5 are statistically insignificant, suggesting that industry or size factors do not affect the relationship between firms' ESG performance and cost of capital in the Nordic region.

However, the findings of this study revealed a statistically significant relationship between the environmental and social pillars across all dependent variables examined. From a governance perspective, the only weakly statistically significant relationship was a negative relationship observed between G and WACC, while G with kD and kE showed insignificance. Based on these findings, it can be argued that G is not the primary driver among the pillars, however, it does have a modest influence on the overall relationship between ESG and the cost of capital in the Nordic region. This is completely contrary to the expectations set in H6 and, from the perspective of stakeholder theory, could be explained by a circumstance argued by Rojo-Suárez and Alonso-Conde (2023), as they suggest that the effects of ESG performance on equilibrium prices largely depend on the presence of different investors that are more or less aware of the ESG policies in practice. Building on this argument, it could be considered that the results derived from models (11-19) could demonstrate stakeholder preferences on the current financial climate, putting more emphasis on the E and S matters than arguably more obscure governance matters.

6.3 Market Interactions

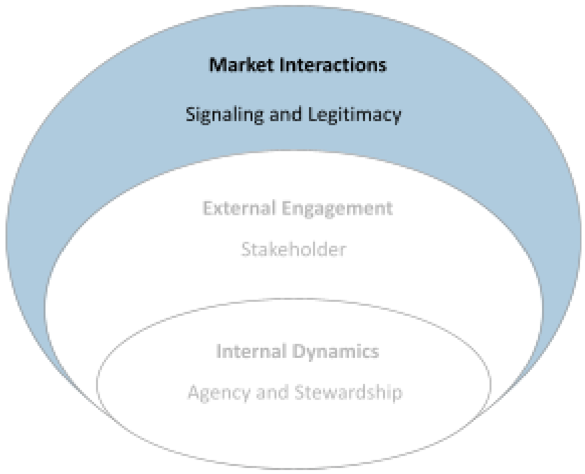

Figure 5, Theoretical framework, Market Interactions.

The findings in this section are analyzed through the lens of market interactions, as explained by signaling and legitimacy theory. These theories are considered here because they influence how markets perceive firms. This analysis encompasses all hypotheses, H1 to H6, due to their relevance within this broader theoretical context.

To link signaling theory to the findings for H1, H2, and H3, it can be argued that if firms signal a higher excess of investment in ESG performance, it will lead to an increase in the firms' kE and kD. The findings in this study are contradictory to other reviewed studies, as Alves and Menezes (2024) and Yasser et al. (2021) found a negative relationship between ESGscore and kD, concluding from a signaling perspective that debt lenders might not regard the ESG activities as an inefficient use of resources. From the findings in H4 and H5, it can be argued that the ESG score does not have an impact on the cost of capital, depending on the sector the firm operates in or its size.

The signaling aspect can also be analyzed from the perspective of environmental risk, as researched by Sharfman and Fernando (2008). They found that equity investors reward firms for increased contributions to environmental risk management, while lenders penalize them. Rojo-Suárez and Alonso-Conde (2023) expanded their analysis on this topic from a signaling perspective, suggesting that ESG performance and the kE have a positive relationship, a finding that aligns with the results of this study. These findings could indicate that in the Nordic context, equity investors are more forward-looking, as they potentially view a higher ESG score as a mechanism for a firm to hedge for potential long-term reputational penalties or time-varying investor preferences. Interpreting the ESG score as a hedge instead of using it as a stability or volatility risk proxy could increase the discount rate for firms with a higher ESG score. The problematic nature of using ESG as a risk proxy was also discussed by Alves and Meneses (2024), and it can provide support for this interpretation.

Furthermore, a possible explanation of the insignificance observed in the polluting model could be that the ESG scoring methodology integrates considerations about the pollutiveness of the industry in which a firm is operating. This could suggest that the ESG scoring methodology compensates for the inherent risks apparent for polluting industries, making the effect unobservable when examining the industries separately. The document provided by Refinitiv (2022) reveals that Refitiv's ESG Scoring Matrix gives different magnitudes and categorical weights varying by industry, which could be one explanation for making the relationship obsolete. However, as noted by Alves and Meneses (2024), ESG is not a solid proxy for risk. The integrated risk matrix still does not fully explain the unobservable relationship between ESGscore and WACC for the polluting industries. The more plausible interpretation is that by altering the sample size radically, the model loses most of its predicting power, thus leading to a statistically insignificant result.

Interestingly, the non-polluting sample has exactly the same correlation coefficient in the variable ESGscore as the full sample (including non-polluting industries), which indicates that there are no economically observable differences for the industries in non-polluting and polluting sectors. One major aspect of the division between polluting and non-polluting is that the categorization was made by the authors. Thus, it might not align with Refinitiv's and general markets' views on the most polluting industry sectors, thus potentially leading to a selection bias in the result.

Dissecting the H6 through signaling theory, it can be argued that the lack of statistical significance when using G as a main independent variable for estimating the cost of equity may be rooted in public expectations. E and S issues can be argued to be generally more prominent in the public discourse, thus having a higher degree of significance in terms of the cost of capital for investors.

A theory coupled with the signaling theory is the legitimacy theory. Firms behave in a specific manner to align themselves with norms and values similar to those of their stakeholders to eventually gain greater access to capital and reputation. Van Der Laan's (2009) and Dumay et al.'s (2019) perspectives have been mentioned, and the legitimacy theory assists in gaining insight into why management in certain sectors acts as they do to please the stakeholders. Similar to the findings of Uyar et al. (2020), in the logistics sector, managers tend to align themselves with the norms and values of their stakeholders.

