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The willingness to pay for ESG.

The impact of ESG on the financial metrics.

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Abstract

To what extent are investors and companies in the Nordic countries inclined to invest in environmental, social, and corporate governance (ESG) practices and consider other related factors? This paper examines the economic effect of ESG factors on the financial metrics of 343 Nordic companies over the period 2013-2022. The ESG ratings were obtained from the Thomson Reuters Refinitiv (2023) database, and Ordinary Least Squares (OLS) regression analysis was used to assess the relationship between ESG factors and financial metrics such as return on equity (ROE), weighted average cost of capital (WACC), Beta, and price-book-value P/B. The findings suggest that the overall ESG combined rating does not exhibit a significant relationship with these financial metrics. The findings emphasize the intricate nature of the relationship between ESG factors and financial performance. Although ESG factors do not have a strong impact on ROE and P/B, they do exhibit significant relationships with Beta and WACC. This suggests that ESG considerations may play a more prominent role in determining a company's risk profile and cost of capital, compared to their direct impact on profitability and valuation metrics. However, the analysis reveals mixed results regarding the influence of specific ESG factors. Human rights have a positive effect on ROE and P/B, while CSR has a negative effect on both. This suggests that different ESG factors can have contrasting effects on financial performance. Variables related to environment, social, human rights, and innovation show no significant association with financial metrics. Workforce and CSR have a negative impact on WACC, indicating potential cost savings for companies prioritizing these factors, whereas governance has a positive impact on WACC, reflecting higher return expectations for firms with strong governance practices.

Preface

This thesis serves as the culmination of the Master of Science in Business Administration program at the University of Stavanger, focusing on the specializations of economics and finance. It explores the correlation between ESG factors rating and financial metrics. Given the current global shift towards sustainability, this topic holds great significance. Throughout the study, we found the research process to be highly informative and engaging, deepening our understanding of the subject matter, and providing valuable insights.

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1. Introduction and motivation

1.1 Structure:

The introduction establishes the context and framework for the research that follows. It commences by providing a concise overview of the thesis's primary objective, elucidating why the research is indispensable and what it aims to accomplish. This lays the foundation for the thesis, outlining the rationale for conducting the study. Subsequently, a rationale for examining the topic will be presented, highlighting its significance and relevance. This is followed by the introduction of the research's primary question and a review of the main literature findings pertinent to the research topic. Finally, the introduction concludes by summarizing the main findings from the empirical component of the thesis.

The literature review section immediately follows the introduction and offers a comprehensive overview of existing research and articles concerning the impact of environmental, social, and governance (ESG) factors on the business and investment market. ESG factors encompass a range of activities, including environment (E), social (S), governance (G), workforce (wf), human rights (hr), corporate social responsibility (CSR), emission (Emiss), and innovation (inn). The literature review begins by presenting evidence on the importance of considering ESG factors when making investment decisions and emphasizes the significant role played by financial institutions and investors in promoting and enhancing ESG investments. The section then discusses the primary methods employed to measure ESG, followed by an exploration of the significance of ESG integration. Additionally, it provides an adequate explanation of the Capital Asset Pricing Model (CAPM) and the Modern Portfolio Theory (MPT). The literature review focuses specifically on articles related to the impact of ESG factors and omits the historical aspect of ESG.

The data and methodology section delves into the data selection process and its contents. It offers a brief description of the dependent and independent variables, as well as control variables. Subsequently, it outlines the construction of the model used to study the impact of ESG factors on financial metrics, along with the diagnostic tests and adjustments conducted to ensure the validity and reliability of the selected data. The results section then presents the outcomes of the regression analysis on various financial metrics, ROE, WACC, Beta, and

P/B to confirm or refute the hypotheses put forth in the paper. Each set of results is interpreted and discussed in relation to the literature review and theoretical frameworks. The section identifies and explores any significant trends, patterns, or inconsistencies that emerge from the analysis.

Finally, the discussion section provides a critical analysis of the findings, comparing them with previous studies in the field. It also highlights areas for future research, aiming to deepen our understanding of the relationship between ESG factors and financial metrics.

1.2 Method

The thesis is based on quantitative research design. The term "quantitative method" refers to a set of research techniques that involve the collection and analysis of numerical data. It is often used synonymously with data collection methods such as surveys or experiments, as well as data analysis procedures like statistical analysis or graphical representations. The main characteristic of quantitative research is its emphasis on numerical measurements and objective analysis. (Saunders et al., 2007)

Quantitative research involves the collection and analysis of numerical data to examine relationships between variables. It is characterized by its emphasis on objective analysis, deductive or inductive reasoning, and the use of statistical and graphical techniques. By providing a systematic and rigorous approach to research, quantitative methods contribute to the advancement of knowledge and understanding in various domains. According to Trochim and Donnelly (2008), quantitative research design focuses on objective measurement and statistical analysis, aiming to answer research questions or test hypotheses.

The method is commonly associated with a deductive approach, where researchers start with a hypothesis or theory and then collect data to test and validate or refute it. However, it is worth noting that quantitative research can also adopt an inductive approach. In this case, data is collected first, and patterns or relationships are identified from the data, which then leads to the development of theories or generalizations. Quantitative research offers several advantages, including precise measurement and quantification of variables, enabling researchers to analyse data using statistical techniques to draw valid and reliable conclusions.

It also provides a structured and systematic approach to research, allowing for replication and generalizability of findings. (Babbie, 2016; Creswell, 2014; Saunders et al., 2007)

1.3 Motivation:

For my bachelor thesis I was thinking to dive in relationship between economic situation of a company and its stock price fluctuation, but the venture capital concept captured my interest, so I end up writing about venture capital investment criteria and its role to improve and promote Smart cities. I always had that interest in the stock market and the way its response to the companies' strategies and the decisions made by firms' leaders. So, studying economic analysis with minor in finance was not an arbitrary choice I made.

The combination of these two majorities is what inspired me to think about the ESGs' relation to companies return and its life-cycle direction. But what inspired me to write about the willingness to pay for ESG is first, the risk-return graph, which illustrating the shift in upward-sloping indifference curves in order to meet the investors preferences and find the optimal portfolio where the indifference curves tangent the *mean-variance opportunity set (MVOS)*. Second, that some investor's view ESG as a cost, while I believe that ESG is an investment that can ultimately generate a positive cash flow and contribute to making businesses more efficient. Understanding how sustainable practices can affect the profitability, cost of capital and the stock market is what inspired me to dive deeper into the impact the ESG practise could have on a firm value creation, access to capital, risk and its value.

1.4 Limitation:

The scope of this study is limited to the Nordic countries (Norway, Finland, Sweden, and Denmark) over a ten-year period, from 2013 to 2022, with the exception of Iceland due to the lack of available data. The chosen time period is a result of data scarcity in the earlier years, making it challenging to analyse ESG factors scores impact in financial metrics accurately. This specific period was deemed suitable as it provides a substantial amount of reliable data, enabling a comprehensive analysis of ESG performance for publicly traded corporations. To ensure consistency and reliability, the study only includes publicly traded corporations that

are listed on their respective country's stock exchanges. The reason for excluding private companies is that their ESG score data is not as widely available compared to publicly traded companies. This limitation is not a significant concern for publicly traded corporations as the Refinitiv data stream provides extensive ESG score ratings and financial results data, including betas and interest rate costs measurements for publicly traded firms.

Furthermore, Refinitiv Data stream provides reliable and up-to-date data, allowing for a comprehensive analysis of ESG performance over the chosen time period. By focusing on publicly traded corporations listed on stock exchanges, this study will hopefully provide valuable insights into ESG performance for companies that are subject to public scrutiny and regulatory oversight. (Refinitiv 2023).

1.5 Research question:

While it is true that the main purpose of any business is to make a profit, this does not mean that businesses should prioritize profit over everything else. Today, more and more businesses are recognizing the importance of balancing profit with social and environmental responsibility and show willingness to invest in ESG activities. This shift in perspective is driven by the growing awareness of the impact of business activities on society and the environment, as well as the need to build trust and credibility with stakeholders. There is a growing demand from the public for a baseline of corporate social responsibility, and there is an anticipation that externalities will eventually be factored into pricing. This underscores the significance for companies and investors to prioritize sustainable finance. (Schoenmaker, D., 2017)

Businesses need to find ways to create value for all stakeholders while still generating a profit. This requires a holistic approach that takes into account the needs and interests of all stakeholders. Developing a new way, method, or formula that satisfies all goals, terms, and requirements such as Sustainable Development Goals 2015, EU taxonomy, generate profit, and create value for all stakeholders requires a holistic and innovative approach. This approach involves understanding the specific requirements of each stakeholder group, integrating sustainability principles into decision-making, collaboration, and transparency and accountability. By doing so, businesses can create value for all stakeholders, build trust and

credibility, and contribute to a more sustainable and equitable world. Schoenmaker, D., & Schramade, W. (2019)

But, to find out how much firms are willing to consider sustainable ways in creating value for both stakeholders and shareholder's and their willingness to pay for ESG, we need first to understand how to measure ESG cost/impact. ESG are externalities that need to be internalized. But measuring ESG is very complicated, and after reading dozens of articles and research it seems that no one has yet come up with a sufficient method to measure ESG impact. ESG are externalities and internalizing them is very difficult task due to the lack of data. Therefore, I will only spot a small lite on this topic just to get some background about internalizing ESG variables.

This paper aims to examine ESG score and its component/pillars impact on the Nordics company's financial performance and determine whether sustainable practices (scores) cause a negative or positive on firm's financial metrics. By testing the relationship between ESG scores and ROE, WACC, Beta and P/B. These data will be retrieved from the Thomson Reuters Refinitiv (2023) database. Lastly attempt to disclose how this impact is measured. It will discuss also whether ESG is conceded as a cost or as an investment. Should investors invest in ESG or cut this cost? How much investors cares for ESG? This led me to the following over all question:

The willingness to pay for ESG.

To find this out, the thesis will be divided into two parts:

In the theory- literature part of the study, a sufficient introduction and explanation about ESG will be provided to give a theoretical framework for the research. It will define ESG and provide an overview of the various factors that fall under each category. Explain why ESG is important for investors and how it is related to a company's economic performance. Lastly, explore the various theories and models that have been developed to explain the relationship between ESG and economic performance. The literature will attempt to answer the following question:

- *Question 1: Do ESG rating effects the firm's profitability and its cost of capital?*

- *Question 2: Do ESG rating effect firm/market volatility and value?*

In the empirical part the listed hypothesis will be test it to answer the two previous questions empirically. To achieve this, the paper will review multiple analysis on companies' ESG scores as well as their financial metrics. The following hypotheses been developed based on the literature review in the first part of the paper to answer the research questions.

- *Ha: There is a significant positive relationship between ESG factors rating and firms' profitability?*

- *Hb: There is a significant negative relationship between ESG factors rating and firms' cost of capital?*

- *Hc: There is a significant negative relationship between ESG factors rating and firms' market volatility?*

- *Hd: there is a significant positive relationship between ESG factors rating and firms' P/B?*

1.6 Deductive Research Design

The research design for this study is based on the foundation steps of the deductive theory and quantitative methodology approach. Creswell, J. W. (2014) defines the deductive approach as a logical process in which a researcher starts with a theory or general hypothesis and then tests specific hypotheses derived from that theory. The process involves breaking down the theory into smaller parts or components and then testing these components with empirical data. The deductive approach is commonly used in quantitative research, which involves collecting numerical data that can be analysed using statistical methods. According to Bryman and Bell (2015), the deductive approach is the best to employ when looking at the relationship between research and theory.

The deductive approach as Creswell defines is a research process that starts with a theory and then moves to specific hypotheses and empirical observations. It is commonly used in quantitative research and involves six steps: examining the theory and previous research, developing a hypothesis, collecting data, analysing the findings, validating, or rejecting the hypotheses, and linking the findings back to the theory.

First steps of the deductive approach involve a thorough examination of the theory and previous research. This step is important because it helps the researcher to understand the existing literature on the topic and to identify any gaps in knowledge that need to be addressed. The next step is to develop a hypothesis, which is a testable statement that predicts the relationship between variables. The hypothesis should be based on the theory and previous research and should be specific and measurable (Bryman and Bell, 2015). Once the hypothesis has been developed, data is collected using a standardized procedure or instrument. This ensures that the data is reliable and can be compared across different participants or settings.

After the data has been collected, the findings are analysed using statistical methods. The researcher then validates or rejects his or her hypotheses based on the results of the analysis. This step is important because it helps to establish the strength and direction of the relationship between variables and to determine whether the theory is supported by the data. Finally, the researcher links the findings back to the theory, drawing conclusions about the relationship between the variables based on the data. This step is important because it helps to establish the theoretical significance of the findings and to contribute to the development of the theory. (Babbie, 2016)

2. Theoretical background

In the upcoming section, various economic theories will be explored to enhance our comprehension of the relationship between ESG factors and firm performance. By delving into these theories, we aim to gain valuable insights into how ESG considerations can impact the financial outcomes of companies.

2.1 Stakeholder and Shareholder Theory

Stakeholder Theory, as discussed by Freeman et al. (2010), is a significant framework in the field of corporate social responsibility that highlights the need to consider the interests of all stakeholders in business decision-making. Unlike the traditional shareholder theory proposed by Friedman (1970), which emphasizes maximizing profits for shareholders as the primary responsibility of a business, Stakeholder Theory expands the scope of corporate responsibility to include employees, customers, communities, and the environment. According to Stakeholder Theory, businesses have a broader responsibility to actively engage with and address the concerns of all stakeholders, contributing to long-term value creation, sustainable relationships, and overall societal development Freeman et al. (2010). This perspective challenges the notion by Friedman (1970) that economic considerations should be the sole driver of business decisions, advocating for a more holistic approach that integrates social and environmental factors into corporate strategies.

Freeman et al. (2010) emphasizes the importance of bridging the gap between stakeholder theory and practical managerial issues faced by organizations. In contrast, according to Friedman (1970), businesses are not suited or accountable for making value judgments related to social issues, which he considers the responsibility of the political realm. He believes that the pursuit of profits itself can have positive social consequences by driving economic growth, job creation, and generating tax revenues to support government initiatives. Friedman's viewpoint, as expressed in 1970, opposes the diversion of resources from profit maximization towards social or environmental causes. He argues that such actions would disrupt the efficient functioning of the free market and impose unintended costs on society.

Freeman et al. (2010) points out that companies that effectively manage their relationships with stakeholders tend to outperform their counterparts financially. Additionally, Eccles et al. (2011) conducted a study that examined the impact of corporate sustainability practices on financial performance using data from a large set of companies. The findings demonstrated that companies with higher sustainability performance scores achieved superior financial performance, thereby supporting the notion that ESG activities aligned with stakeholder interests can contribute to positive financial outcomes.

Eccles et al. (2011) contribute to the discussion by highlighting the positive impact of corporate sustainability on organizational processes and performance. Their research suggests that companies prioritizing sustainability outperform their counterparts in terms of stock market and accounting performance over the long term. Sustainability-oriented companies are more likely to exhibit long-term orientation, measurement, and disclosure of nonfinancial information.

Freeman et al. (2010) and Eccles et al. (2011) emphasize the importance of considering stakeholders and sustainability in organizational decision-making to create value, enhance performance, and align with societal interests. These studies provide empirical evidence for the positive relationship between stakeholder oriented ESG activities and financial performance. By prioritizing stakeholder well-being and incorporating sustainability practices into their operations, companies can enhance their reputation, attract, and retain talented employees, foster customer loyalty, and mitigate risks associated with environmental and social issues. These factors can contribute to improved financial performance over the long term.

2.2 Capital Market Theory

The Capital Market Theory is a prominent framework that examines the relationship between risk and return in financial markets. According to this theory, investors demand higher returns for assuming higher levels of systematic risk. This theory provides insights into how ESG activities may influence financial metrics by affecting the risk profile of a company. A study by Derwall et al. (2005) examined the relationship between corporate social performance and systematic risk across a large sample of companies. The findings indicated that firms with better social performance exhibited lower systematic risk, suggesting that strong ESG practices may contribute to reduced financial risk. Furthermore, research by Eccles et al. (2012) examined the relationship between sustainability and financial performance, specifically focusing on the risk perspective. The study revealed that companies with higher sustainability ratings had lower cost of equity capital, indicating a lower level of systematic risk. This suggests that investors perceive firms with strong ESG practices as less risky, leading to a potential reduction in the cost of capital. The findings highlighted by Eccles et al. (2011) suggest that companies can incorporate environmentally and socially

responsible policies without compromising their ability to create wealth for shareholders. This challenges the conventional belief that pursuing sustainability initiatives may come at the expense of financial performance.