To connect the legitimacy theory to the findings for H1, H2, and H3, it can be argued that if the firms align themselves to the norms and values to maintain legitimacy, a higher excess of investment in ESG performance will increase the kE and the kD. This could be explained by Dumay et al. (2019), who found that increased disclosure does not necessarily correlate with greater legitimacy or trust. Issues such as greenwashing and adverse selection can undermine the perceived authenticity of the disclosures.

The findings from H4 and H5 consider firms in polluting industries, and depending on the size of the firm, the ESG score shows no effect on the cost of capital. The reason for this could be explained by the signaling theory that investors in polluting industries may be aware of the volatile and uncertain investment environment and prioritize return on invested capital over ESG initiatives, as supported by Nazir et al. (2022). Additionally, large firms may not need to invest in ESG issues to gain legitimacy and benefit from a lower cost of capital, as supported by Gjergji et al. (2021). However, tying it to H6, the individual pillar analysis from models (11-19) reveals that the significance of the E and S pillars, coupled with the insignificance of the G pillar, could indicate the areas where firms seek to promote legitimacy.

7. Conclusion

The purpose of this study is to gain more profound knowledge of corporate finance by identifying if ESG performance influences financing costs for Nordic firms. This study also seeks to fill a gap in the current literature on sustainable finance, particularly regarding the representation of the Nordics in the current financial climate. This study contributes to the existing literature by drawing on insights from several pivotal theories and arguments developed from empirical research in related fields. Additionally, by examining the potential effects of a firm's ESG performance on its cost of capital in the Nordic countries, the first research question is addressed:

1. Is there an observable relationship between a firm's ESG score (performance) and its cost of capital in the Nordic region?

An observable relationship between ESG score and the cost of capital is detected in the results. This is highlighted by the statistical significance between the ESGscore, kD, and kE suggested by models (2-3). Model (1), which examines the WACC, yields statistically insignificant results but does not solely invalidate the existence of this relationship. However, any economically significant conclusions can not be derived from the results and analysis provided, as the correlation coefficients observed in the models are too marginal to have any concrete economic impact. In light of the analysis provided, it can be argued that many economic theories are not fully capable of grasping the complexity of ESG as a concept. Therefore, no direct links between the theories and the results derived from this study can be drawn.

Furthermore, to answer the second research question:

2. Do firms in the Nordic region with higher ESG scores benefit from lower financing costs compared to their counterparts, and what are the key drivers in this relationship?

Because of the positive correlation between ESGscore, kD, and kE, the conclusion drawn from that is that Nordic firms with a higher ESG score are penalized by equity investors and debt lenders with higher financing costs. Investments and active participation in ESG issues seem to increase the cost of capital for the firms in this study. This positive relationship can best be explained through signaling and agency theories by differences in investor preferences, industries, markets, and regulatory frameworks. The interpretation of the findings suggests that the key drivers among the individual pillars are Environmental and Social rather than the hypothesized Governance. However, contrary to the expectations based on financial theories and empirical literature, the hypothesized size and industry effects do not appear to be significant drivers from an ESG standpoint, according to this study.

Reflecting on Laurence Fink's CEO letter (2022), which challenges firms to lead in the transition to a net zero world, this study highlights the nuanced dynamics between ESG performance and financing costs. Agency and stewardship theories reveal that managers are under scrutiny when they try to balance between committing to sustainable practices and fulfilling stakeholder expectations by addressing broader stakeholder concerns through the stakeholder theory. Signaling and legitimacy theories further explain how the market perceives firms' ESG contributions, potentially demanding higher returns in situations of increased perceived risks or traction when trying to align with societal norms to gain trust.

The findings suggest that higher ESG scores in Nordic firms are associated with, although not economically significant in magnitude, higher cost of equity and debt capital. This implication, mostly contradicting the existing academic consensus, underscores the intricate, context-dependent nature of ESG performance. This study suggests that the pursuit of a net zero world in the Nordics does not, in fact, come with benefits but rather disadvantages when investigating the matter through financing costs. To conclude, ESG research must pay close attention to regional, sectoral, market-specific, and other nuances to understand and internalize its financial implications entirely. As pressure from investors and debt lenders increases, Nordic firms might need to critically evaluate their level of ESG contributions and investments. This growing scrutiny suggests that the relationship between ESG performance and the cost of capital could potentially strengthen in the future, providing benefits to firms that actively engage in contributing to a more sustainable world. Consequently, firms must consider whether the potential advantages of maintaining high ESG scores could offset the observed negative impacts on their cost of capital, ultimately promoting both economic and environmental sustainability. For policymakers, these findings suggest that streamlining the ESG rating methodologies (having one rating methodology instead of many) and integrating ESG reporting into the compliance framework might be beneficial for investors, firms, and other stakeholders alike.

7.1 Importance of Findings

Although this study has not found economically significant results throughout the regression models and the results are contradictory to some earlier empirical evidence, the findings contribute to the literature by emphasizing the importance of understanding investor behavior, market perceptions, and the potential costs associated with ESG initiatives. These insights contribute to the broader discourse on sustainable finance, highlighting areas for further research and consideration in corporate strategy and policymaking.

The contributions of this study stem from four main perspectives: regionality, scope, time period, and findings. Firstly, the Nordics are arguably underrepresented in ESG and cost of capital research. There are existing studies that discuss ESG performance in the Nordic context. However, they mostly focus on value creation or the individual cost of capital components, focusing solely on the cost of debt or equity while excluding broader analysis. Therefore, introducing a robust methodology to examine the cost of capital and its hypothesized key drivers offers new insights into this research area.

Further, the time period of 2017-2022 is concise yet comprehensive and more recent than all of the reviewed literature in this study, apart from Alves and Meneses (2024), who also feature data until 2022. The time period selection contributes to the existing literature by reflecting the most recent economic and regulatory trends affecting ESG and the cost of capital. Furthermore, the contradictory findings to general academic consensus highlight the complex nature of ESG as a concept and underscore the possibility that ESG research is not easily generalizable through different regions, markets, and industries.

Lastly, one discreet factor that provides an additional layer to the contributions is to note that ESG performance disclosure was not mandatory during the time period of the study; thus, some firms voluntarily do not report their scores to the public, regardless of the reason. By acknowledging that, it can be argued that ESG research as a field is biased by default due to the voluntary aspect of reporting, contrary to financial reporting. This acknowledgement warrants that the readers of ESG research should put even more emphasis on critically evaluating studies presented in the ESG spectrum. However, with the updated regulatory framework, large firms and listed SMEs in Europe must report on CSR during 2024, with the reports being published in 2025 (European Commission, 2024). This will lead to more data on the Environmental, Social, and Governance pillars, which can be used for future research on the topic. Additionally, the increased information on firm performance may reveal larger contrasts between firms, potentially improving the credibility of similar studies' results.

8. Limitations and Future Research

The main limitations of this study are the homogenous nature of primary data, selection bias, and methodology choices. The primary data source, Datastream, was chosen for this study due to its accessibility through the university as well as its application of several empirical papers reviewed in this study. However, as many ESG data providers have unique frameworks to evaluate and rank companies, it is impossible to claim that one excels the other. Furthermore, due to time and content limits, there was no possibility of using a benchmark platform from an alternative agency, even if it would have been provided by the university, thus potentially reducing the robustness of the findings. Lack of benchmarking can also lead to validation issues, as the results can not be replicated with different primary data.

There are several aspects that could affect the results derived in this study through selection bias. First, due to the purpose of this study, the Nordics were selected as a sample, decreasing the sample size and reducing generalizability. In addition, limiting the sample geographically may not represent broader market trends. Also, since ESG is a fairly new concept, it translates to the availability of ESG scores from the past. Due to this, coupled with the regulatory environment, the sample period was selected to be six years. Furthermore, some of the observations (firms) needed to be deleted from the primary data due to inadequate data on some of the variables, thus introducing potential biases to the sample by excluding companies with different characteristics that were included in the sample.

Lastly, the methodology choices of variable selection and modelling choices were made arbitrarily by the authors, thus potentially leading to biased and/or skewed results. Consequently, the chosen methods might not be the most viable ones when examining the relationship between ESG performance and the cost of capital. In practice, this means that the methodological choices might not be the most suitable ones, and the methodologies selected were based on the reviewed literature, relevant theories, and the authors' capabilities. The variables included in the models can result in overfitting or underfitting, leading to biases in the estimates. The scope of the analysis was limited to chosen variables, models, and the authors' expertise, thus potentially omitting relevant factors.

For further research, a third-party provider of the ESG data should be assessed to increase its validity with a more robust measurement of the ESG data. Study a longer time period to expand the sample and gain more data to analyze. Extending the sample size and period would allow for a richer analysis of long-term trends that might overlook short-term fluctuations affecting the result for a shorter time period. Furthermore, the Nordics should be compared with the rest of Europe and/or the world to gain a broader understanding of the impact of the results and to be able to generalize the results through meaningful comparison. Lastly, consider adding initial control variables as risk proxies (e.g., Altman's Z-score for volatility) to shift the risk-estimating role of the ESG score to other metrics. In addition, the analysis should be coupled with ESG disclosure and controversies to gain a deeper understanding of how these factors interplay with the cost of the capital framework. The cost of capital could also be examined simultaneously with value creation to examine whether there is a mutually exclusive/inclusive relationship between the cost of capital and value creation in the ESG context.

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Appendix

Summary Statistics

Appendix 1.1, Summary Statistics, unwinsorized

Summary statistics

	N	Mean	Median	SD	Min	Max	Skew	Kurt
Year	2308	2020	2020	1.50	2017	2022	-.55	2.32
ESGScore	2308	47.66	49.06	20.80	1.20	92.88	-.142	2.25
E	2308	41.28	40.17	27.10	0	97.98	.115	1.88
S	2308	50.37	52.39	23.76	0	95.76	-.252	2.14
G	2308	48.74	48.74	23.18	.311	98.56	.001	2.04
BS	2308	7.72	7.00	2.50	3	28	1.47	9.69
CEO	2308	.216	0.00	.412	0	1	1.38	2.90
Beta	2308	1.06	1.02	.524	-1.15	4.41	.92	7
kD	2308	.024	0.02	.02	-.003	.273	2.19	20.55
kE	2308	.084	0.081	.036	-.061	.378	1.30	9.23
WACC	2308	.07	0.069	.031	-.056	.268	.855	6.35
WACCTaxRate	2308	.212	0.217	.058	0	.711	.136	15.27
MarketCap	2308	5681.03	1072.77	18867.93	0	456194.56	12.86	233.44
ROA	2308	.018	0.045	.191	-2.06	1.72	-3.77	37.33
leverage	2308	.249	0.23	.199	0	2.96	3.00	32.41
MTB	2308	3.76	1.58	10.33	.158	298.45	15.15	345.90
logassets	2308	13.82	13.91	2.16	7.65	20.36	-.022	2.93
period 1	2308	.06	0.000	.237	0	1	3.71	14.79
period 2	2308	.1	0.000	.3	0	1	2.67	8.10
period 3	2308	.133	0.000	.339	0	1	2.17	5.70
period 4	2308	.218	0.000	.413	0	1	1.37	2.87
period 5	2308	.243	0.000	.429	0	1	1.20	2.44
period 6	2308	.247	0.000	.431	0	1	1.17	2.38