The study conducted by Eccles et al. (2011) compared the performance of High Sustainability firms to that of traditional firms. When accounting rates of return were analysed, it was found that high sustainability firms outperformed their counterparts. This indicates that companies with strong sustainability practices were able to generate higher returns on their investments and operational activities. Derwall et al. (2005) finds that a portfolio consisting of stocks from companies ranked high in terms of eco-efficiency (worst-in-class) performs better than a portfolio composed of stocks from low-ranked (best-in-class) companies, even after accounting for market risk, investment style, and industry effects. This finding aligns with Eccles et al. (2011) that indicates a positive relationship between sustainability practices and financial performance. This observation challenges the traditional belief that integrating sustainability considerations into investment strategies may come at the expense of financial returns. Instead, it suggests that companies with better eco-efficiency performance can deliver strong financial performance, leading to higher investment returns.

2.3 Agency Theory

Agency Theory is a widely recognized framework in corporate governance that examines the relationship between principals (shareholders) and agents (managers) within a firm. This theory suggests that managers may act in their self-interests, potentially diverging from the goals and interests of shareholders Shapiro (2005). However, ESG activities can help align the interests of managers and shareholders, reducing agency costs and potentially leading to improved financial performance. Gompers et al. (2003)

Stakeholder engagement, based on mutual trust and cooperation, plays a crucial role in reducing potential agency costs. When firms actively engage with stakeholders and prioritize their interests, it fosters a sense of trust and cooperation. This, in turn, reduces the likelihood of opportunistic behaviour by managers and encourages them to adopt a long-term orientation rather than a short-term focus. By aligning their actions and decisions with the long-term interests of stakeholders, managers can mitigate agency costs and enhance the overall efficiency of contracting. Cheng et al. (2014)

Furthermore, higher levels of transparency resulting from better CSR performance contribute to reducing informational asymmetries between the firm and investors. Informational asymmetries occur when one party has more information than the other, which can lead to market inefficiencies and perceived risk. However, firms that prioritize CSR activities tend to be more transparent in their operations, disclosing relevant information about their environmental, social, and governance practices. This increased transparency enables investors to make more informed decisions, as they have a better understanding of the firm's values, practices, and risk profile. Consequently, the perceived risk associated with investing in these firms is mitigated, which can lead to a more favourable view of their financial prospects. Gompers et al. (2003), Cheng et al. (2014)

Traditionally, market frictions such as informational asymmetries and agency costs have been identified as factors contributing to upward sloping supply curves faced by firms in capital markets. However, the study by Cheng et al. (2014) demonstrates that firms with better CSR performance experience a capital supply curve that is effectively less steep. This indicates that these firms face a more favourable financing environment, potentially benefiting from lower costs of capital and increased access to funding.

2.4 Resource-Based View

The Resource-Based View (RBV) is a theoretical framework that emphasizes the role of a firm's unique resources and capabilities in generating competitive advantage and superior financial performance. According to RBV, firms that possess valuable, rare, inimitable, and non-substitutable resources are more likely to achieve sustained competitive advantage. In the context of ESG activities, these activities can be viewed as valuable resources that differentiate a company from its competitors, potentially leading to improved financial performance. A resource refers to anything that can be considered as a strength or weakness of a particular firm. In a more precise sense, a firm's resources can be defined as the assets, both tangible and intangible, that are closely associated with the firm for a significant period of time. These resources form a semi-permanent connection to the firm and contribute to its overall capabilities and competitive advantage. Wernerfelt, B. (1984).

(Thukral, Sharma & Bhattacharya, 2019) explain that there is an inverse relationship between return on asset (ROA) and ESG reporting, as well as the reporting of the individual

components of social and environmental performance. In other words, companies that have lower ESG reporting and provide less information about their social and environmental performance tend to have higher ROA. This inverse relationship can be understood in several ways. First, companies that prioritize maximizing their profitability may allocate fewer resources towards ESG initiatives and reporting. They may prioritize financial performance over social and environmental considerations, which can lead to higher ROA. Secondly, companies with strong ESG reporting and a focus on social and environmental performance may invest more resources in sustainable practices, employee welfare, community engagement, and environmental stewardship. These investments may reduce short-term profitability but can contribute to long-term value creation and sustainable growth. As a result, their ROA may be lower compared to companies that prioritize financial performance without considering ESG factors. Investing in environmental and social initiatives creates valuable intangible resources, including reputation, brand value, and goodwill, according to the resource-based view. Despite potential initial costs, these initiatives can strategically yield economic benefits. (Sharma et al. 2019).

3. literature

The literature chapter serves as a comprehensive exploration of fundamental concepts in the financial market and valuation strategies, while examining their integration with sustainable ESG activities. It aims to provide a deep understanding of the distinction between value creation in production and the value generated in the stock market. Additionally, the chapter delves into the complexities involved in measuring the impact and cost of ESG factors, highlighting the challenges associated with quantifying and incorporating these externalities. Furthermore, the chapter critically analyses various articles that emphasize the significance of ESG factors in the decision-making process and their strong correlation with financial metrics. By engaging with these studies, we provide insights into the essential role that ESG considerations play in shaping a company's financial performance and overall success.

3.1 CAPM

The Capital Asset Pricing Model (CAPM) is a financial model that is based on Modern Portfolio Theory (MPT), which was introduced by Harry Markowitz in 1952. CAPM is a tool that is used to estimate the expected return on an investment based on its risk characteristics, as well as the overall market risk. According to CAPM, the expected return on an investment should be based on its risk, which is measured by beta, a measure of a security's volatility in relation to the overall market. Watson & Head (2010)

The CAPM expresses the expected return on company its stock E[R] as follows:

$$E[R_1] - R_f + B_1(E[R_m] - R_f) \tag{3.1}$$

$E[R_1]$ = expected return on an investment

R_f = risk-free rate of return, typically the yield on a government bond

B_1= measure of a security's volatility in relation to the overall market (beta)

$E[R_m]$= expected return on the overall market

Beta is a measure of a portfolio's or stock's sensitivity to market movements, indicating how closely its returns follow changes in the market. It is calculated as the covariance between the returns on the portfolio and the market, divided by the variance of the market's return. If a portfolio or stock has a beta of greater than one, it indicates that its returns are more volatile than the market's returns, while a beta of less than one implies that the portfolio or stock is less volatile than the market. A beta of exactly one means that the portfolio or stock moves in line with the market, indicating that it has the same level of risk as the market Watson & Head (2010). Investors can use beta to position themselves in the market if they have a strong conviction that the market will rise or fall. For example, if an investor expects the market to rise, they may choose to invest in portfolios or stocks with higher betas to take advantage of the potential gains. Similarly, if they expect the market to fall, they may choose to invest in portfolios or stocks with lower betas to minimize potential losses. It is important to note that returns on portfolios or stocks with high betas in rising markets, or low betas in falling markets, are generally viewed as resulting from taking a market view and market risk, rather

than from good stock picking. Therefore, investors should be aware of their exposure to market risk when making investment decisions and consider diversifying their portfolios to manage their risk. Berk & DeMarzo (2011)

The idea behind CAPM is that investors should be compensated for taking on risk. The more risk a security has, the higher its expected return should be. However, this risk should not be considered in isolation per security, but by how much the investment affects the overall portfolio's risk and return. In other words, CAPM emphasizes that investors should consider how each investment fits into their overall portfolio, and how it contributes to the portfolio's risk and return characteristics. (Goetzmann, Brown, Gruber, Elton, 2014). CAPM also suggests that investors can construct an efficient frontier of optimal portfolios that maximize expected return for a given level of risk. This means that by selecting a combination of investments that fall along the efficient frontier, an investor can achieve the highest possible return for a given level of risk. This approach leads to an efficient economic allocation, where investors are able to achieve the best possible return for the level of risk, they are willing to take. Berk & DeMarzo (2011)

3.2 Fundamental analysis, EMH & AMH

The traditional investment approach, which is based on the neoclassical paradigm of efficient markets and portfolio theory, has several limitations when it comes to integrating social and environmental issues into investment decisions.

The efficient markets hypothesis (EMH) assumes that all information is incorporated into stock prices, making it difficult to identify undervalued or overvalued companies. This suggests a passive investing approach, which may not be appropriate for investors who want to actively manage their portfolios. Malkiel, B. G. (2003) and Fama (1970). In addition, portfolio theory, which spans the financial return and risk space, does not include social and environmental issues in its equation. This means that the traditional investment approach does not consider the societal allocation role of finance, and may not be well-suited to address issues such as climate change, resource depletion, or social inequality. Furthermore, the excessive diversification of portfolio theory creates a free-rider problem with regard to the monitoring of corporate managements, as investors may not have enough incentives to monitor individual companies.

To address these limitations, the adaptive markets hypothesis (AMH) provides a better framework. The AMH recognizes the limitations of market efficiency and the need for market participants to adapt to new information, including social and environmental factors. The AMH emphasizes the importance of active investment management and the need for investors to adapt their investment strategies based on new information. lo (2004) Investors and lenders are increasingly using environmental dimensions to evaluate companies and assess risks. However, external ratings based on environmental, social, and governance (ESG) factors rely on scanty and sometimes conflicting data and provide limited information on material ESG factors. This means that investors need to be cautious and perform their own analysis to fully understand a company's sustainability performance. Malkiel, B. G. (2003).

The traditional investment approach, based on the neoclassical paradigm of efficient markets and portfolio theory, has limitations when it comes to integrating social and environmental issues into investment decisions. The adaptive markets hypothesis provides a better framework, emphasizing the importance of active investment management and the need for investors to adapt their strategies based on new information. However, investors still face challenges in obtaining reliable and comprehensive ESG data to inform their investment decisions as highlighted by lo (2004), (Malkiel, 2003) and (Fama, 1970).

The incorporation of ESG information into stock prices is an adaptive process that requires the participation of fundamental analysts. Fundamental investing is an investment approach that involves analysing a company's financial and operational performance to determine its intrinsic value. This approach typically leads to more concentrated portfolios, as investors focus on a smaller number of companies that they believe are undervalued or have strong growth potential. ESG issues can have a significant impact on a company's financial performance and long-term value, but their effects may not be immediately reflected in stock prices. Fundamental analysts who are knowledgeable about ESG issues can help to identify companies that are well-positioned to manage these risks and opportunities, and incorporate this information into their valuation models. Schramade (2016)

However, the success of the ESG incorporation process is dependent on the number of fundamental analysts and the quality of their learning. A larger number of analysts with

expertise in ESG issues can help to improve the quality of ESG research and ensure that it is incorporated into investment decisions. Furthermore, ongoing learning and improvement in ESG analysis can help to refine investment strategies and identify emerging risks and opportunities. Schramade (2016)

3.3 Evidence and limitations

ESG stands for Environmental, Social, and Governance, and refers to a set of criteria used to evaluate a company's performance and impact in these areas. There is a growing body of research that suggests that ESG factors can have a significant impact on a company's financial performance and risk profile. Paying attention to ESG factors can be beneficial for investors and companies alike.

In recent years, there has been an increasing awareness among investors of the importance of considering ESG factors when making investment decisions. This is driven by a growing recognition that companies with strong ESG performance tend to have better long-term financial performance and are better positioned to manage risks associated with environmental and social issues. Additionally, there is a growing demand among investors for investment opportunities that align with their values and have a positive impact on society and the environment. As a result, companies are under increasing pressure to improve their ESG performance, and investment firms are developing new ESG-focused products and strategies to meet the demand from investors. Schoenmaker, D., & Schramade, W. (2019). The following are some examples of evidence highlighting the fact that ESG matters:

- Environment

Companies with strong environmental performance, such as those with low carbon emissions or efficient use of resources, have been shown to deliver higher stock returns than companies with poor environmental performance. A study by Derwall et al. (2005) found that eco-efficient companies delivered significantly higher stock returns than their peers. Similarly, (Liesen, Figge, Hoepner, & Patten, 2017) found that investors achieved abnormal risk-adjusted returns of up to 13 percent annually by exploiting inefficiently priced positive effects of greenhouse gas emissions disclosure and good corporate climate change performance.

- Social

Companies that prioritize social factors, such as employee satisfaction and diversity, have been found to have better stock returns and higher valuations. A study by Edmans (2011; 2012) found that companies with higher employee satisfaction levels tend to have better stock returns and more positive earnings surprises. Similarly, Edmans, Li and Zhang (2014) found that employee satisfaction is associated with positive abnormal returns in countries with high labour market flexibility.

- Governance

Strong governance practices, such as board diversity and effective risk management, have been shown to reduce a company's risk profile and increase its long-term financial performance. The correlation between governance and environmental and social issues is highlighted, with high-quality corporate governance being the driving force behind strong performance on environmental and social issues. A study by Shrivastava and Addas (2014) found that high-quality corporate governance can engender strong performance on environmental and social factors. Additionally, companies with better governance practices have been found to be less prone to fraud and other unethical practices, which can have a negative impact on their financial performance.

The evidence suggests that paying attention to ESG factors can be beneficial for investors and companies alike, as it can lead to better financial performance, improved risk management, and a more positive impact on society and the environment. Strong sustainability performance is helpful for value driver performance. Ortize-de Mandojana and Bansal (2016) find that companies that adopt better sustainability practices have lower financial volatility, higher sales growth, and higher chances of survival.

Investors are increasingly interested in evaluating a company's ESG performance based on specific key performance indicators (KPIs). For example, on the environmental front, companies are reporting their CO2 emissions following the Greenhouse Gas Protocol and water and waste data. On social issues, companies are reporting on employee attrition, gender balance, job creation, and safety data Schoenmaker & Schramade (2019). On governance, investors are looking at the number of independent directors, gender balance, and voting rules. While it is encouraging to see companies providing this data and investors analysing it, there are limitations to evaluating performance based on narrow KPIs. First, each KPI only pertains to a specific aspect of performance and does not

provide a holistic view of sustainability performance. Second, sustainability is context-specific, making it difficult to compare KPIs across companies and industries. For instance, safety issues may be more relevant for mining companies than financial institutions. Third, the KPIs may not measure all that should be measured, and fourth, it is not clear if performance on certain KPIs contributes sufficiently to achieving a more sustainable model. Pryshlakivsky & Searcy (2017)

While ESG ratings and indices provide a quick and easy way for investors to assess a company's sustainability and responsibility practices, they are not precise measures and may contain errors. Therefore, investors should exercise caution when using them and consider additional sources of information when making investment decisions. Ultimately, companies need to integrate ESG considerations into their core business strategies and financials to drive sustainable performance and create long-term value for all stakeholders Schoenmaker, D. (2017).

3.4 ESG issues and strategies

The finance-as-usual approach aligns with the idea that the only responsibility of business is to maximize profits within the rules (Friedman, 1970). The financial sector plays a significant role in the transition to a low-carbon and circular economy. Banks and investment funds can influence this transition by setting their lending and investment strategies towards sustainable projects and companies. Investors also have a strong influence in monitoring and directing the companies they invest in, and the finance sector can utilize risk management to address the uncertainties of environmental issues. The traditional approach of maximizing shareholder value through financial returns and risk management can lead to short-term thinking, but there is a need to consider the medium to long-term impact. Ortiz-de-Mandojana and Bansal's (2016) found that in the long term, sustainable organizations have a higher survival rate. This is because resilience helps companies to avoid crises and bounce back from shocks, such as economic downturns or natural disasters. According to (The Chartered Financial Analyst, 2015) (CFA) ESG considerations in investment strategies can be implemented through six methods. (1) Exclusionary screening involves avoiding investments in companies that don't meet specific criteria. (2) Best in class focuses on investing in companies outperforming their

peers on ESG issues. (3) Active ownership engages with companies to improve their ESG performance. (4) Thematic investing targets sectors benefiting from or providing solutions to ESG trends. (5) Impact investing aims for financial and societal value creation. (6) ESG integration explicitly incorporates E, S, and G factors into security valuation and selection. These methods provide options for aligning investments with sustainability goals.

These six methods reflect a range of approaches to considering ESG issues in investment decision-making. Each method has its own strengths and weaknesses, and investors may choose to employ one or more of these methods depending on their goals and preferences. The CFA's recognition of these methods highlights the growing importance of ESG factors in investment analysis and decision-making. On other (hand Dyllick, T. & K. Muff, 2016) proposed three categories of sustainable finance, which are as follows:

1. **Profit maximisation, while avoiding 'sin' stock.**
   Investors aim to maximize the financial value of their portfolio by increasing profits and reducing risk, while also ensuring that their investments do not have a significant negative impact on society and the environment by establishing a minimum threshold of social and environmental value.
2. **Internalisation of externalities to avoid risk.**
   In order to account for social and environmental externalities, investors aim to optimize the integrated value of their portfolio. This includes the financial value, social value, and environmental value. By maximizing integrated profits and minimizing the variability of those profits, investors can achieve an optimal integrated value, without exacerbating their social and environmental impact.
3. Contributing to sustainable development, while observing financial viability.
   Investors aim to promote sustainable development by optimizing the social and environmental impact or value. To achieve this goal, investors focus on increasing their impact while reducing their risk (i.e. the variability of impact), while also ensuring a minimum financial value.

These categories of sustainable finance highlight the diverse range of approaches that can be taken to promote sustainable development through finance. By focusing on optimizing financial systems, developing innovative financial instruments, and creating enabling

environments, sustainable finance can play a critical role in addressing the pressing social and environmental challenges facing the world today. Schoenmaker, D., & Schramade, W. (2019). Overall, the ultimate goal of sustainable finance is to address environmental and social issues in a systematic way and contribute to sustainable development for current and future generations. sustainable practices can help companies to maintain financial stability and increase their market share over time. Ortiz-de-Mandojana and Bansal's (2016).

3.5 Measuring ESG

As it stated earlier ESG er externalities that need to be internalized for better integration into the financial performance. This section will focus on illustrating how ESG is measured to provide an understanding about the complexity of calculating and integrating ESG into financial metrics.

Internalization of externalities refers to the process of companies considering the social and environmental costs of their actions, which are typically not reflected in market prices. This process is dynamic and can be challenging for companies to navigate, as some externalities may already be internalized through best business practices, such as externalities related to energy and material savings in their production processes, which can lead to cost savings and improve their bottom line. While others may require changes to the company's business model in order to address, other externalities may require government regulation, societal pressure, or technological developments to be internalized. For instance, the adoption of low-cost solar and wind energy could help companies to reduce their carbon footprint and lower their externalities related to greenhouse gas emissions (True Price, 2014). There are several models for internalizing externalities, this section will list three models for internalizing these externalities.

3.5.1 The production functions.

It is essential to consider a broader range of factors to ensure sustainable production systems. According to Daly and Farley (2011) the neoclassical production function doesn't consider the impact of production on natural resources, social and human capital,

and sustainability. The function does not consider the depletion of non-renewable resources, the environmental degradation resulting from production activities, or the social and health costs associated with certain production processes Alternative approaches, such as ecological economics and social production function, have been proposed to address these limitations. Where the includes natural resources as a factor of production and recognizes the importance of maintaining ecological systems.

Daly and Farley (2011) suggest that to address the shortcomings of the neoclassical production function, it is necessary to distinguish between funds (labour and physical capital inputs) and flows (natural resources used up in the production process) and to recognize that natural resources can be renewable or non-renewable. Ecological economics can better account for energy use and waste emissions by incorporating natural resources into the production function, which is crucial for sustainable development.

The incorporation of natural resources in the production function involves accounting for the flows of natural resources in the production process, which includes the natural resource inputs, such as minerals and fossil fuels, and the natural resource outputs, such as waste emissions. For example, the production function can be written as:

$$q + w = F(K, L, N; r, e) \tag{3.2}$$

(q) represents flows of (consumption) goods and services, (*W)*flows of waste (*R)* flows of natural resources, *(E)* flows of energy, *(N*) stands for the fund function of natural capital and the flow function of natural capital yielding a flow of resource is already captured in (*r)*.

By incorporating natural resources into the production function, ecological economics recognizes that natural resources are complementary and cannot be substituted with labour or physical capital. A final step is to include the social impact of production. The enlarged production function is written as:

$$q + w = F(K, L, S, H; r, e) \tag{3.3}$$

The enlarged production function includes the social impact of production and considers two new factors: social and relationship capital (S) and human capital (H). The enlarged

production function represents an extension of the traditional production function to account for the social impact of production. This is important because production has social and environmental consequences that can impact communities, ecosystems, and natural resources.

The inclusion of social and relationship capital in the production function recognizes that production activities can impact social activities, nuisance, or contributions to local communities, and relationships within and between communities. These impacts can be positive or negative and should be considered in the production process. Human capital, on the other hand, is the knowledge, skills, and experience of workers involved in the production process. Human capital includes issues such as health and safety, gender equality, training, and job satisfaction. By investing in human capital, companies can improve the quality of their products, reduce production costs, and increase employee retention. Daly and Farley (2011)

3.5.2 Monetizing externalities

Innovations in technology and science have made it possible to measure social and environmental impacts in monetary terms. For example, life-cycle analyses, social life-cycle analyses, environmentally extended input-output analysis, and environmental economics are some of the methods used to monetize social and environmental impacts. True Price is a methodology that takes into account the social and environmental costs in addition to financial costs, which allows companies to establish the true value of their products and services. Attaching a financial value to social and environmental externalities can help companies optimize their production processes while considering financial, social, and environmental aspects. By quantifying the social and environmental impacts of production activities in monetary terms, companies can make informed decisions that optimize their operations for financial, social, and environmental outcomes (True Price, 2014).

By integrating financial, social, and environmental values, the total or true value of a product or service can be established. This approach allows companies to account for the externalities associated with their operations, which can lead to a more accurate understanding of the true costs of production. Externalities are the costs or benefits that affect third parties who are not

involved in an economic activity (True Price, 2014). For example, if a factory produces air pollution that affects the health of people living nearby, this is a negative externality. Similarly, if a company invests in clean energy, it creates a positive externality by reducing carbon emissions and contributing to a cleaner environment. Internalizing externalities means incorporating these costs and benefits into the decision-making process of the parties involved in the activity. By doing so, companies and investors can make more informed decisions that consider the full impact of their actions, rather than just financial returns. (Caldecott, Tilbury & Carey, 2014)

Figure 1 shows the four-step methodology for calculating the total value, which helps corporations consider financial, social, and environmental impacts of their investments. The methodology involves measuring, monetising, and balancing financial and non-financial values.

The first step is to calculate financial value and monetise social and environmental impacts. The second step is to internalise externalities and calculate total value as the sum of values. The third step adjusts for trade-offs between economic (F), social (S), and environmental (E) aspects. The final step calculates total value T* by integrating financial, social, and environmental values, providing a comprehensive view of investment impact.

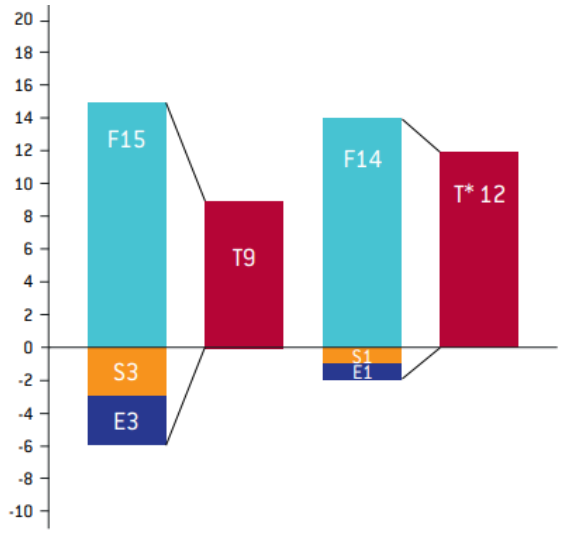

Figure 1: internalizing externalities Schoenmaker, D. (2017). Financial value(F), social (S), and environmental (E), Total value (T)

Figure 1 shows that internalizing externalities leads to an increase in the total value from 9 (bar 2) to 12 (bar 4). This means that by considering the costs and benefits that affect third parties, the overall value of the economic activity increases Schoenmaker, D. (2017). In the case of the factory producing air pollution, internalizing the negative externality may involve investing in pollution control technology or compensating the affected community, which may increase costs in the short term but lead to long-term benefits such as improved reputation and reduced regulatory risks. The traditional finance approach, which focuses only on maximizing financial returns, may ignore externalities and their impact on the overall value of the economic activity. This approach could result in reputation damage, customer strikes, or talent drain, leading to a loss of financial value in the long term. (Caldecott et al, 2014).

Overall, the four-step methodology for calculating the total value provides corporations with a framework to make informed decisions that take into account the financial, social and environmental impacts of their investments. By considering all three factors, corporations can identify the optimal combination of the three factors, resulting in sustainable and profitable investments. Internalizing externalities can also help companies identify opportunities to create positive externalities that can lead to increased value in the long term. (Caldecott et al, 2014).

3.5.3 Scenario analysis

Scenario analysis is a technique used to explore and evaluate possible future events and outcomes by considering alternative scenarios. It is a powerful tool when there is significant uncertainty about the future, as it helps decision-makers to understand the potential risks and opportunities associated with different outcomes Duinker & Greig (2007). The process of scenario analysis involves developing multiple alternative futures or 'alternative worlds' and analysing them to identify the possible development of externalities. Scenario analysis is one of the main forms of projections used in business and policymaking, but it does not try to predict a single precise picture of the future. Rather, it presents several different scenarios based on different assumptions and factors. Each scenario considers a range of possible outcomes and helps decision-makers to prepare for various possibilities (Lo, 2017).

(Bianchini and Gianfrate, 2018) demonstrate that scenario analysis can be a valuable tool for corporate valuation in investment decision-making. Scenario-based valuation involves the creation of multiple scenarios of possible outcomes for a company's financial performance, based on different assumptions and factors. Scenario-based valuation requires at least two scenarios, but it is common to have three or more scenarios. The scenarios typically include a best-case scenario, a most likely scenario, and a worst-case scenario. By considering different scenarios, investors can identify the key drivers of value and better understand the potential outcomes in various market conditions. This can help them make more informed investment decisions and mitigate risk.

(De Ruijter, 2014) proposes a strategic approach to creating scenarios for organizations, which can help decision-makers to better understand and prepare for the future. De Ruijter's (2004) strategic approach to creating scenarios involves identifying the most important uncertainties, developing multiple scenarios based on these uncertainties, and presenting the scenarios in a way that is engaging and relevant to decision-makers. By following this approach, organizations can better understand and prepare for the future, and make more informed decisions in the face of uncertainty.

The approach consists of three steps. First, decision-makers identify critical uncertainties that could impact the organization's future, using a two-axis or decision tree representation with key questions. Next, they develop multiple scenarios that explore possible outcomes based on different assumptions and factors, using tools such as trend and stakeholder analysis. Finally, decision-makers present the scenarios in an engaging and relevant way, using compelling narratives and visualizations. This enables them to better understand and internalize the potential impact of each scenario, which in turn informs their decision-making.

Scenario analysis & DCF

Analyst reports provide insights and recommendations based on detailed analysis of various factors that can impact an investment's performance. One of the most commonly used methods in analyst reports is the discounted cash flow (DCF) methodology, which is used to value investments based on their expected future cash flows. DCF requires a forecast of future inward cash flows, outward cash flows, and the terminal value of the investment beyond the projection period. These cash flows are then discounted back to their present value using a discount rate. The discount rate consists of the risk-free rate and the risk

premium, which reflects the additional return required by an investor to compensate for the investment's inherent risk. Berk & DeMarzo (2011). For private investors, higher risk or uncertainty leads to a higher discount rate, which in turn reduces the present value of the investment's future cash flows. Therefore, the accuracy of the forecasted cash flows and the determination of the appropriate discount rate are critical in determining the value of an investment. Analysts use various methods such as expert judgment and statistical extrapolation to forecast cash flows, but these methods may have limitations and may not account for rare events or changes in external conditions that can significantly impact the investment's performance. (De Ruijter, 2017).

Forecasting often assumes that "all else is equal" or ceteris paribus, meaning that only the variables being forecasted will change and everything else will remain constant. However, this assumption is not always valid in real-world situations where various exogenous factors, such as changes in the economy, politics, or technology, can impact the performance of the investment in unexpected ways. Therefore, it is crucial for investors to recognize the limitations of forecasting and use other tools, such as scenario analysis to assess the potential impact of rare events and uncertainties on their investment decisions. By considering a range of alternative scenarios, investors can better prepare for the unexpected and make more informed investment decisions (De Ruijter, 2017).

3.5.4 Summary

Sustainable finance involves integrating ESG factors into financial decision-making to support sustainable development. It has three phases, with the ultimate goal being to address environmental and social issues in a systematic way and contribute to sustainable development. Companies can maintain financial stability and increase their market share over time by adopting sustainable practices. The CFA recognizes six methods for considering ESG issues in investment decision-making, including integration, exclusionary screening, best-in-class screening, thematic investing, impact investing, and engagement, and investors may choose to employ one or more of these methods depending on their goals and preferences.

The enlarged production function takes into account the social impact of production, along with human and social and relationship capital, while also recognizing the non-substitutability of some natural resources. Sustainable production involves substituting

natural resources with other natural resources, developing new technologies, and investing in human and social capital. The financial institutions and companies use a private discount rate to discount future cash flows, which is higher than the public discount rate due to uncertainties. As social and environmental impacts become manifest over a longer horizon and are also more uncertain than financial impacts, private discounting leads to a lower weighting of social and environmental value than financial value. This means that social and environmental impacts may be undervalued in the optimization process. The four-step methodology for calculating the total value provides corporations with a framework to make informed decisions that take into account the financial, social and environmental impacts of their investments. By considering all three factors, corporations can identify the optimal combination of the three factors, resulting in sustainable and profitable investments. Internalizing externalities can also help companies identify opportunities to create positive externalities that can lead to increased value in the long term. (Caldecott et al, 2014).

Lastly, Scenario analysis is a valuable tool for organizations to prepare for the future by exploring a range of plausible scenarios based on assumptions such as market trends, changes in the competitive landscape, and shifts in consumer behaviour. To ensure that scenario analysis is effective, a balance must be struck between the number of scenarios created and their complexity. Scenario analysis can also help organizations to consider externalities and develop appropriate strategies to respond to potential risks and opportunities.

3.6 The importance of ESG integration

The section underscores the importance of integrating sustainability considerations into business strategies to improve financial performance. The section highlights the interconnection between sustainability performance and financial performance. It discusses various studies that suggest companies with stronger sustainability performance have a competitive advantage in accessing finance, improving their financial performance, reducing their cost of equity, and enhancing their reputational benefits. It will also demonstrate some other concept to provide a deeper understanding of what sustainable finance is.

3.6.1 Link between ESG and financial metrics

(Khan, Serafeim, and Yoon, 2016) explores the relationship between a company's sustainability performance and its financial performance, specifically in the context of the stock market. They distinguish between two types of sustainability issues: material and immaterial. Material issues are those that have a direct impact on a company's financial performance, such as environmental risks, labour practices, and supply chain management. In contrast, immaterial issues are those that do not have a direct impact on financial performance, such as community engagement or charitable donations. They found that firms that performed well on material sustainability issues tend to outperform in terms of stock price, while those that performed well on immaterial sustainability issues tended to underperform. This is because material sustainability issues are closely tied to a company's financial performance and therefore, investors view strong performance on these issues as a positive signal of future financial success. In contrast, immaterial sustainability issues may be seen as less relevant to financial performance and thus, less influential in the market.

(Dhaliwal and colleagues, 2011) complement the findings of Khan et al. (2016) by demonstrating that superior CSR performance can reduce the cost of equity for firms that initiate voluntary CSR disclosures. The study suggests that companies that disclose their CSR activities and performance can signal to investors that they are committed to sustainable practices, which can lead to a reduction in the perceived risk associated with the company's equity. This reduction in risk can translate into lower costs of capital for the company, which can positively impact its financial performance. Khan et al. (2016) study is based on changes in ESG performance (momentum) rather than the levels of ESG performance. This suggests that ESG momentum may be a useful signal for investors, as changes in ESG performance may indicate changes in a company's competitive position. However, the study provides evidence that ESG factors can be financially material for firms, and that investors may benefit from incorporating ESG considerations into their investment decision-making process.

Cheng et al. (2014) conducted a study to examine the relationship between sustainability performance and access to finance for a large sample of global companies. Their analysis shows that companies with stronger sustainability performance have better access to finance, which they attribute to two main factors: stakeholder engagement and transparency.

Firstly, the study found that companies with better sustainability performance have better stakeholder engagement. This means that these companies are more effective in communicating with their stakeholders, including investors, employees, and customers, about their sustainability efforts and the impact of their business on the environment and society. As a result, stakeholders are more likely to be supportive of the company's long-term goals and vision, which can translate into better access to finance Cheng et al. (2014). Similarly, Gompers et al. (2003) argues that engaging in active dialogue with investee companies is crucial because it can result in improved disclosure, allow for feedback, and provide investors with a better understanding of the company's management and board quality.