Appendix 1.2, Panel Data Summary Statistics

firmid: 1, 2, ..., 570 n = 570
Year: 2017, 2018, ..., 2022 T = 6
Delta(Year) = 1 unit
Span(Year) = 6 periods
(firmid*Year uniquely identifies each observation)

Distribution of T_i:	min	5%	25%	50%	75%	95%	max
	1	2	3	4	5	6	6

Freq.	Percent	Cum.	Pattern
198	34.74	34.74	...111
138	24.21	58.95	111111
92	16.14	75.09	.11111
74	12.98	88.07	..1111
56	9.82	97.89	11
9	1.58	99.47	1
1	0.18	99.65	...1.1
1	0.18	99.82	..1.11
1	0.18	100.00	.11.11
570	100.00		XXXXXX

The Wald test

Appendix 2.1

WACC
Modified Wald test for groupwise heteroskedasticity in Fixed effect model
H0: sigma(i)^2 = sigma^2 for all *i* chi2 (570) = 3.3e+33 Prob>chi2 = 0.0000

Appendix 2.2

kD
Modified Wald test for groupwise heteroskedasticity in Fixed effect model
H0: sigma(i)^2 = sigma^2 for all *i* chi2 (570) = 1.1e+34 Prob>chi2 = 0.0000

Appendix 2.3

kE
Modified Wald test for groupwise heteroskedasticity in Fixed effect model
H0: sigma(i)^2 = sigma^2 for all *i* chi2 (570) = 1.8e+35 Prob>chi2 = 0.0000

The Hausman test

Appendix 3.1

Hausman (1978) specification test

	Coef.
Chi-square test value	361.19
Prob > chi2	0.0000

White's test for models 4-6

Appendix 3.2

H0: Homoskedasticity Ha: Unrestricted heteroskedasticity
chi2(88) = 712.65 Prob > chi2 = 0.0000

Multicollinearity test

Appendix 4.1,

Pairwise correlations, WACC with pillars

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) WACC	1.000											
(2) ESGScore	-0.05	1.000										
(3) E	-0.10	0.856	1.000									
(4) S	-0.06	0.910	0.759	1.000								
(5) G	0.026	0.752	0.454	0.505	1.000							
(6) leverage_win	-0.27	0.071	0.111	0.061	0.038	1.000						
(7) Beta_win	0.732	0.063	0.037	0.048	0.092	0.040	1.000					
(8) MTB_win	0.126	-0.176	-0.207	-0.161	-0.105	-0.191	0.007	1.000				
(9) logassets	-0.249	0.641	0.650	0.601	0.407	0.228	-0.026	-0.347	1.000			
(10) ROA	-0.060	0.261	0.271	0.290	0.105	0.019	-0.058	-0.018	0.333	1.000		
(11) BS	-0.092	0.483	0.450	0.482	0.294	-0.049	-0.036	-0.149	0.538	0.148	1.000	
(12) CEO	0.046	-0.055	-0.027	0.006	-0.125	0.014	0.009	0.023	0.025	0.015	0.088	1.000

Appendix 4.2,

Pairwise correlations, kD with pillars

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) kD	1.000											
(2) ESGScore_win	-0.062	1.000										
(3) E	-0.049	0.856	1.000									
(4) S	-0.086	0.910	0.759	1.000								
(5) G	-0.003	0.752	0.454	0.505	1.000							
(6) leverage_win	0.223	0.071	0.111	0.061	0.038	1.000						
(7) Beta_win	0.112	0.063	0.037	0.048	0.092	0.040	1.000					
(8) MTB_win	-0.211	-0.176	-0.207	-0.161	-0.105	-0.191	0.007	1.000				
(9) logassets_win	0.007	0.641	0.650	0.601	0.407	0.228	-0.026	-0.347	1.000			
(10) ROA_win	-0.097	0.261	0.271	0.290	0.105	0.019	-0.058	-0.018	0.333	1.000		
(11) BS	-0.094	0.483	0.450	0.482	0.294	-0.049	-0.036	-0.149	0.538	0.148	1.000	
(12) CEO	-0.045	-0.055	-0.027	0.006	-0.125	0.014	0.009	0.023	0.025	0.015	0.088	1.000

Appendix 4.3,Pairwise correlations, kE with pillars

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) kE	1.000											
(2) ESGScore_win	0.062	1.000										
(3) E	0.037	0.856	1.000									
(4) S	0.044	0.910	0.759	1.000								
(5) G	0.095	0.752	0.454	0.505	1.000							
(6) leverage_win	0.044	0.071	0.111	0.061	0.038	1.000						
(7) Beta_win	0.863	0.063	0.037	0.048	0.092	0.040	1.000					
(8) MTB_win	-0.026	-0.176	-0.207	-0.161	-0.105	-0.191	0.007	1.000				
(9) logassets_win	-0.016	0.641	0.650	0.601	0.407	0.228	-0.026	-0.347	1.000			
(10) ROA_win	-0.047	0.261	0.271	0.290	0.105	0.019	-0.058	-0.018	0.333	1.000		
(11) BS	-0.027	0.483	0.450	0.482	0.294	-0.049	-0.036	-0.149	0.538	0.148	1.000	
(12) CEO	0.013	-0.055	-0.027	0.006	-0.125	0.014	0.009	0.023	0.025	0.015	0.088	1.000

Appendix 4.4, Pairwise correlations, WACC

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) WACC	1.000								
(2) ESGScore	-0.047	1.000							
(3) leverage_win	-0.265	0.071	1.000						
(4) Beta_win	0.726	0.063	0.040	1.000					
(5) MTB_win	0.116	-0.176	-0.191	0.007	1.000				
(6) logassets_win	-0.231	0.641	0.228	-0.026	-0.347	1.000			
(7) ROA_win	-0.059	0.260	0.019	-0.058	-0.018	0.333	1.000		
(8) BoardSize	-0.086	0.483	-0.049	-0.036	-0.149	0.538	0.148	1.000	
(9) CEO	0.037	-0.055	0.014	0.009	0.023	0.025	0.015	0.088	1.000

Appendix 4.5, Pairwise correlations, kD

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) kD	1.000								
(2) ESGScore	-0.065	1.000							
(3) leverage_win	0.212	0.071	1.000						
(4) Beta_win	0.116	0.063	0.040	1.000					
(5) MTB_win	-0.196	-0.176	-0.191	0.007	1.000				
(6) logassets_win	0.004	0.641	0.228	-0.026	-0.347	1.000			
(7) ROA_win	-0.116	0.260	0.019	-0.058	-0.018	0.333	1.000		
(8) BoardSize	-0.093	0.483	-0.049	-0.036	-0.149	0.538	0.148	1.000	
(9) CEO	-0.047	-0.055	0.014	0.009	0.023	0.025	0.015	0.088	1.000

Appendix 4.6, Pairwise correlations, kE

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) kE	1.000								
(2) ESGScore	0.062	1.000							
(3) leverage_win	0.044	0.071	1.000						
(4) Beta_win	0.863	0.063	0.040	1.000					
(5) MTB_win	-0.026	-0.176	-0.191	0.007	1.000				
(6) logassets_win	-0.016	0.641	0.228	-0.026	-0.347	1.000			
(7) ROA_win	-0.047	0.260	0.019	-0.058	-0.018	0.333	1.000		
(8) BoardSize	-0.027	0.483	-0.049	-0.036	-0.149	0.538	0.148	1.000	
(9) CEO	0.013	-0.055	0.014	0.009	0.023	0.025	0.015	0.088	1.000

Regressions

Appendix 5.1, FE regression of the main models

Regression results

	(1)	(2)	(3)
	Model_1	Model_2	Model_3
	WACC	kD	kE
ESG Score	0.0001	0.0003***	0.0002**
	(0.0001)	(0.0001)	(0.0001)
leverage	-0.0384***	-0.0147*	-0.0134**
	(0.0061)	(0.0084)	(0.0068)
BS	-0.0006	-0.0003	-0.0002
	(0.0005)	(0.0005)	(0.0007)
CEO	0.0017	-0.0025	0.0017
	(0.0019)	(0.0017)	(0.0019)
Beta	0.0412***	-0.0002	0.0579***
	(0.0025)	(0.0014)	(0.0022)
ROA	-0.0030	-0.0095	0.0028
	(0.0088)	(0.0114)	(0.0078)
MTB	-0.0002	-0.0008***	-0.0003**
	(0.0001)	(0.0001)	(0.0001)
logassets	0.0051***	0.0104***	0.0051***
	(0.0015)	(0.0017)	(0.0019)
_cons	-0.0325	-0.1246***	-0.0495**
	(0.0205)	(0.0222)	(0.0236)
Observations	2308	2308	2308
R-squared	0.3810	0.1268	0.5045
Standard errors	Clustered	Clustered	Clustered
Method	FE	FE	FE

Standard errors are in parentheses

**** p<.01, ** p<.05, * p<.1*

Appendix 5.2

Regression results, Model 1

WACC	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
ESGScore	.0001	.0001	0.98	.3293	-.0001	.0002	
leverage_win	-.0384	.0061	-6.24	0	-.0504	-.0263	***
BS	-.0006	.0005	-1.17	.2425	-.0016	.0004	
CEO	.0017	.0019	0.88	.3773	-.002	.0053	
Beta	.0412	.0025	16.68	0	.0363	.046	***
ROA_win	-.003	.0088	-0.34	.7324	-.0202	.0142	
MTB_win	-.0002	.0001	-1.51	.131	-.0004	.0001	
logassets	.0051	.0015	3.33	.0009	.0021	.0081	***
Constant	-.0325	.0205	-1.58	.1139	-.0729	.0078	

Mean dependent var	0.0701	SD dependent var	0.0306
R-squared	0.3810	Number of obs	2308
F-test	52.2613	Prob > F	0.0000
Akaike crit. (AIC)	-13026.9039	Bayesian crit. (BIC)	-12980.9508

*** *p<.01,* ** *p<.05,* * *p<.1*

Appendix 5.3

Regression results, Model 2

kD	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
ESGScore	.0003	.0001	4.92	0	.0002	.0004	***
leverage_win	-.0147	.0084	-1.75	.0801	-.0312	.0018	*
BS	-.0003	.0005	-0.65	.515	-.0013	.0006	
CEO	-.0025	.0017	-1.42	.1563	-.0059	.001	
Beta	-.0002	.0014	-0.11	.9116	-.003	.0027	
ROA_win	-.0095	.0114	-0.84	.401	-.0319	.0128	
MTB_win	-.0008	.0001	-6.24	0	-.0011	-.0006	***
logassets	.0104	.0017	6.26	0	.0071	.0136	***
Constant	-.1246	.0222	-5.61	0	-.1682	-.081	***