Secondly, Cheng et al. (2014) found that transparency around sustainability performance is also an important factor in reducing capital constraints. Companies that are transparent about their sustainability practices and performance are viewed as more trustworthy and reliable by investors, which can lead to greater access to finance. This is because investors are more likely to invest in companies that they believe are committed to sustainability and have a track record of delivering on their sustainability commitments. This requires proactive management of ESG issues and an iterative process that involves all actors in the investment decision-making process, including portfolio managers, financial analysts, and ESG specialists. The process helps identify blind spots and drives improved disclosure as the company comes to understand the investor's perspective.

According to research by the European Center for Corporate Engagement (ECCE) in 2016, companies that are improving their sustainability ratings tend to outperform the stock market, while companies that already have high scores do not. This is due to the fact that companies with high scores are already firmly established in terms of sustainability, rendering their ratings no longer newsworthy. Schoenmaker & Schramade (2019) highlights the fact that ESG performance is often proxied by sustainability ratings, which have serious shortcomings and tend to be rather static. The level of ratings is therefore unlikely to impact stock returns, but changing in ratings are more promising. However, the situation is slightly different in emerging markets, as the ECCE point out that in emerging markets, both companies with improving sustainability ratings and those with higher ratings tend to outperform the stock market. The researchers attribute this finding to the lower efficiency of emerging markets, which is consistent with the adaptive markets hypothesis (AMH). The AMH suggests that less efficient markets are more likely to reward companies that are improving their

sustainability performance, as this indicates a positive change in the company's prospects and potential for growth. (ECCE, 2016).

El Ghoul and colleagues (2011) examine the relationship between sustainability performance and the cost of equity financing for a large sample of US companies. The researchers measure sustainability performance using a composite score that incorporates ESG indicators. The cost of equity financing is measured by the implied cost of capital derived from stock market data. The findings of the study suggest that companies with better sustainability scores have cheaper equity financing. This implies that investors are willing to pay a premium for companies that perform well on sustainability indicators. This premium reduces the cost of equity financing for these companies, making it cheaper for them to raise capital in the stock market. It also suggests that this relationship between sustainability performance and cost of equity financing can be explained by the fact that sustainability performance is seen as an indicator of good management practices, which in turn reduce risks and enhance long-term value creation. This makes companies with better sustainability scores more attractive to investors, who are willing to pay a premium for their equity. El Ghoul and colleagues (2011)

The capital asset pricing model is a widely used financial model that assumes that the only relevant factor for determining a stock's return is its sensitivity to the market, which is referred to as systematic risk. This model implies that non-systematic or idiosyncratic risk is not priced and therefore not relevant for determining a stock's expected return. In an equilibrium state, all investors are assumed to hold the market portfolio, which is typically replicated in the form of a market index. This leads to the idea that investors can adopt a passive investment approach by investing in the market index, rather than attempting to identify undervalued stocks or outperform the market through active management Elton et al. (2014). However, this approach has limitations as it ignores the social and environmental dimensions of investing. Furthermore, the measure of financial risk used in the CAPM model is rather narrow, as it is based solely on the volatility of past stock returns, which may not accurately capture future financial risks or the fundamental risks of the companies in the portfolio. This narrow view on risk and return may lead investors to overlook important information about the companies they invest in, such as their environmental and social performance, and fail to account for potential risks and opportunities beyond traditional financial metrics. Therefore, it is important for investors to consider a broader range of factors, including non-financial risks, in their investment decisions to achieve more sustainable and responsible outcomes. Elton et al. (2014)

Clark and Viehs (2014) provide an overview of various studies examining the relationship between ESG factors, corporate financial performance, and investment performance. They argue that many of these studies focus on individual ESG factors in isolation, such as environmental impact, social responsibility, or corporate governance, or only examine the cost of capital. By doing so, they may overlook the combined impact of these factors on corporate performance and investment returns. The authors find that the relationship between ESG factors and financial performance is generally positive, with firms that perform well on ESG metrics tending to have better financial performance than those that do not. This relationship is particularly strong for companies with strong environmental performance, as well as those with good corporate governance practices. Clark and Viehs also note that studies examining the relationship between ESG factors and investment performance have produced mixed results. Some studies have found that incorporating ESG factors into investment decisions can lead to better returns, while others have found no significant relationship.

Despite the positive headlines, the extent to which investors actually undertake ESG integration is debatable. Some managers may only use ESG information for risk management, rather than actively integrating it into their investment decisions. Schoenmaker & Schramade (2019). However, some experts argue that this growth in Social responsible investment (SRI) is not necessarily indicative of widespread ESG integration. For instance, Van Duuren, Plantinga, and Scholtens (2016) found that many investment managers use ESG information primarily for risk management purposes, rather than as a means of actively seeking out sustainable investment opportunities. Moreover, they argue that ESG investing is highly similar to fundamental investing, in which investors analyse a company's financial and non-financial performance in order to make investment decisions. Thus, it is possible that some investors are simply using ESG information as one of many factors in their investment analysis, rather than fully integrating it into their decision-making process.

3.6.2 Criticism-Challenges

The CFA Institute (2015) identifies several challenges that hinder the consideration of ESG factors in investment decision-making. Firstly, it can be challenging to express the effects of sustainability issues in monetary terms and integrate them into quantitative models. This is

because ESG factors can have complex and indirect effects on financial performance, which can be difficult to quantify and model accurately. Secondly, ESG issues disclosure by companies may be limited, unverified, and non-standardized, making it difficult for investors to compare and assess the sustainability performance of companies. This can lead to information asymmetry and limit the ability of investors to make informed decisions based on ESG factors. Finally, ESG issues tend to influence financial performance in the long-term, whereas many investors have relatively short-term horizons. This can create a misalignment between the time horizons of investors and the time horizons required for ESG issues to have a material impact on financial performance.

The interest in ESG factors among investors continues to grow, but challenges persist in accessing reliable and comprehensive ESG data that can effectively inform investment decisions. Researchers and market observers have acknowledged this limitation. According to Lo (2004), obtaining accurate and consistent ESG information is difficult due to varying disclosure practices and the quality of ESG reporting among companies. This inconsistency makes it challenging for investors to compare and evaluate companies based on their ESG performance. Malkiel (2003) also highlights the issue of data reliability in ESG analysis, noting the challenges faced by ESG data providers in collecting and verifying information, especially regarding subjective measures like social and governance factors. These challenges can introduce biases and inaccuracies, further complicating the investment decision-making process. Fama (1970) contributes to the understanding of the challenges investors face in obtaining reliable ESG data. While his work primarily focuses on market efficiency and securities pricing, it indirectly emphasizes the importance of accurate and consistent information in making informed investment choices. Without reliable ESG data, investors may struggle to fully incorporate ESG considerations into their decision-making process, potentially limiting the effectiveness of ESG integration in investment strategies.

The limitations in accessing reliable and comprehensive ESG data underscore the ongoing need for efforts to improve data quality, standardization, and transparency in the ESG space. Addressing these challenges will provide investors with a solid foundation for incorporating ESG factors into their investment decisions, promoting sustainable and responsible investing practices. As a result of these challenges, the integration of ESG factors in investment decision-making still has a long way to go. However, efforts are being made to address these challenges, including the development of standardized sustainability reporting frameworks,

improved data quality and transparency, and the use of alternative investment horizons and risk management strategies that take into account long-term sustainability considerations.

3.6.3 Summary

Research suggests that companies that prioritize sustainability and CSR performance are more likely to attract the capital they need to support their long-term sustainability goals. Cheng, et al. (2014) argue that companies that engage with stakeholders and are transparent about their sustainability practices are more likely to attract investors and lenders who are increasingly interested in sustainability performance. This is supported by Dhaliwal and colleagues (2011) and Khan et al. (2016), who found that companies that perform well on material sustainability issues and voluntarily disclose their CSR performance are likely to benefit from improved financial performance, reduced cost of equity, and enhanced reputational benefits. In addition, El Ghoul and colleagues (2011) suggest that investment in improving sustainability policies and product strategies can substantially reduce companies' cost of equity, which can help to reduce the overall cost of capital and improve financial performance.

Investors can construct an optimal portfolio that achieves the best possible return for a given level of risk by taking into account how each investment affects the portfolio's risk and return. The Capital Asset Pricing Model stresses that risk and return characteristics should not be isolated per security, but rather considered in the context of the overall portfolio. This can help investors to make informed investment decisions and achieve their financial goals (Elton et al., 2014). on the other hand, the adaptive markets hypothesis provides a better framework, emphasizing the importance of active investment management and the need for investors to adapt their strategies based on new information, including social and environmental factors. Incorporating ESG information into stock prices requires fundamental analysts who are knowledgeable about ESG issues and can incorporate them into their valuation models. Despite all that, Schoenmaker & Schramade (2019) argues that the degree to which investors adopt ESG integration remains a subject of debate. While some managers may incorporate ESG information into their investment decisions, others may only use it for risk management purposes.

Clark and Viehs (2014) suggest that taking a holistic approach to Environmental, Social, and Governance factors may lead to better outcomes for both companies and investors. Rather than looking at these factors in isolation, they argue that a more comprehensive understanding of how they interact with one another may lead to better financial and investment outcomes. For example, companies that score well on environmental factors may also have good governance practices, which can lead to better long-term financial performance. Similarly, companies that prioritize social responsibility may be better positioned to attract and retain top talent, which can lead to better financial performance over time. Therefore, taking a holistic approach to ESG factors can lead to better long-term financial performance and better investment outcomes.

4. Data and Methodology

This chapter is dedicated to exploring the data and methodology employed in the research. The purpose is to offer a complete overview of the processes engaged in gathering and scrutinizing the data, as well as conducting diagnostic tests to highlight the various factors that impacted the study's results.

The first subsection of this chapter concentrates on the sample selection and data filtering criteria adopted to obtain the data sample. A comprehensive account of the procedures used to select participants and filter data is provided, emphasizing the role they played in ensuring the accuracy and reliability of the results obtained. The subsection includes the techniques used to gather the data and the various factors considered during the data collection process. In the subsequent subsection, a thorough analysis of how each regression model was measured is presented, which includes detailed information on the techniques used to analyse the data and the statistical models employed to interpret the results.

Additionally, a detailed description of the sample data that was collected, including information on the participants' demographics and other relevant factors, is provided. The last part of this chapter focuses on conducting diagnostic tests to identify and address any potential issues with the data. These tests are designed to check for outliers, multicollinearity, heteroscedasticity, normality, and other potential sources of error or bias in the data to make

sure the data is free from errors, inconsistencies, and any other issues that may compromise the validity of the results obtained.

4.1 Sample selection and data filtering

A total of 1181 Nordic companies were included in the initial sample data collected from the Thomson Reuters Refinitiv (2023) database. Out of these, 343 companies had both ESG and financial data for at least two years. After the initial data collection process, the sample data was refined further through a series of selection and filtering criteria. This was done in order to ensure that the final dataset was representative of the specific research question being investigated, and that it contained high-quality data that could be used to draw meaningful conclusions.

One of the primary criteria used to filter the data was the country of exchange The research only encompasses publicly listed companies on the stock exchanges of Norway, Sweden, Denmark, and Finland. Iceland is not considered in the study due to limited data availability, where only a small number of firms had ESG assessments. Another key filtering criterion used was the exclusion of certain companies. To generate a dataset that is as representative as possible, certain filtering criteria were applied. First and foremost, companies without ESG scores were excluded from the dataset, as they were not considered significant. However, this approach may have resulted in selection bias, as some companies may have been excluded due to lack of available data, rather than being irrelevant to the study.

Additionally, companies without yearly returns or market values were also excluded. These metrics were deemed necessary in order to compare the relationship between ESG scores and financial metrics such as ROE, beta, P/B, and WACC. Excluding companies without this information helped ensure the quality and reliability of the data, as it allowed for a more accurate analysis.

It is important to note, however, that while these filtering criteria were necessary to generate a representative dataset, they also had limitations. For example, excluding companies without ESG scores may have overlooked smaller companies that do not report their ESG performance, but may still have a significant impact on their industry or community. Additionally, excluding companies without yearly returns or market values may have

excluded startups or companies in early stages of development. Only active enterprises are employed in the analysis. Lastly, the data selected is for the last 10 years from 2013 to 2022. This time interval is chosen because many company did not had record for ESG. Actually, most of the selected data didn't report for ESG for more than the last 5-6 years.

4.2 Sample collection and description

In this section, an overview is provided of how and why the sample data for the independent, dependent, and control variables was acquired.

4.2.1 Independent Variables – ESG factors Scores and ESG pillar scores

Corporate responsibility is an increasingly important consideration for companies and stakeholders alike, and ESG scores have emerged as a widely accepted tool for measuring a company's performance in this area. This approach is in line with previous research that has highlighted the importance of measuring and evaluating a company's environmental, social, and governance practices, and their impact on financial outcomes.

To measure the ESG performance of companies several datasets been obtained for the independent variables. The first dataset included ESG combined scores (referred to as ESG), which provide an overall assessment of a company's ESG performance. The second dataset included individual scores for the environmental (E), social (S), and governance (G) pillars, which allow for a more detailed analysis of a company's performance in each of these areas. The last dataset is workforce (wf), Innovation (inn), corporate social responsibility (CSR) human rights (hr), to get a more comprehensive understanding of how ESG practices influence a company's financial metrics, and allow to identify the sort of the impact that hit the company.

All datasets were obtained from Thomson Reuters Refinitiv (2023), a widely recognized and respected source of ESG data. The datasets included ESG scores for companies from Norway, Sweden, Finland, and Denmark, representing a broad range of industries and sectors. To ensure the representativeness of the sample, the study only included publicly

listed companies from their original stock exchanges, namely Euronext Oslo Stock Exchange, Nasdaq OMX Stockholm, Nasdaq OMX Helsinki, and Nasdaq OMX Copenhagen.

By using standardized and validated measures of ESG performance, the study aimed to provide a comprehensive analysis of the relationship between ESG rating and financial metrics. The use of ESG scores as a measuring tool reflects the growing importance of corporate responsibility in the business world and highlights the need for companies to prioritize their ESG practices. Moreover, by including both the ESG combined scores and the individual pillar scores as independent variables, the paper aim to provide a more nuanced analysis of the relationship between ESG performance and financial outcomes. This approach highlights the commitment to providing a thorough examination of the link between ESG performance and financial metrics. Overall, the datasets used in the study are a testament to the rigor and systematic approach taken to investigate the relationship between ESG performance and financial outcomes.

4.2.2 Dependent variables and Control variables - ROE, WACC, Beta P/B and CMC

The study at hand aims to explore the impact of ESG factors on the financial performance of Nordic enterprises. To achieve this, the study focuses on analysing several financial metrics such as profitability, volatility, P/B ratio, and cost of capital of these companies, with the goal of determining whether there is a correlation between these metrics and the different ESG factors. The dependent variables in the study also serve as control variables.

In evaluating the profitability of Nordic enterprises, the study employs the widely recognized financial metric ROE. ROE measures the net income generated by a company in relation to the shareholder equity invested in the business. A high ROE indicates strong profits in relation to equity invested, while a low ROE implies insufficient returns for investors. ROE is considered the single most important indicator for investors to measure a firm's management performance. In addition to ROE, the study also considers Beta as a measure of the volatility of Nordic enterprises. Beta measures a company's volatility compared to the broader market. A Beta of 1 signifies that a company's stock price moves in line with the overall market, while a Beta greater than 1 indicates that a company's stock price is more volatile than the market.

The cost of capital is another important variable examined in this study. It represents the rate of return that investors require to invest in a company. To calculate the cost of capital for Nordic enterprises, the study utilizes the Weighted Average Cost of Capital (WACC), which considers both the cost of debt and equity financing and provides a comprehensive view of the overall cost of capital for a company. By including WACC in the analysis, the study can assess whether Nordic public firms that achieve better ESG performance are able to benefit from a lower cost of capital, which could incentivize them to continue improving their sustainability practices.

The price-to-book (P/B) ratio is a metric that indicates the market's appraisal of a company in relation to its book value. It can also be used to determine whether investors are paying more than the actual value of the company's assets in the event of bankruptcy. Essentially, if the company sold all its assets and settled its debts, the residual value would be equivalent to its book value.

The P/B ratio is a useful tool for investors to avoid overvalued companies. Companies with low P/B ratios are usually classified as value stocks, indicating that they may be undervalued. Conversely, companies with high P/B ratios are often classified as growth stocks, indicating that their stock price may be overvalued. A higher P/B ratio corresponds to a more expensive stock price, potentially increasing the overall value of the company. In essence, the P/B ratio helps investors determine the market's valuation of a company relative to its book value and can be used as a guide for investment decisions.