Mean dependent var	0.0240	SD dependent var	0.0204
R-squared	0.1268	Number of obs	2308
F-test	30.1085	Prob > F	0.0000
Akaike crit. (AIC)	-12976.1543	Bayesian crit. (BIC)	-12930.2012

*** *p<.01,* ** *p<.05,* * *p<.1*

Appendix 5.4

Regression results, Model 3

kE	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
ESGScore	.0002	.0001	2.13	.0335	0	.0003	**
leverage_win	-.0134	.0068	-1.98	.0477	-.0267	-.0001	**
BS	-.0002	.0007	-0.32	.7473	-.0015	.0011	
CEO	.0017	.0019	0.89	.3716	-.0021	.0055	
Beta	.0579	.0022	25.92	0	.0535	.0623	***
ROA_win	.0028	.0078	0.35	.7247	-.0126	.0181	
MTB_win	-.0003	.0001	-2.32	.021	-.0005	0	**
logassets	.0051	.0019	2.69	.0074	.0014	.0088	***
Constant	-.0495	.0236	-2.10	.0361	-.0958	-.0032	**

Mean dependent var	0.0843	SD dependent var	0.0357
R-squared	0.5045	Number of obs	2308
F-test	134.3610	Prob > F	0.0000
Akaike crit. (AIC)	-12663.4156	Bayesian crit. (BIC)	-12617.4625

**** p<.01, ** p<.05, * p<.1*

Appendix 5.5

Regression results with WACC, Polluting

	(1)	(2)	(3)
	Model_4	Model_5	Model_6
	WACC	WACC	WACC
ESG Score	0.0001**	-0.0000	0.0001**
	(0.0000)	(0.0001)	(0.0000)
leverage	-0.0418***	-0.0263***	-0.0443***
	(0.0026)	(0.0045)	(0.0029)
BS	0.0002	0.0003	0.0002
	(0.0002)	(0.0004)	(0.0002)
CEO	0.0038***	0.0046***	0.0031***
	(0.0008)	(0.0016)	(0.0009)
Beta	0.0421***	0.0413***	0.0417***
	(0.0017)	(0.0024)	(0.0020)
ROA	0.0054*	-0.0014	0.0061**
	(0.0033)	(0.0234)	(0.0031)
MTB	0.0003***	0.0005***	0.0003***
	(0.0001)	(0.0001)	(0.0001)
logassets	-0.0029***	-0.0009	-0.0032***
	(0.0003)	(0.0007)	(0.0003)
Year== 2017.0000	-0.0080***		-0.0069***
	(0.0010)		(0.0012)
Year== 2018.0000		0.0110***	
		(0.0015)	
Year== 2019.0000	-0.0136***	-0.0042*	-0.0129***
	(0.0012)	(0.0023)	(0.0014)
Year== 2020.0000	-0.0186***	-0.0088***	-0.0179***
	(0.0010)	(0.0018)	(0.0012)
Year== 2021.0000	-0.0090***	0.0040**	-0.0094***
	(0.0010)	(0.0018)	(0.0012)
Year== 2022.0000	0.0045***	0.0161***	0.0047***
	(0.0011)	(0.0023)	(0.0012)
_cons	0.0769***	0.0395***	0.0809***
	(0.0036)	(0.0079)	(0.0041)
Observations	2308	526	1782
R-squared	0.6986	0.6624	0.7077
Standard errors	robust	robust	robust
Method	POLS	POLS	POLS

Robust standard errors are in parentheses

**** p<.01, ** p<.05, * p<.1*

Appendix 5.6

Linear regression, full sample

WACC	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
ESGScore	.0001	0	2.24	.0253	0	.0001	**
leverage_win	-.0418	.0026	-16.21	0	-.0469	-.0367	***
BS	.0002	.0002	1.15	.2487	-.0002	.0007	
CEO	.0038	.0008	4.88	0	.0023	.0053	***
Beta	.0421	.0017	25.02	0	.0388	.0454	***
ROA_win	.0054	.0033	1.66	.0969	-.001	.0118	*
MTB_win	.0003	.0001	5.40	0	.0002	.0004	***
logassets	-.0029	.0003	-10.37	0	-.0035	-.0024	***
period_1	-.008	.001	-8.10	0	-.0099	-.006	***
o	0	.	.	.	.	.	
period_3	-.0136	.0012	-11.33	0	-.016	-.0112	***
period_4	-.0186	.001	-18.55	0	-.0205	-.0166	***
period_5	-.009	.001	-8.99	0	-.011	-.0071	***
period_6	.0045	.0011	4.14	0	.0024	.0067	***
Constant	.0769	.0036	21.56	0	.0699	.0839	***

Mean dependent var	0.0701	SD dependent var	0.0306
R-squared	0.6986	Number of obs	2308
F-test	217.5378	Prob > F	0.0000
Akaike crit. (AIC)	-12293.2769	Bayesian crit. (BIC)	-12212.8590