Damodaran, A. (2012), Watson & Head (2010), Berk & DeMarzo (2011).

Company Market capitalization (CMC) is included as a control variable to account for the potential impact of company size on the dependent variable. Larger companies typically have economies of scale, resulting in higher earnings due to lower production costs. Additionally, they tend to have more resources and learning capabilities, providing them with an advantage over smaller firms in terms of innovation and market penetration. In addition, larger companies may have more bargaining power in raising capital, making it possible for them to secure funding at a lower cost than smaller companies, thereby impacting their financial performance. By incorporating market capitalization as a control variable, the analysis can isolate the effect of the independent variable on the dependent variable while controlling for the possible impact of company size. (Edelen, Evans & Kadlec, 2013). The cost of capital for

small firms is likely to be higher than for larger firms due to the increased risk associated with smaller, less diversified firms (Brigham & Smith, 1967).

Using the specified data filtering and collection criteria, we arrived at a final sample set that consisted of 343 public companies from the Nordic region. Among these, Danish public firms accounted for 12.5%, Finnish public firms accounted for 16%, Norwegian public firms accounted for 13.1%, and Swedish public firms accounted for 58.3% as shown in *table 1*. *Table 2* highlights the proportion of firms collected from each industry in the final sample data. The sample companies were categorized into 11 industry categories based on the Standard Industry Code "Economic Sector Name". It is apparent that this sample is not normally distributed, with a significant weight for the dominant sectors such as Industrials (24.2%), Technology (15.2%), and Consumer Cyclicals (14.6%). In contrast, Academic & Educational services were underrepresented, accounting for only 0.6% of the distribution.

The number of companies in each country		
Country	**Number of companies**	**country portion %**
Denmark	43	12,5%
Finland	55	16,0%
Norway	45	13,1%
Sweden	200	58,3%
Total	343	100,0%

Table 1: Country portion, Refinitiv (2023)

The number of companies in each in each sector		
Economic Sector	**Number of companies**	**Sector portion %**
Academic & Educational Services	2	0,6%
Basic Materials	27	7,9%
Consumer Cyclicals	50	14,6%
Consumer Non-Cyclicals	22	6,4%
Energy	7	2,0%
Financials	38	11,1%
Healthcare	32	9,3%
Industrials	83	24,2%
Real Estate	25	7,3%
Technology	52	15,2%
Utilities	5	1,5%

Total	343	100,0%

Table 2: Economic sector, Refinitiv (2023)

4.3 Estimation of Models

Our pane data is obtained through a longitudinal study, where the same multiple entities (e.g. Nordic individual companies and countries) are observed at several time periods. Longitudinal designs offer researchers several benefits, including the ability to track processes, identify antecedents and consequences in chronological order, and differentiate short-term and long-term phenomena. While Panel data combine both inter-individual differences, which are revealed in cross-sectional data, and intra-individual dynamics, which are revealed in time-series data. The values of all the variables in this study are also registered at several time points for each individual company. Thus, our panel dataset consists of both time series and cross-sectional data. This is because panel data has a variety of advantages as compared to solely using timeseries or simply cross-sectional data (Ghauri, Grønhaug & Strange, 2020). The additional data from both time series and cross-sectional data allows the panel data for more accurate estimations. As a consequence, the panel data estimate methods involve fewer assumptions and are frequently less difficult to use than other methods. Since they combine the values of using both cross-sectional data and time-series data, this adds further benefit in terms of problem-solving (Ghauri et al. 2020). Panel data regression was also chosen because we are studying changes in the dependent variables over time, making it possible to eliminate the effect of omitted variables that differ across entities but are constant over time (Stock & Watson, 2003).

The regression analysis will be conducted to test the following hypotheses:

- *Ha: there is a significant positive relationship between ESG factors rating and firms' profitability?*
- *Hb: there is a significant negative relationship between ESG factors rating and firms' cost of capital?*
- *Hc: there is a significant negative relationship between ESG factors rating and firms' market volatility?*
- *Hd: there is a significant positive relationship between ESG factors rating and firms' P/B?*

The following models will be utilized to test the hypotheses:

ROE regression model:

With only ESG model:

- $ROE = a_0 + a_1 * {}_{it}ESG_{value}\ a_2 * {}_{it}Beta_{value} + a_3 * {}_{it}P/B\_value + a_4 * {}_{it}WACC_{value} + a_5 * CMC + e$ (4.1)

Without ESG model:

- $ROE = a_0 + a_1 * {}_{it}E_{value} + e$ (4.2)
- $ROE = a_0 + a_1 * {}_{it}E_{value} + a_2 * {}_{it}S_{value} + e$ (4.3)
- $ROE = a_0 + a_1 * {}_{it}E_{value} + a_2 * {}_{it}S_{value} + a_3 * {}_{it}G_{value} + e$ (4.4)
- $ROE = a_0 + a_1 * {}_{it}E_{value} + a_2 * {}_{it}S_{value} + a_3 * {}_{it}G_{value} + a_4 * {}_{it}wf_{value} + e$ (4.5)
- $ROE = a_0 + a_1 * {}_{it}E_{value} + a_2 * {}_{it}S_{value} + a_3 * {}_{it}G_{value} + a_4 * {}_{it}wf_{value} + a_5 * {}_{it}hr_{valuea} + e$ (4.6)
- $ROE = a_0 + a_1 * {}_{it}E_{value} + a_2 * {}_{it}S_{value} + a_3 * {}_{it}G_{value} + a_4 * {}_{it}wf_{value} + a_5 * {}_{it}hr_{valuea} + a_6 * {}_{it}CSR_{value} + e$ (4.7)
- $ROE = a_0 + a_1 * {}_{it}E_{value} + a_2 * {}_{it}S_{value} + a_3 * {}_{it}G_{value} + a_4 * {}_{it}wf_{value} + a_5 * {}_{it}hr_{valuea} + a_6 * {}_{it}CSR_{value} + a_7 * {}_{it}Emiss_{value} + e$ (4.8)

- $ROE = a_0 + a_1 * {}_{it}E_{value} + a_2 * {}_{it}S_{value} + a_3 * {}_{it}G_{value} + a_4 * {}_{it}wf_{value} + a_5 * {}_{it}hr_{valuea} + a_6 * {}_{it}CSR_{value} + a_7 * {}_{it}Emiss_{value} + a_8 * {}_{it}inn_{value} + e$ (4.10)
- $ROE = a_0 + a_1 * {}_{it}E_{value} + a_2 * {}_{it}S_{value} + a_3 * {}_{it}G_{value} + a_4 * {}_{it}wf_{value} + a_5 * {}_{it}hr_{valuea} + a_6 * {}_{it}CSR_{value} + a_7 * {}_{it}Emiss_{value} + a_8 * {}_{it}inn_{value} + a_9 * {}_{it}WACC_{value} + e$ (4.11)
- $ROE = a_0 + a_1 * {}_{it}E_{value} + a_2 * {}_{it}S_{value} + a_3 * {}_{it}G_{value} + a_4 * {}_{it}wf_{value} + a_5 * {}_{it}hr_{valuea} + a_6 * {}_{it}CSR_{value} + a_7 * {}_{it}Emiss_{value} + a_8 * {}_{it}inn_{value} + a_9 * {}_{it}WACC_{value} + a_{10} * {}_{it}Beta_{value} + e$ (4.12)
- $ROE = a_0 + a_1 * {}_{it}E_{value} + a_2 * {}_{it}S_{value} + a_3 * {}_{it}G_{value} + a_4 * {}_{it}wf_{value} + a_5 * {}_{it}hr_{valuea} + a_6 * {}_{it}CSR_{value} + a_7 * {}_{it}Emiss_{value} + a_8 * {}_{it}inn_{value} + a_9 * {}_{it}WACC_{value} + a_{10} * {}_{it}Beta_{value} + a_{11} * {}_{it}P/B_{value} + e$ (4.13)
- $ROE = a_0 + a_1 * {}_{it}E_{value} + a_2 * {}_{it}S_{value} + a_3 * {}_{it}G_{value} + a_4 * {}_{it}wf_{value} + a_5 * {}_{it}hr_{valuea} + a_6 * {}_{it}CSR_{value} + a_7 * {}_{it}Emiss_{value} + a_8 * {}_{it}inn_{value} + a_9 * {}_{it}WACC_{value} + a_{10} * {}_{it}Beta_{value} + a_{11} * {}_{it}P/B_{value} + a_{12} * {}_{it}CMC + e$ (4.14)

WACC regression model:

With only ESG model:

- $WACC = a_0 + a_1 * {}_{it}ESG_{value} + a_2 * {}_{it}ROE_{value} + a_3 * {}_{it}Beta_{value} + a_4 * {}_{it}P/B_{value} + a_5 * {}_{it}CMC + e$ (4.15)

Without ESG model:

- $WACC = a_0 + a_1 * {}_{it}E_{value} + e$ (4.16)
- $WACC = a_0 + a_1 * {}_{it}E_{value} + a_2 * {}_{it}S_{value} + e$ (4.17)
- $WACC = a_0 + a_1 * {}_{it}E_{value} + a_2 * {}_{it}S_{value} + a_3 * {}_{it}G_{value} + e$ (4.18)
- $WACC = a_0 + a_1 * {}_{it}E_{value} + a_2 * {}_{it}S_{value} + a_3 * {}_{it}G_{value} + a_4 * {}_{it}wf_{value} + e$ (4.19)
- $WACC = a_0 + a_1 * {}_{it}E_{value} + a_2 * {}_{it}S_{value} + a_3 * {}_{it}G_{value} + a_4 * {}_{it}wf_{value} + a_5 * {}_{it}hr_{valuea} + e$ (4.20)
- $WACC = a_0 + a_1 * {}_{it}E_{value} + a_2 * {}_{it}S_{value} + a_3 * {}_{it}G_{value} + a_4 * {}_{it}wf_{value} + a_5 * {}_{it}hr_{valuea} + a_6 * {}_{it}CSR_{value} + e$ (4.21)
- $WACC = a_0 + a_1 * {}_{it}E_{value} + a_2 * {}_{it}S_{value} + a_3 * {}_{it}G_{value} + a_4 * {}_{it}wf_{value} + a_5 * {}_{it}hr_{valuea} + a_6 * {}_{it}CSR_{value} + a_7 * {}_{it}Emiss_{value} + e$ (4.22)
- $WACC = a_0 + a_1 * {}_{it}E_{value} + a_2 * {}_{it}S_{value} + a_3 * {}_{it}G_{value} + a_4 * {}_{it}wf_{value} + a_5 * {}_{it}hr_{valuea} + a_6 * {}_{it}CSR_{value} + a_7 * {}_{it}Emiss_{value} + a_8 * {}_{it}inn_{value} + e$ (4.23)

- $WACC = a_0 + a_1 * {}_{it}E_{value} + a_2 * {}_{it}S_{value} + a_3 * {}_{it}G_{value} + a_4 * {}_{it}wf_{value} + a_5 * {}_{it}hr_{valuea} + a_6 * {}_{it}CSR_{value} + a_7 * {}_{it}Emiss_{value} + a_8 * {}_{it}inn_{value} + a_9 * {}_{it}ROE_{value} + e$ (4.24)
- $WACC = a_0 + a_1 * {}_{it}E_{value} + a_2 * {}_{it}S_{value} + a_3 * {}_{it}G_{value} + a_4 * {}_{it}wf_{value} + a_5 * {}_{it}hr_{valuea} + a_6 * {}_{it}CSR_{value} + a_7 * {}_{it}Emiss_{value} + a_8 * {}_{it}inn_{value} + a_9 * {}_{it}ROE_{value} + a_{10} * {}_{it}Beta_{value} + e$ (4.25)
- $WACC = a_0 + a_1 * {}_{it}E_{value} + a_2 * {}_{it}S_{value} + a_3 * {}_{it}G_{value} + a_4 * {}_{it}wf_{value} + a_5 * {}_{it}hr_{valuea} + a_6 * {}_{it}CSR_{value} + a_7 * {}_{it}Emiss_{value} + a_8 * {}_{it}inn_{value} + a_9 * {}_{it}ROE_{value} + a_{10} * {}_{it}Beta_{value} + a_{11} * {}_{it}P/B_{value} + e$ (4.26)
- $WACC = a_0 + a_1 * {}_{it}E_{value} + a_2 * {}_{it}S_{value} + a_3 * {}_{it}G_{value} + a_4 * {}_{it}wf_{value} + a_5 * {}_{it}hr_{valuea} + a_6 * {}_{it}CSR_{value} + a_7 * {}_{it}Emiss_{value} + a_8 * {}_{it}inn_{value} + a_9 * {}_{it}ROE_{value} + a_{10} * {}_{it}Beta_{value} + a_{11} * {}_{it}P/B_{value} + a_{12} * {}_{it}CMC + e$ (4.27)

Beta regression model

With only ESG model:

- $Beta = a_0 + a_1 * {}_{it}ESG_{value} + a_2 * {}_{it}ROE_{value} + a_3 * {}_{it}WACC_{value} + a_4 * {}_{it}P/B_{value} + a_5 * {}_{it}CMC + e$ (4.28)

Without ESG model:

- $Beta = a_0 + a_1 * {}_{it}E_{value} + e$ (4.29)
- $Beta = a_0 + a_1 * {}_{it}E_{value} + a_2 * {}_{it}S_{value} + e$ (4.30)
- $Beta = a_0 + a_1 * {}_{it}E_{value} + a_2 * {}_{it}S_{value} + a_3 * {}_{it}G_{value} + e$ (4.31)
- $Beta = a_0 + a_1 * {}_{it}E_{value} + a_2 * {}_{it}S_{value} + a_3 * {}_{it}G_{value} + a_4 * {}_{it}wf_{value} + e$ (4.32)
- $Beta = a_0 + a_1 * {}_{it}E_{value} + a_2 * {}_{it}S_{value} + a_3 * {}_{it}G_{value} + a_4 * {}_{it}wf_{value} + a_5 * {}_{it}hr_{valuea} + e$ (4.33)
- $Beta = a_0 + a_1 * {}_{it}E_{value} + a_2 * {}_{it}S_{value} + a_3 * {}_{it}G_{value} + a_4 * {}_{it}wf_{value} + a_5 * {}_{it}hr_{valuea} + a_6 * {}_{it}CSR_{value} + e$ (4.34)
- $Beta = a_0 + a_1 * {}_{it}E_{value} + a_2 * {}_{it}S_{value} + a_3 * {}_{it}G_{value} + a_4 * {}_{it}wf_{value} + a_5 * {}_{it}hr_{valuea} + a_6 * {}_{it}CSR_{value} + a_7 * {}_{it}Emiss_{value} + e$ (4.35)
- $Beta = a_0 + a_1 * {}_{it}E_{value} + a_2 * {}_{it}S_{value} + a_3 * {}_{it}G_{value} + a_4 * {}_{it}wf_{value} + a_5 * {}_{it}hr_{valuea} + a_6 * {}_{it}CSR_{value} + a_7 * {}_{it}Emiss_{value} + a_8 * {}_{it}inn_{value} + e$ (4.36)

- $Beta = a_0 + a_1 * {}_{it}E_{value} + a_2 * {}_{it}S_{value} + a_3 * {}_{it}G_{value} + a_4 * {}_{it}wf_{value} + a_5 * {}_{it}hr_{valuea} + a_6 * {}_{it}CSR_{value} + a_7 * {}_{it}Emiss_{value} + a_8 * {}_{it}inn_{value} + a_9 * {}_{it}ROE_{value} + e$ (4.37)
- $Beta = a_0 + a_1 * {}_{it}E_{value} + a_2 * {}_{it}S_{value} + a_3 * {}_{it}G_{value} + a_4 * {}_{it}wf_{value} + a_5 * {}_{it}hr_{valuea} + a_6 * {}_{it}CSR_{value} + a_7 * {}_{it}Emiss_{value} + a_8 * {}_{it}inn_{value} + a_9 * {}_{it}ROE_{value} + a_{10} * {}_{it}WACC_{value} + e$ (4.38)
- $Beta = a_0 + a_1 * {}_{it}E_{value} + a_2 * {}_{it}S_{value} + a_3 * {}_{it}G_{value} + a_4 * {}_{it}wf_{value} + a_5 * {}_{it}hr_{valuea} + a_6 * {}_{it}CSR_{value} + a_7 * {}_{it}Emiss_{value} + a_8 * {}_{it}inn_{value} + a_9 * {}_{it}ROE_{value} + a_{10} * {}_{it}WACC_{value} + a_{11} * {}_{it}P/B_{value} + e$ (4.39)
- $Beta = a_0 + a_1 * {}_{it}E_{value} + a_2 * {}_{it}S_{value} + a_3 * {}_{it}G_{value} + a_4 * {}_{it}wf_{value} + a_5 * {}_{it}hr_{valuea} + a_6 * {}_{it}CSR_{value} + a_7 * {}_{it}Emiss_{value} + a_8 * {}_{it}inn_{value} + a_9 * {}_{it}ROE_{value} + a_{10} * {}_{it}WACC_{value} + a_{11} * {}_{it}P/B_{value} + a_{12} * {}_{it}CMC + e$ (4.40)

P/B regression model:

With only ESG model:

- $P/B = a_0 + a_1 * {}_{it}ESG_{value} + a_2 * {}_{it}ROE_{value} + a_3 * {}_{it}WACC_{value} + a_4 * {}_{it}Beta_{value} + a_5 * {}_{it}CMC + e$ (4.41)

Without ESG model:

- $P/B = a_0 + a_1 * {}_{it}E_{value} + e$ (4.42)
- $P/B = a_0 + a_1 * {}_{it}E_{value} + a_2 * {}_{it}S_{value} + e$ (4.43)
- $P/B = a_0 + a_1 * {}_{it}E_{value} + a_2 * {}_{it}S_{value} + a_3 * {}_{it}G_{value} + e$ (4.44)
- $P/B = a_0 + a_1 * {}_{it}E_{value} + a_2 * {}_{it}S_{value} + a_3 * {}_{it}G_{value} + a_4 * {}_{it}wf_{value} + e$ (4.45)
- $P/B = a_0 + a_1 * {}_{it}E_{value} + a_2 * {}_{it}S_{value} + a_3 * {}_{it}G_{value} + a_4 * {}_{it}wf_{value} + a_5 * {}_{it}hr_{valuea} + e$ (4.46)
- $P/B = a_0 + a_1 * {}_{it}E_{value} + a_2 * {}_{it}S_{value} + a_3 * {}_{it}G_{value} + a_4 * {}_{it}wf_{value} + a_5 * {}_{it}hr_{valuea} + a_6 * {}_{it}CSR_{value} + +e$ (4.47)
- $P/B = a_0 + a_1 * {}_{it}E_{value} + a_2 * {}_{it}S_{value} + a_3 * {}_{it}G_{value} + a_4 * {}_{it}wf_{value} + a_5 * {}_{it}hr_{valuea} + a_6 * {}_{it}CSR_{value} + a_7 * {}_{it}Emiss_{value} + e$ (4.48)
- $P/B = a_0 + a_1 * {}_{it}E_{value} + a_2 * {}_{it}S_{value} + a_3 * {}_{it}G_{value} + a_4 * {}_{it}wf_{value} + a_5 * {}_{it}hr_{valuea} + a_6 * {}_{it}CSR_{value} + a_7 * {}_{it}Emiss_{value} + a_8 * {}_{it}inn_{value} + e$ (4.49)

- $P/B = a_0 + a_1 * {}_{it}E_{value} + a_2 * {}_{it}S_{value} + a_3 * {}_{it}G_{value} + a_4 * {}_{it}wf_{value} + a_5 * {}_{it}hr_{valuea} + a_6 * {}_{it}CSR_{value} + a_7 * {}_{it}Emiss_{value} + a_8 * {}_{it}inn_{value} + a_9 * {}_{it}ROE_{value} + e$ (4.50)
- $P/B = a_0 + a_1 * {}_{it}E_{value} + a_2 * {}_{it}S_{value} + a_3 * {}_{it}G_{value} + a_4 * {}_{it}wf_{value} + a_5 * {}_{it}hr_{valuea} + a_6 * {}_{it}CSR_{value} + a_7 * {}_{it}Emiss_{value} + a_8 * {}_{it}inn_{value} + a_9 * {}_{it}ROE_{value} + a_{10} * {}_{it}WACC_{value} + e$ (4.51)
- $P/B = a_0 + a_1 * {}_{it}E_{value} + a_2 * {}_{it}S_{value} + a_3 * {}_{it}G_{value} + a_4 * {}_{it}wf_{value} + a_5 * {}_{it}hr_{valuea} + a_6 * {}_{it}CSR_{value} + a_7 * {}_{it}Emiss_{value} + a_8 * {}_{it}inn_{value} + a_9 * {}_{it}ROE_{value} + a_{10} * {}_{it}WACC_{value} + a_{11} * {}_{it}Beta_{value} + e$ (4.52)
- $P/B = a_0 + a_1 * {}_{it}E_{value} + a_2 * {}_{it}S_{value} + a_3 * {}_{it}G_{value} + a_4 * {}_{it}wf_{value} + a_5 * {}_{it}hr_{valuea} + a_6 * {}_{it}CSR_{value} + a_7 * {}_{it}Emiss_{value} + a_8 * {}_{it}inn_{value} + a_9 * {}_{it}ROE_{value} + a_{10} * {}_{it}WACC_{value} + a_{11} * {}_{it}Beta_{value} + a_{12} * {}_{it}CMC + e$ (4.53)

4.4 Data included in the study.

Code	Variables	Explanation
	Independent variables	
ESG	ESG Combined score	The ESG Combined Score is a comprehensive measure that incorporates the reported information from the environmental, social, and corporate governance pillars (ESG Score), while also considering any ESG controversies that may be present.
E_value	Environmental pillar	The environmental pillar assesses the influence of a company on both living and non-living natural systems, encompassing areas such as air, land, water, and ecosystems as a whole. It evaluates a company's adherence to best management practices in mitigating environmental risks and leveraging environmental opportunities to create sustainable value for shareholders in the long term.
S_value	Social pillar	The social pillar evaluates a company's ability to foster trust and loyalty among its employees, customers, and society at large by implementing best management practices. It represents the company's reputation and the strength of its social license to operate, both of which are crucial in determining its potential to generate sustainable shareholder value in the long run.
G_value	Corporate governance pillar	The corporate governance pillar assesses a company's systems and processes that ensure the alignment of its board members and executives with the long-term interests of shareholders. It indicates the company's ability, through effective management practices, to oversee and control its rights and responsibilities, including the establishment of incentives and the implementation of checks and balances. This pillar plays a crucial role in generating sustainable shareholder value over the long term.
Emiss_value	Emission	The emission category score evaluates a company's dedication and effectiveness in reducing environmental emissions during its production and operational processes. It reflects the company's efforts to minimize its environmental footprint and promote sustainable practices in order to mitigate the impact of emissions on the environment.
wf_value	Workforce	Workforce category score measures a company's effectiveness towards job satisfaction, healthy and safe workplace, maintaining diversity and equal opportunities, and development opportunities for its workforce.
hr_value	Human rights	The human rights category score assesses a company's effectiveness in upholding and respecting fundamental human rights conventions. It reflects the company's commitment to ensuring the protection and promotion of human rights, both within its own operations and throughout its supply chain. The score evaluates the company's efforts to address human rights issues and promote fair and equitable treatment of all individuals involved in its business activities.
CSR_value	CSR	The CSR strategy category score assesses a company's integration of economic, social, and environmental considerations in decision-making and communication practices.
Inn_value	Environmental innovation	The environmental innovation category score measures a company's ability to create new market opportunities and reduce environmental costs through innovative technologies, processes, and eco-friendly products.
	Dependent/Control variables	
roe_value	ROE	Normalized Value represents the actual value of a company adjusted for currency and corporate actions, such as stock splits. Return On Equity (ROE) is a profitability ratio that compares a company's net income to its total common equity.
wacc_value	WACC	WACC is a financial metric that calculates a company's cost of capital by assigning proportional weights to each category of capital, including equity stock, preferred stock, and debt. It takes into account all sources of capital in order to determine the overall cost of financing for the company.
B_value	Beta	Beta is a measure of a stock's sensitivity to market movements. It represents the covariance between the price movement of the stock and the market. Beta can be calculated using different look-back periods, such as Beta 5Y monthly, Beta 3Y weekly, Beta 2Y weekly, Beta 180D daily, and Beta 90D daily, depending on data availability. These different periods are used in the calculation of Beta, with preference given to longer-term periods for more accurate results.

PtB_value	Price To Book Value Per Share	Price to Book Value per Share is a financial ratio that is computed by dividing a company's latest closing price by its book value per share. The book value per share is determined by dividing the total equity from the latest fiscal period by the current total shares outstanding. This ratio provides insight into the market's valuation of a company relative to its book value.
	Control variables	
Company_market_Capitalization	Company Market Capitalization	

Table 3: Variable definisjons, Refinitiv (2023)

4.5 Descriptive statistics

Table 4 provides a comprehensive overview of the descriptive statistics for all the dependent, independent, and control variables that are included in the regression analysis. The sample used in this study consists of 26997 observations, and all the ESG variables are rated on a numerical scale ranging from 0 to 100. The ESG rating is an aggregate score, reflects the companies' performance on environmental, social, and governance criteria. As such, the highest ESG score in the sample is 93,21, while the lowest is 1,42. The mean ESG rating for all companies listed on the representative Nordic Stock Exchanges is 52.77, which suggests that there is substantial variation in ESG performance across firms.

Furthermore, the S and G pillar scores have higher maximum score levels than the ESG score since the latter is an aggregate score, while E has a lower mean The individual scores for the E, S, and G pillars tend to be higher than the ESGC score. It is interesting to note that the S pillar score has a lower mean and higher standard deviation than the ESGC score. This suggests that Nordic companies tend to perform relatively well on Social and governance-related issues compared to environmental criteria.

We can also observe that the ESG variable has a relatively lower standard deviation compared to the E, S, and G pillar scores. This indicates that the performance of Nordic companies on the individual ESG pillars has significant variation. This variation could be attributed to differences in the companies' sizes, industries, and regions, among other factors. Nonetheless, the descriptive statistics presented in *Table* 4 provide valuable insights into the distribution of the ESG scores across the sample of Nordic companies and lay the foundation for further analysis in this study.

If a variable follows a normal distribution, then its skewness coefficient will be close to zero. However, a high skewness coefficient suggests that the mean differs significantly from the

median, indicating skewness in the distribution. A high negative coefficient indicates left-skewed distribution, while a high positive coefficient indicates right-skewed distribution. (Ghauri et al. 2020).

	Obs	mean	sd	median	min	max	range	skew	kurtosis
ESG_value	1606	52,77	18,92	54,42	1,42	93,21	91,79	-0,37	-0,42
E_value	1605	50,56	26,91	53,13	0	98,12	98,12	-0,24	-1,05
G_value	1606	51,44	22,25	51,7	1,24	96,48	95,24	-0,11	-0,94
Emiss_value	1605	55,48	28,31	59,7	0	99,83	99,83	-0,47	-0,82
inn_value	1605	37,95	33,14	36	0	99,89	99,89	0,25	-1,37
wf_value	1605	65,22	22,15	69,11	0,68	99,5	98,83	-0,69	-0,2
hr_value	1605	59,37	32,66	68,56	0	99,53	99,53	-0,63	-0,94
CSR_value	1606	49,4	30,87	51,38	0	99,81	99,81	-0,15	-1,28
roe_value	2414	0,19	0,43	0,15	0	20,46	20,46	42,95	2010,41
wacc_value	2440	0,06	0,03	0,06	-0,07	0,24	0,31	0,39	1,58
Beta_value	2440	0,89	0,43	0,88	-1,66	2,52	4,18	-0,03	0,77
PtB_value	3430	3,38	4,7	2,13	0	60,93	60,93	4,78	36,4
Company_Market_Capitalization	3430	4838,22	17767,73	883,81	4,19	286144,35	286140,15	12,32	183,69
Total	26997								

Table 4: Statistic data description. Observations (Obs), average (mean), Stander deviation (sd), minimum (min, Maximum (max), range = max – min, tailedness of a distribution (kurtosis).

4.6 Diagnostics test

The purpose of the diagnostic section is to make sure that the data set is valid and reliable.

4.6.1 Correlation Matrix

When examining the relationship between continuous variables, correlation coefficients are commonly used to assess the strength and direction of the relationship. Pearson's correlation coefficient, also known as Pearson's r, is a metric that quantifies the magnitude and direction

of the linear association between two continuous variables. The scale of the Pearson's correlation coefficient ranges from -1 to 1, with a value of -1 indicating a perfect negative correlation, a value of 0 indicating no correlation, and a value of 1 indicating a perfect positive correlation. Saunders et al. (2007)

However, relying solely on correlation coefficients may not provide a complete understanding of the relationship as they do not consider other important factors that may affect the relationship. Outliers, nonlinearity, or confounding variables can have a significant impact on the relationship between two variables, and thus must be taken into account. Saunders et al. (2007)

In addition, high values of independent variables in regression analysis may suggest strong predictive power, but they can also be an indication of multicollinearity. Multicollinearity occurs when two or more independent variables in a regression model are highly correlated, causing unstable parameter estimates and decreased accuracy in predicting the outcome. Variables with correlation coefficient value -/+ 1.0 are considered to be perfectly multicollinear. Saunders et al. (2007). Perfect multicollinearity can have negative consequences as it can distort or mislead the interpretation of the effectiveness of each independent variable in predicting and comprehending the dependent variables in our multiple regression models. This can result in skewed or inaccurate outcomes. (Stock & Watson, 2003)

To identify perfect multicollinearity among the independent variables in a model, Pearson's correlation matrix is typically employed. This matrix displays the correlation coefficients between all possible pairs of continuous variables, allowing researchers to identify any problematic relationships between variables. Furthermore, researchers may use variance inflation factors (VIFs) to measure the extent to which the variance of the estimated regression coefficients is inflated due to multicollinearity. By utilizing these techniques, researchers can better comprehend and address any issues related to multicollinearity in their regression analyses. Saunders et al. (2007). The graph of Pearson's correlation matrix for all the variables in the study, depicted below, indicates that the correlations between the variables vary widely in strength.

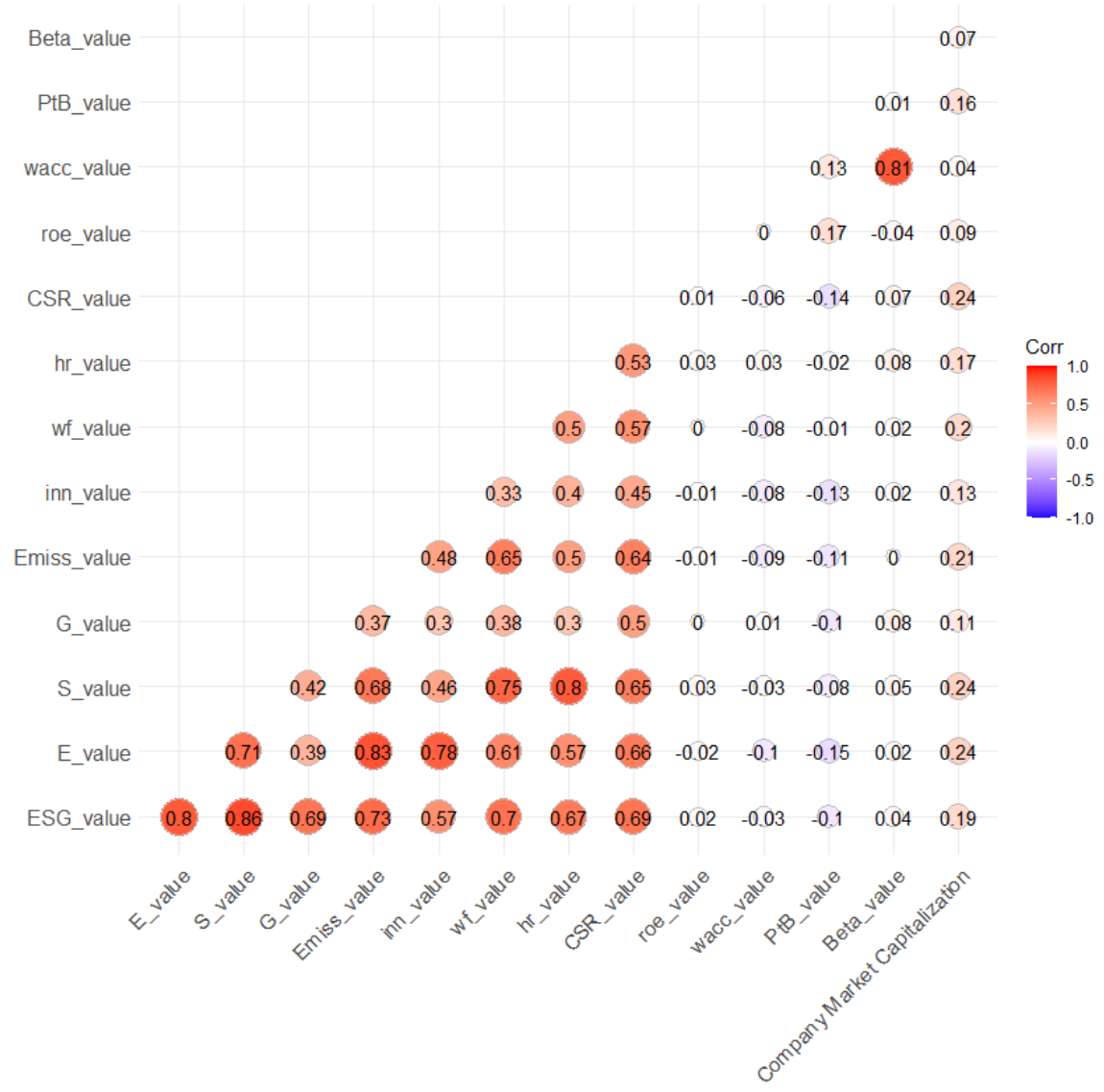

Figure 2: Pearson's correlation matrix.