**** p<.01, ** p<.05, * p<.1*

Appendix 5.7

Linear regression, polluting industries

WACC	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
ESGScore	0	.0001	-0.54	.5888	-.0001	.0001	
leverage_win	-.0263	.0045	-5.82	0	-.0352	-.0174	***
BS	.0003	.0004	0.82	.4121	-.0005	.0011	
CEO	.0046	.0016	2.79	.0055	.0014	.0078	***
Beta	.0413	.0024	17.32	0	.0366	.0459	***
ROA_win	-.0014	.0234	-0.06	.952	-.0473	.0445	
MTB_win	.0005	.0001	4.94	0	.0003	.0007	***
logassets	-.0009	.0007	-1.32	.1868	-.0022	.0004	
o	0	.	.	.	.	.	
period_2	.011	.0015	7.19	0	.008	.014	***
period_3	-.0042	.0023	-1.83	.0678	-.0088	.0003	*
period_4	-.0088	.0018	-4.96	0	-.0124	-.0053	***
period_5	.004	.0018	2.19	.0289	.0004	.0076	**
period_6	.0161	.0023	6.92	0	.0115	.0206	***
Constant	.0395	.0079	5.00	0	.024	.055	***

Mean dependent var	0.0757	SD dependent var	0.0257
R-squared	0.6624	Number of obs	526
F-test	52.0913	Prob > F	0.0000
Akaike crit. (AIC)	-2901.3256	Bayesian crit. (BIC)	-2841.6113

**** p<.01, ** p<.05, * p<.1*

Appendix 5.8

Linear regression, excluding the polluting industries

WACC	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
ESGScore	.0001	0	2.41	.0159	0	.0001	**
leverage_win	-.0443	.0029	-15.14	0	-.05	-.0385	***
BS	.0002	.0002	0.69	.4875	-.0003	.0006	
CEO	.0031	.0009	3.55	.0004	.0014	.0048	***
Beta	.0417	.002	20.75	0	.0378	.0457	***
ROA_win	.0061	.0031	1.97	.0493	0	.0122	**
MTB_win	.0003	.0001	3.68	.0002	.0001	.0004	***
logassets	-.0032	.0003	-10.23	0	-.0038	-.0026	***
period_1	-.0069	.0012	-5.62	0	-.0093	-.0045	***
o	0	.	.	.	.	.	
period_3	-.0129	.0014	-9.02	0	-.0157	-.0101	***
period_4	-.0179	.0012	-15.08	0	-.0203	-.0156	***
period_5	-.0094	.0012	-7.92	0	-.0117	-.0071	***
period_6	.0047	.0012	3.73	.0002	.0022	.0071	***
Constant	.0809	.0041	19.58	0	.0728	.089	***

Mean dependent var	0.0685	SD dependent var	0.0317
R-squared	0.7077	Number of obs	1782
F-test	185.2389	Prob > F	0.0000
Akaike crit. (AIC)	-9414.2669	Bayesian crit. (BIC)	-9337.4701

*** *p<.01*, ** *p<.05*, * *p<.1*

Appendix 5.9

Regression results, WACC – kD - kE

	(1)	(2)	(3)
	Model_7	Model_8	Model_9
	WACC	kD	kE
ESG Score	0.0001	0.0003***	0.0001**
	(0.0001)	(0.0001)	(0.0001)
large	-0.0107	0.0033	-0.0108
	(0.0141)	(0.0107)	(0.0146)
ESGScorexLarge	0.0001	-0.0001	0.0001
	(0.0002)	(0.0001)	(0.0002)
leverage	-0.0386***	-0.0151*	-0.0135*
	(0.0060)	(0.0084)	(0.0069)
BS	-0.0006	-0.0003	-0.0002
	(0.0005)	(0.0005)	(0.0007)
CEO	0.0018	-0.0025	0.0018
	(0.0019)	(0.0017)	(0.0019)
Beta	0.0412***	-0.0002	0.0579***
	(0.0025)	(0.0014)	(0.0022)
ROA	-0.0028	-0.0094	0.0029
	(0.0088)	(0.0114)	(0.0078)
MTB	-0.0002	-0.0008***	-0.0002**
	(0.0001)	(0.0001)	(0.0001)
logassets	0.0056***	0.0106***	0.0055***
	(0.0016)	(0.0018)	(0.0019)
_cons	-0.0385*	-0.1274***	-0.0540**
	(0.0211)	(0.0231)	(0.0237)
Observations	2308	2308	2308
R-squared	0.3823	0.1275	0.5051
Standard errors	Clustered	Clustered	Clustered
Method	FE	FE	FE

Standard errors are in parentheses

**** p<.01, ** p<.05, * p<.1*

Appendix 5.10

Regression results, model 7

WACC	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
ESGScore	.0001	.0001	0.86	.3889	-.0001	.0002	
large	-.0107	.0141	-0.76	.4502	-.0385	.0171	
ESGScorexLarge	.0001	.0002	0.36	.7193	-.0003	.0004	
leverage_win	-.0386	.006	-6.43	0	-.0504	-.0268	***
BS	-.0006	.0005	-1.14	.255	-.0016	.0004	
CEO	.0018	.0019	0.94	.3486	-.0019	.0055	
Beta	.0412	.0025	16.68	0	.0363	.046	***
ROA_win	-.0028	.0088	-0.32	.7474	-.0201	.0145	
MTB_win	-.0002	.0001	-1.35	.1783	-.0004	.0001	
logassets	.0056	.0016	3.51	.0005	.0025	.0088	***
Constant	-.0385	.0211	-1.82	.0691	-.0799	.003	*

Mean dependent var	0.0701	SD dependent var	0.0306
R-squared	0.3823	Number of obs	2308
F-test	42.2884	Prob > F	0.0000
Akaike crit. (AIC)	-13027.7925	Bayesian crit. (BIC)	-12970.3511