Based on the correlation matrix in figure 2, we can observe an imperfect multicollinearity relationship between the ESG independent variable and the E and S pillar scores, with respective correlation values of 0.8 and 0.86. These correlations are expected since the ESG score is calculated using the same raw input data as the E and S pillar scores, and thus, there is no need to be concerned about multicollinearity among the ESG variables. The same applies to the E pillar and emission as well. Furthermore, there are no imperfect multicollinearity relationships between the independent and dependent variables or among the dependent variables.

However, there is a strong positive relationship between the control variable Beta and the dependent variable WACC, with a correlation value of 0.81. On the other hand, there is no linear relationship between Emission and beta, with a correlation value of 0.0. This suggests that changes in Emission do not necessarily impact beta in a linear way. Overall, the correlation matrix reveals a good to strong positive relationship between the ESG components and a slightly weak negative correlation between the ESG components and the financial metrics. These findings may have implications for how we interpret the results of the regression model and the extent to which we can use ESG components to predict financial performance.

4.6.2 Multicollinearity Test

Multicollinearity reduces the power of hypothesis tests in regression analysis because it can make it difficult to determine the independent effect of each predictor variable on the outcome variable. When two or more predictor variables are highly correlated, it becomes difficult to distinguish the individual effects of each variable on the outcome variable (Ghosh, 2017). This can lead to unstable and unreliable estimates of the regression coefficients, as well as wider confidence intervals and higher standard errors. (Ghauri et al. 2020).

When a regression model exhibits perfect multicollinearity, the ordinary least squares (OLS) method is unable to distinguish the effects of one explanatory variable from the effects of the others. Perfect multicollinearity occurs when two or more explanatory variables are perfectly correlated, meaning that one of the variables can be expressed as a linear combination of the others. This results in a situation where it is impossible to generate estimates of the regression parameters. (Ghauri et al. 2020).

However, even high levels of collinearity between the explanatory variables can be a problem as they result in imprecise estimates of the parameters. When the explanatory variables are highly correlated, the OLS method tends to magnify the impact of random errors, leading to increased standard errors and decreased precision of the parameter estimates. This makes it difficult to draw reliable conclusions about the relationship between the explanatory variables and the dependent variable. (Ghauri et al. 2020). To remedy the issue of multicollinearity, several techniques can be employed. One approach is to drop one or more of the correlated explanatory variables from the model. Another approach is to combine the correlated

variables into a single variable using principal component analysis or factor analysis. Alternatively, regularization techniques such as ridge regression or lasso regression can be used to reduce the impact of collinearity on the parameter estimates. By employing these techniques, we can obtain more accurate and reliable estimates of the regression parameters, which can help us to better understand the relationship between the explanatory variables and the dependent variable. (Ghauri et al. 2020).

Multicollinearity only ESG					
ROE			**WACC**		
Variables	Tolerance	VIF	Variables	Tolerance	VIF
ESG_value	0,94	1,06	ESG_value	1,06	1,06
wacc_value	0,42	2,39	roe_value	1,06	1,80
Beta_value	0,42	2,36	Beta_value	1,06	1,01
PtB_value	0,85	1,17	PtB_value	1,06	1,69
Company_Market_Capitalization	0,91	1,10	Company_Market_Capitalization	1,06	1,19
Mean	0,71	1,62		1,06	1,35
Beta			**P/B**		
Variables	Tolerance	VIF	Variables	Tolerance	VIF
ESG_value	0,94	1,06	ESG_value	0,96	1,04
wacc_value	0,98	1,02	wacc_value	0,42	2,41
roe_value	0,55	1,80	roe_value	0,79	1,26
PtB_value	0,59	1,69	Beta_value	0,42	2,38
Company_Market_Capitalization	0,84	1,19	Company_Market_Capitalization	0,83	1,20
Mean	0,78	1,35		0,68	1,66

Table 5: Multicollinearity test on only ESG models

Test for multicollinearity using the variance inflation factor (VIF), which in this case indicates that there is no problem, as all values are below the critical threshold of 5. The VIF test value for the current model with only ESG combined rating is less than 10, it can be concluded that there is no problem with multicollinearity in the model and it is unlikely to affect the results. While the model with no ESGC rating shows value higher than 5 for E, and S as shown in *table 5* in the appendix which is very reasonable since ESG value comes from the E, S and G combined. but the VIF result is also under 10 and the tolerance is over 0.1 for the no ESGC model, which means no need for further investigation and adjusting according to James et. al (2013)

The Variance Inflation Factor (VIF) test is a useful tool for detecting multicollinearity in linear regression models. Multicollinearity refers to the situation where two or more independent variables in a regression model are highly correlated with each other, making it difficult to determine their separate effects on the dependent variable. The presence of multicollinearity can lead to unstable and unreliable estimates of the regression coefficients, as well as misleading interpretations of the results. Chapman & Feit (2015)

The VIF test measures the extent to which the variance of the estimated regression coefficient for an independent variable is inflated due to its correlation with other independent variables in the model. Specifically, it assesses how much an independent variable can be explained by the other independent variables in the model and determines if multicollinearity has inflated the variance of the estimated coefficient. Essentially, the VIF test measures the degree of multicollinearity in the model and detects its presence or absence. A VIF value greater than 10 indicates some degree of multicollinearity, as it suggests that the variance of the estimated coefficient is larger than it would be if the independent variable was uncorrelated with the other independent variables in the model. However, there is no universally accepted threshold for what constitutes a problematic level of multicollinearity. Generally, a VIF greater than 5 or a tolerance (1/VIF) less than 0.25 is considered to indicate the existence of multicollinearity that requires further investigation (Studenmund, 2014). When the VIF test result is greater than 10 or the tolerance is less than 0.1, severe multicollinearity that must be addressed is indicated, according to (James et al., 2017). The results of the VIF test can guide further investigation and decision-making about whether to remove correlated variables from the model or apply other techniques to address the multicollinearity issue.

4.6.3 Outliers

An outlier is a point for which observation is far from the value predicted by the outlier model. Outliers can arise for a variety of reasons, such as incorrect recording of an observation during data collection. Outliers have a strong impact on the estimation of unknown regression coefficients in OLS, as they are given a significant weight. This means that extreme observations can result in highly distorted estimates of regression coefficients. (Hanck, Arnold, Gerber & Schmelzer, 2019)

When an outlier does not have an unusual predictor value, it usually has a negligible impact on the least squares fit. Nonetheless, an outlier can still cause problems, even if it does not affect the least squares fit significantly. One such problem is the increase of the residual standard error (RSE), which is used to calculate confidence intervals and p-values. A single data point causing a significant increase in RSE can affect the interpretation of the fit. Additionally, including the outlier in the data can cause the R-squared (R2) value to increase or decrease. Even when an outlier does not have an unusual predictor value, it can still cause issues. For example, it can increase the residual standard error (RSE), which is used to calculate confidence intervals and p-values. A single data point causing a significant increase in RSE can impact the interpretation of the fit. Additionally, including the outlier in the data can affect the R-squared (R2) value, causing it to increase or decrease. James et al. (2013)

Cook's distance is a statistical technique used to detect influential observations in a linear regression model. It involves comparing the estimated values of the dependent variable (Y) with and without a potential outlier. Cook's distance measures the extent to which the residuals change when an observation (i.e., an outlier) is excluded from the estimation process. Specifically, Cook's distance calculates a value for each observation in the dataset, indicating how much the regression coefficients change when that observation is removed from the analysis. This allows researchers to identify influential observations that may be having a disproportionate impact on the model's results.

The resulting output of cook's distance is presented in a *table 6*. This table consists of two rows for each model: the first row displays the indexes of the observations, while the second row presents the corresponding Cook's distances. These distances are useful for identifying potentially influential observations. However, the cut-off for what constitutes a significant Cook's distance may vary depending on the specific dataset and research question. The regression model used is the one with all the variable except ESG.

ROE regression model	**Observation**	**1003**	**702**	**1642**	**3133**	**1**	**2**
	impact	0,72	0,01	0,01	0,01	0	0
WACC regression model	**Observation**	**1003**	**3133**	**483**	**1642**	**3131**	**3121**
	impact	44,57	2,1	0,13	0,12	0,04	0,03
Beta regression model	**Observation**	**3132**	**2081**	**2572**	**483**	**482**	**1361**
	impact	0,07	0,05	0,05	0,04	0,03	0,02
P/B regression model	**Observation**	**1003**	**3133**	**3132**	**1642**	**2573**	**483**
	impact	230,47	3,41	0,7	0,43	0,11	7

Table 6: cook's distance (Outliers)

Although none of the potential outliers in the ROE and Beta model have a Cook's distance value greater than one, while in WACC and P/B we observe some high impact value. We therefore have attempted to remove all these observations from the regression to improve the results. Removing these outliers has resulted in significant improvements in all regression modes.

Several variables have become highly significant at the 5% and 1% levels in some of the models. Specifically, E is now significant at a 1% level in models 1 to 7 (*table 9*), whereas it was not significant in the original model as shown the appendix. Similarly, hr has become significant at a 1% level in models 5 to 8 and 10% in the last model, whereas it was also not significant in the original model. Additionally, the area variable for G has become significant at a various significant level in all models except the last one, along with wf and CSR after removing the outliers. These results are surprising as these variables did not show any significant values in the original model. However, some observations, such as Emiss and inn remain insignificant.

Finally, it is worth noting that the constant remains significant before and after eliminating the outliers. This suggests that removing the outliers did not have a significant impact on the intercept's value. Overall, although Cook's distance values did not indicate a significant effect of the outliers on the original model, removing them has led to significant improvements in the adjusted model.

4.6.4 Heteroskedasticity tests

Heteroskedasticity is a common issue that arises in many cross-sectional regressions, as noted by (Kleiber & Zeileis 2008). Residual plots often show a funnel or cone shape, indicating that the variance of the residuals increases for larger fitted values. This violates the assumption of homoscedasticity, which requires constant variance across the range of fitted values, as explained by James et al. (2013). Heteroskedasticity can result in biased parameter estimates and incorrect hypothesis tests, as some residuals may have an undue influence on the line of best fit. To address this issue, one possible solution is to transform either the predictor or outcome variable using a logarithmic transformation. Alternatively, a weighted regression model can be employed, where the weights are inversely proportional to the variance of the residuals, as suggested by (Chapman and Feit, 2015).

In OLS regression, the residuals are assumed to be drawn from a population with constant variance, but heteroscedasticity violates this assumption, as noted by (Baum & Lewbel, 2019). This can lead to incorrect parameter estimates and standard errors. OLS regression aims to minimize the residuals to produce the smallest possible standard errors, but this assumes that all observations have equal weight. In the presence of heteroscedasticity, observations with larger disturbances have a greater influence, leading to skewed results. To address this, alternative methods such as weighted regression or transformations can be employed.

The Breusch-Pagan test is a widely used statistical method for identifying the presence of heteroscedasticity in linear regression models. Heteroscedasticity is a violation of the assumption of homoscedasticity, which assumes that the variance of the errors is constant across all levels of the independent variables. When this assumption is not met, the reliability of the regression model's results may be compromised. The Breusch-Pagan test generates a p-value and test statistic, which can be used to determine whether or not the null hypothesis of constant variance should be rejected. If the p-value is less than the chosen significance level, it suggests that there is evidence of heteroscedasticity, and the null hypothesis should be rejected. On the other hand, if the p-value is greater than the significance level, it suggests that there is not enough evidence to reject the null hypothesis, and it can be concluded that the variances of the residuals are constant. To address heteroscedasticity, weighted least squares or variable transformations can be employed. In our model, we used weighted least squares and assigned larger weights to variables impacted by heteroscedasticity. (Saunders, 2007; James et al., 2013)

Heteroscedasticity test for models without no ESG combined.

	ROE	WACC	Beta	PtB
Breusch-Pagan Test				
BP	7,99	5,03	6,31	20,21
df	12,00	12,00	12,00	1,00
P-value	0,79	0,96	0,90	0,06
White test				
BP	3,80	4,13	5,57	16,38
df	2,00	2,00	2,00	2,00
P-value	0,15	0,13	0,06	0,00

Table 7: Heteroscedasticity test on models with all variable's except for ESG

Table 7 displays the results of the heteroskedasticity tests for the model without ESG combined rating, namely the Breusch-Pagan test and the White test, which assess the null hypothesis of homoskedasticity in the OLS model. The p-value is used to determine whether to accept or reject the null hypothesis. Based on the results, the Breusch-Pagan test was performed, and the test statistic (BP) was found to be 7.99 for ROE, 5.02 for WACC, 6.31 for Beta, and 20.21 for P/B, with 12 degrees of freedom and p-values of 0.79, 0.96, 0.90, and 0.06, respectively. Since the p-values are higher than the 5% significance level, we accept the null hypothesis of homoscedasticity and conclude that there is no evidence of heteroskedasticity in the model. Consequently, there is no indication of heteroskedasticity in the model. (Kleiber et al., 2008). According to *Table 7* output, the null hypothesis is accepted, indicating that there is homoskedasticity in the OLS model. This conclusion is supported by the p-values of both tests, except for White test of P/B no ESG model, which is less than the 5% significance level. For correcting for that a hypothesis test on the coefficients of a regression model been conducted, where the coefficient of the model is tested using a heteroscedasticity consistent covariance matrix estimator. (Hanck et al., 2019). The result of the test is displayed in the result chapter.

Heteroscedasticity test for models with only ESG combined.

	ROE	WACC	Beta	PtB
Breusch-Pagan Test				
BP	7,21	4,90	22,23	26,73
df	5,00	5,00	5,00	5,00
P-value	0,21	0,43	0,00	0,00
White test				
BP	3,96	4,55	2,83	20,29
df	2,00	2,00	2,00	2,00
P-value	0,14	0,10	0,24	3,92E+00

Table 8: Heteroscedasticity test for models with only ESG.

From the *table 8* we observe that the p-value for ROE and WACC in both test is greater than the significance level 0.05, indicating that we do not have enough evidence to conclude that there is heteroscedasticity in the relationship. While the p-value for both Beta and PB is less than the significance level as the Breusch-Pagan Test shows, indicating strong evidence of heteroscedasticity in the relationship. For correcting for that a hypothesis test on the

coefficients of a regression model been conducted. The result of the test is displayed in the result chapter.

5 Results

In this section, we will delve into the regression results obtained for four key variables, namely ROE, WACC, Beta, and P/B, after making necessary adjustments to deal with outliers, multicollinearity, and heteroskedasticity. Our objective was to obtain reliable data that would accurately reflect the underlying relationships between these variables. To achieve this objective, we applied various tests and adjustments to our data, and after analysing the outcomes, we arrived at a conclusion that the adjusted models are the most suitable for our purposes. The adjustments involved the removal of outliers, and the use of weighted method for the ESG variable in all models with only ESG, and weighted S was also weighted in models that did not include the ESGC variable, aiming to address heteroskedasticity and improve the accuracy of the results. This indicate that ESG and S may have a greater impact on ROE, WACC, Beta and P/B than other independent variables.