**** p<.01, ** p<.05, * p<.1*

Appendix 5.11

Regression results kD

kD	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
ESGScore	.0003	.0001	4.79	0	.0002	.0005	***
large	.0033	.0107	0.30	.7605	-.0178	.0243	
ESGScorexLarge	-.0001	.0001	-0.76	.4486	-.0004	.0002	
leverage_win	-.0151	.0084	-1.81	.0711	-.0315	.0013	*
BS	-.0003	.0005	-0.62	.534	-.0013	.0007	
CEO	-.0025	.0017	-1.41	.158	-.0059	.001	
Beta	-.0002	.0014	-0.14	.8913	-.003	.0026	
ROA_win	-.0094	.0114	-0.83	.407	-.0318	.0129	
MTB_win	-.0008	.0001	-6.13	0	-.0011	-.0006	***
logassets	.0106	.0018	6.02	0	.0071	.014	***
Constant	-.1274	.0231	-5.52	0	-.1727	-.0821	***

Mean dependent var	0.0240	SD dependent var	0.0204
R-squared	0.1275	Number of obs	2308
F-test	24.2879	Prob > F	0.0000
Akaike crit. (AIC)	-12974.0421	Bayesian crit. (BIC)	-12916.6007

*** *p<.01*, ** *p<.05*, * *p<.1*

Appendix 5.12

Regression results kE

kE	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
ESGScore	.0001	.0001	1.99	.0467	0	.0003	**
large	-.0108	.0146	-0.74	.4604	-.0395	.0179	
ESGScorexLarge	.0001	.0002	0.50	.6205	-.0003	.0005	
leverage_win	-.0135	.0069	-1.95	.0514	-.0271	.0001	*
BS	-.0002	.0007	-0.31	.7572	-.0015	.0011	
CEO	.0018	.0019	0.94	.3477	-.002	.0056	
Beta	.0579	.0022	25.94	0	.0535	.0623	***
ROA_win	.0029	.0078	0.36	.7153	-.0125	.0182	
MTB_win	-.0002	.0001	-2.20	.0283	-.0005	0	**
logassets	.0055	.0019	2.88	.0041	.0018	.0093	***
Constant	-.054	.0237	-2.28	.0231	-.1006	-.0074	**

Mean dependent var	0.0843	SD dependent var	0.0357
R-squared	0.5051	Number of obs	2308
F-test	108.4338	Prob > F	0.0000
Akaike crit. (AIC)	-12662.2056	Bayesian crit. (BIC)	-12604.7642

**** p<.01, ** p<.05, * p<.1*

Appendix 5.13

Regression results, Individual Pillars

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Model_11	Model_12	Model_13	Model_14	Model_15	Model_16	Model_17	Model_18	Model_19
	WACC	WACC	WACC	kD	kD	kD	kE	kE	kE
E	0.0001***			0.0003***			0.0001***		
	(0.0000)			(0.0000)			(0.0001)		
S		0.0001**			0.0002***			0.0002***	
		(0.0001)			(0.0001)			(0.0001)	
G			-0.0001*			0.0001			-0.0000
			(0.0000)			(0.0000)			(0.0000)
leverage	-0.0389***	-0.0384***	-0.0375***	-0.0147*	-0.0136	-0.0135	-0.0134*	-0.0132**	-0.0123*
	(0.0061)	(0.0062)	(0.0061)	(0.0083)	(0.0083)	(0.0083)	(0.0069)	(0.0066)	(0.0068)
BS	-0.0006	-0.0007	-0.0006	-0.0004	-0.0004	-0.0003	-0.0002	-0.0003	-0.0002
	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0007)	(0.0007)	(0.0007)
CEO	0.0018	0.0017	0.0010	-0.0029*	-0.0031*	-0.0030*	0.0015	0.0016	0.0010
	(0.0018)	(0.0019)	(0.0019)	(0.0017)	(0.0017)	(0.0018)	(0.0019)	(0.0019)	(0.0020)
Beta	0.0409***	0.0411***	0.0416***	-0.0002	0.0003	0.0005	0.0578***	0.0578***	0.0584***
	(0.0024)	(0.0025)	(0.0025)	(0.0014)	(0.0015)	(0.0014)	(0.0022)	(0.0022)	(0.0022)
ROA	-0.0033	-0.0029	-0.0030	-0.0100	-0.0092	-0.0093	0.0025	0.0029	0.0028
	(0.0088)	(0.0088)	(0.0088)	(0.0115)	(0.0115)	(0.0114)	(0.0078)	(0.0078)	(0.0078)
MTB	-0.0002	-0.0002	-0.0001	-0.0008***	-0.0008***	-0.0008***	-0.0003**	-0.0002**	-0.0002**
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
logassets	0.0045***	0.0049***	0.0059***	0.0102***	0.0112***	0.0116***	0.0050***	0.0050***	0.0062***
	(0.0016)	(0.0015)	(0.0015)	(0.0016)	(0.0016)	(0.0017)	(0.0018)	(0.0018)	(0.0019)
_cons	-0.0263	-0.0332	-0.0379*	-0.1190***	-0.1329***	-0.1320***	-0.0465**	-0.0521**	-0.0563**
	(0.0208)	(0.0205)	(0.0206)	(0.0221)	(0.0219)	(0.0224)	(0.0236)	(0.0231)	(0.0236)
Observations	2308	2308	2308	2308	2308	2308	2308	2308	2308
R-squared	0.3839	0.3825	0.3819	0.1320	0.1231	0.1163	0.5053	0.5076	0.5034
Standard errors	Clustered	Clustered	Clustered	Clustered	Clustered	Clustered	Clustered	Clustered	Clustered
Method	FE	FE	FE	FE	FE	FE	FE	FE	FE

Standard errors are in parentheses

**** p<.01, ** p<.05, * p<.1*