The process of adjusting for outliers is important as outliers can significantly skew the results, making it difficult to accurately model the relationship between the variables. Multicollinearity is another issue that can arise when using multiple independent variables, and it occurs when two or more independent variables are highly correlated with each other. This can lead to unstable and unreliable regression results, as the regression model cannot accurately distinguish the effects of each independent variable. Heteroskedasticity is yet another issue that can impact the reliability of regression results. It occurs when the variance of the residuals is not constant across different levels of the independent variable S and can lead to biased and inconsistent estimates of the regression coefficients.

By implementing these adjustments, we were able to arrive at more reliable results, which will enable us to make more accurate predictions about the relationship between ROE, WACC, Beta, P/B, and ESG factors in Nordics countries. Our analysis shows that it is important to carefully consider and address such issues when conducting regression analysis to obtain reliable and accurate results to confirm or reject our following hypothesis:

- *Ha: There is a significant positive relationship between ESG factors rating and firms' profitability?*
  H0 = significant positive relationship, H1 = significant negative or insignificant relationship

- *Hb: There is a significant negative relationship between ESG factors rating and firms' cost of capital?*
  H0 = significant negative relationship, H1 = significant positive or insignificant relationship

- *Hc: There is a significant negative relationship between ESG factors rating and firms' market volatility?*
  H0 = significant negative relationship, H1 = significant positive or insignificant relationship

- *Hd: There is a significant positive relationship between ESG factors rating and firms' P/B?*
  H0 = significant positive relationship, H1 = significant negative or insignificant relationship

5.1 Regression Results ROE

The regression model is used to estimate the relationship between the dependent variable ROE and the independent variables ESG, and other financial and non-financial variables such as ESGC, E, S G, wf, hr, CSR, Emission, innovation, WACC, Beta, P/B and CMC. The results offer valuable insights into understanding this relationship.

- *Ha: There is a significant positive relationship between ESG factors rating and firms' profitability?*
  H0 = no significant positive relationship, H1 = significant positive relationship

Model with only ESGC

The coefficients presented in the regression analysis in *table 9* represent the estimated effects of the independent variables on ROE. Their significance and magnitudes provide insights into the relationships under investigation. Based on this analysis, the variables WACC, Beta, P/B and CMC appear to exert significant effects on the ROE at 1% level. While ESG seems to have no significant effect on ROE.

	Dependent variable:
	roe_value
ESG_value	-0.0001
	(0.0001)
wacc_value	1.213***
	(0.185)
Beta_value	-0.068***
	(0.012)
PtB_value	0.008***
	(0.0004)
Company_Market_Capitalization	0.00000***
	(0.00000)
Constant	0.127***
	(0.010)
Observations	1,282
R^2	0.345
Adjusted R^2	0.343
Residual Std. Error	0.016 (df = 1276)
F Statistic	134.639*** (df = 5; 1276)
Note:	*p<0.1; **p<0.05; ***p<0.01

Table 9: ESG impact on ROE - Regression

The residual standard error, at 0.016, provides an estimate of the average discrepancy between the observed values and the values predicted by the model. It serves as an indicator of the model's overall goodness of fit. The multiple R-squared value of 0.345 implies that approximately 34.54% of the variance in the dependent variable can be explained by the included independent variables. The adjusted R-squared value (0.343) adjusts for the number of predictors and the sample size.

The F-statistic tests the overall significance of the model, considering all the predictors jointly. With an F-statistic of 134.6 and a p-value of less than 2.2e-16, the model is deemed statistically significant.

The analysis indicates a non-significant relationship between ESG rating and ROE. This implies that the initial hypothesis, which stated that there is no significant positive relationship between ESG factors rating and firms' profitability, is supported by the findings and that ESG analysis may not have a substantial impact on the variation in the ROE. It is important to note that a non-significant relationship does not necessarily imply the absence of any relationship between the variables. Instead, it suggests that the observed data does not provide sufficient evidence to conclude that a significant positive relationship exists. Other factors or variables not considered in the analysis may have a stronger influence on profitability, or there may be complexities and nuances in the relationship that were not captured by the model.

Model with no ESG

As we delve into the results of the regression analysis of ROE, we can see that model 9, which includes all variables, has the highest adjusted R-squared value, the model explains approximately 28.25% of the variance in the ROE. This indicates that the model has a strong explanatory power and can accurately account for the variation in the dependent variable. Upon closer examination, we can see that only hr and CSR shows positive and negative significant value respectively, with a significance level of 10%. While the financial metrics shows highly significant effect on ROE.

Models 1 through 7 also reveal intriguing insights. We can see that E is significant at the 1% level, while G demonstrates a significant value that varies in model 3 through 8. wf and emission shows highly significant effect in models 4 through 8 at 1% level. These findings suggest that these variables play a critical role in predicting ROE and can help us gain a better understanding of the factors that contribute to firm profitability, but they all become unsignificant in the 9^{th} model. Moreover, the constant coefficient in the 9^{th} model is significant at the 1% level, indicating a relationship between ESG factors and ROE. This is an important finding as it highlights the significance of ESG factors in predicting firm profitability.

So, variables such as E, S, G, wf, hr, CSR, and innovation do not exhibit a statistically positive significant relationship with ROE suggests that these factors may not have a substantial impact on the variation in the relationship between ROE and the listed variables. In other words, these variables may not play a significant role in determining a company's profitability as measured by ROE and may not be key drivers of variations in ROE. Furthermore, the finding that Emissions demonstrate a negative significant relationship with ROE implies that higher levels of emissions are associated with lower profitability. This suggests that environmental factors, specifically emissions, may have a detrimental effect on a company's financial performance. But as shown in the table, it become insignificant in the 9^{th} model.

On the other hand, the WACC, Beta, P/B and CMC demonstrate a significant influence on the ROE. The positive coefficient estimate for WACC suggests that an increase in the weighted average cost of capital is associated with an increase in the ROE. This implies that higher capital costs may contribute to higher returns on equity in the model. Conversely, the

negative coefficient estimate for Beta indicates that an increase in the beta value is linked to a decrease in profitability. This implies that higher systematic risk may have a detrimental effect on the returns on equity. Additionally, the positive coefficient estimate for P/B and CMC implies that higher price-to-book ratios and larger market capitalizations are associated with higher returns on equity. These variables may reflect market sentiment and investor expectations about future profitability.

The results of the hypothesis testing reveal some surprising findings regarding the relationship between the variables and ROE. Upon comparing the results in *table 10* with the initial hypothesis, it becomes apparent that only hr has a statistically significant positive impact on ROE, while CSR has a statistically significant negative impact. This means that the initial hypothesis of no significant positive relationship between hr and ROE is rejected.

However, the alternative hypothesis for the variables E, S, G, wf, Emiss, CSR and inn must be dismissed as there is no significant evidence to support a significant positive impact of these variables on ROE. These findings highlight the need to reevaluate the initial assumptions about the relationships between these variables and ROE. While the variables we initially hypothesized to have a positive impact on ROE did not show significant effects in the regression analysis, the constant coefficient demonstrated unexpected results. As a result, we may need to reconsider our hypothesis and develop a more comprehensive understanding of the factors that drive firm profitability.

	Dependent variable:								
	roe_value								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
E_value	-0.0004***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001	-0.0004
	(0.0001)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0004)	(0.0004)
S_value		0.001***	0.001***	0.0003	-0.0004	-0.0002	-0.0002	-0.0003	-0.0001
		(0.0002)	(0.0002)	(0.0003)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0003)
G_value			-0.0004**	-0.0005***	-0.0005***	-0.0003*	-0.0003*	-0.0003*	-0.0001
			(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
wf_value				0.001***	0.001***	0.001***	0.001***	0.001***	0.0003
				(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
hr_value					0.0004**	0.0004**	0.0005**	0.0005***	0.0003*
					(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
CSR_value						-0.0004***	-0.0004***	-0.0004***	-0.0003*
						(0.0002)	(0.0002)	(0.0002)	(0.0002)
Emiss_value							0.0002	0.00002	0.00002
							(0.0002)	(0.0002)	(0.0002)
inn_value								-0.0002	-0.0001
								(0.0002)	(0.0002)
wacc_value									1.056***
									(0.195)
Beta_value									-0.059***
									(0.012)
PtB_value									0.006***
									(0.0004)
Company_Market_Capitalization									0.00000***
									(0.00000)
Constant	0.197***	0.186***	0.192***	0.180***	0.181***	0.177***	0.177***	0.177***	0.136***
	(0.006)	(0.006)	(0.007)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.011)
Observations	1,449	1,449	1,449	1,449	1,449	1,449	1,449	1,449	1,282
R^2	0.011	0.019	0.022	0.033	0.037	0.041	0.042	0.043	0.283
Adjusted R^2	0.010	0.018	0.020	0.030	0.033	0.037	0.037	0.037	0.276
Residual Std. Error	0.018 (df = 1447)	0.018 (df = 1446)	0.018 (df = 1445)	0.018 (df = 1444)	0.018 (df = 1443)	0.018 (df = 1442)	0.018 (df = 1441)	0.018 (df = 1440)	0.016 (df = 1269)
F Statistic	15.638*** (df = 1; 1447)	13.991*** (df = 2; 1446)	11.058*** (df = 3; 1445)	12.296*** (df = 4; 1444)	11.001*** (df = 5; 1443)	10.325*** (df = 6; 1442)	8.919*** (df = 7; 1441)	7.993*** (df = 8; 1440)	41.646*** (df = 12; 1269)

Note: *p<0.1; **p<0.05; ***p<0.01

Table 10: ESG factors impact on ROE.

5.2 Regression Results Cost of capital.

The regression model is used to estimate the relationship between the dependent variable WACC and the independent variables ESG, and other financial and non-financial variables such as E, S G, wf, hr, CSR, Emission, innovation, ROE, Beta, P/B and CMC. The results offer valuable insights into understanding this relationship.

- *Hb: There is a significant negative relationship between ESG factors rating and firms' cost of capital?*
  H0 = no significant negative relationship, H1 = significant negative relationship

Model with only ESG

Based on the analysis displayed in *table 11*, it is evident that ESG does not exhibit a statistically significant relationship with WACC. The coefficient estimate for ESG is very close to zero, and its p-value is greater than the conventional significance level of 0.1. Therefore, we do not have enough evidence to conclude that ESG have a significant impact on the model.

	Dependent variable:
	wacc_value
ESG_value	0.00000
	(0.00002)
roe_value	0.027***
	(0.004)
Beta_value	0.050***
	(0.001)
PtB_value	0.0002***
	(0.0001)
Company_Market_Capitalization	-0.00000**
	(0.00000)
Constant	0.011***
	(0.002)
Observations	1,282
R^2	0.610
Adjusted R^2	0.608
Residual Std. Error	0.002 (df = 1276)
F Statistic	399.138*** (df = 5; 1276)
Note:	*p<0.1; **p<0.05; ***p<0.01

Table 11: ESG impact on WACC.

In this analysis, the multiple R-squared is 0.61, indicating that the included independent variables collectively explain approximately 61% of the variance observed in the regression model. The adjusted R-squared is 0.6085, which accounts for the number of predictors in the model.

The analysis reveals that variables such as return on equity, beta value, price-to-book ratio, and company market capitalization have a significant impact on the weighted average cost of capital in the model. However, ESG do not demonstrate a significant relationship with the dependent variable in this analysis. These findings contribute to a deeper

understanding of the relationships between these variables, but it denies the significant relationship stated in the literature part between ESG and WACC.

ESG demonstrates a non-significant relationship with WACC. This implies that the statistical analysis did not find sufficient evidence to support a significant negative relationship between ESG rating and firms' cost of capital. Therefore, since ESG demonstrates a non-significant relationship with WACC, we would fail to reject the initial hypothesis of Hb. This means that the analysis does not support the presence of a significant negative relationship between ESG rating and firms' cost of capital. However, it is crucial to note that the absence of a significant relationship does not necessarily mean there is no relationship at all. It at least ESG do not increases the cost of capital.

Model without ESGC

Table 12 show the output of the linear regression model that estimates the WACC based on various financial and ESG factors. The coefficient estimates for each independent variable in the model represent the relationship between that variable and the dependent WACC. The overall model fit is assessed using the multiple R-squared and adjusted R-squared values. The multiple R-squared is 0.6308, indicating that the included independent variables collectively explain approximately 63.08% of the variance observed in the regression model. The adjusted R-squared of 0.6273 accounts for the number of predictors in the model and provides a slightly lower value due to its penalty for including additional variables.

The intercept term has an estimated coefficient of 0.011***, with a standard error of 0,002, meaning that it is highly unlikely to have occurred by chance. indicating that the intercept is statistically significant at a conventional significance level ($p < 0.01$). This suggests that even when all other independent variables are zero, there is a non-zero baseline value for the dependent variable.

The analysis indicates that certain independent variables such as G, wf, hr, CSR, Emiss, ROE, Beta and P/B have statistically significant relationships with WACC, while others do not. The financial variables such as ROE, Beta, and P/B are also statistically significant at the 1% level. While among the ESG factors, so G, wf, and emission are statistically significant at the 5% level. The CSR and hr are statistically significant at the level 1% and 10% respectively. In contrast E, S, and innovation are not statistically significant. As we see that

the company size has a negative impact on the cost of capital, which expect as big company has more negotiation power than small companies, but there is no significant relationship between them. Conversely, ROE, Beta and P/B have a positive impact on WACC. As the risk increases, the WACC increases to as well as the ROE.

The results of the regression analysis on WACC reveal more significant values for most variables. Moreover, the model demonstrates highly negative and significant values for E in the beginning. In models 1 through 5, E appears to be highly significant at the 1% level and at 5% in model 6, but it's become insignificant in model 7 through 9. hr demonstrates a significant value at the 1% level in model 5 through 8, then it increases to 10% in model 9. Interestingly, CSR shows a significant negative value at the 5% level in model 6, and at the 10% level in models 7 and 8. However, it becomes highly significant and negative in model 9 at the 1% level. On the other hand, Emiss exhibits a significant negative effect in model 7, but it becomes significant and positive in the 9th model at the 5% level.

Surprisingly, the hypothesis testing yielded unexpected results when comparing the findings from *table 11* and *table 12* with our initial hypotheses. Only the variables wf and CSR demonstrated a highly significant negative impact on WACC. On the other hand, variables G, hr, and Emiss showed a significant positive relationship with WACC in model 9. Consequently, we accept the alternative hypothesis H1 for the negative significant relationship of wf and CSR, but we must also reject the alternative hypothesis H1 that state that there is a significant negative relationship as there is insufficient evidence to support the negative impact of the other ESG factors on WACC. It appears that the variables we initially expected to have a negative impact on WACC did not demonstrate significant effects in the regression analysis.

	Dependent variable:								
	wacc_value								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
E_value	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001**	-0.00004	-0.0001	-0.0001
	(0.00002)	(0.00004)	(0.00004)	(0.00004)	(0.00004)	(0.00004)	(0.0001)	(0.0001)	(0.0001)
S_value		0.0001	0.00001	0.00004	-0.0002**	-0.0002**	-0.0002**	-0.0002*	0.0001
		(0.00004)	(0.00004)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.00005)
G_value			0.0001***	0.0001***	0.0001***	0.0001***	0.0001***	0.0001***	0.0001**
			(0.00004)	(0.00004)	(0.00004)	(0.00004)	(0.00004)	(0.00004)	(0.00002)
wf_value				-0.00003	0.00002	0.00003	0.0001	0.0001	-0.0001**
				(0.00005)	(0.00005)	(0.00005)	(0.00005)	(0.0001)	(0.00003)
hr_value					0.0002***	0.0002***	0.0002***	0.0002***	0.00005*
					(0.00004)	(0.00004)	(0.00004)	(0.00004)	(0.00002)
CSR_value						-0.0001**	-0.0001*	-0.0001*	-0.0001***
						(0.00004)	(0.00004)	(0.00004)	(0.00002)
Emiss_value							-0.0001*	-0.0001	0.0001**
							(0.0001)	(0.0001)	(0.00003)
inn_value								0.00004	0.00000
								(0.00004)	(0.00003)
roe_value									0.021***
									(0.004)
Beta_value									0.049***
									(0.001)
PtB_value									0.0003***
									(0.0001)
Company_Market_Capitalization									-0.00000
									(0.00000)
Constant	0.069***	0.069***	0.066***	0.067***	0.067***	0.066***	0.066***	0.066***	0.011***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Observations	1,427	1,427	1,427	1,427	1,427	1,427	1,427	1,427	1,282
R^2	0.006	0.007	0.014	0.014	0.025	0.028	0.030	0.031	0.631
Adjusted R^2	0.005	0.006	0.012	0.011	0.021	0.023	0.025	0.025	0.627
Residual Std. Error	0.004 (df = 1425)	0.004 (df = 1424)	0.004 (df = 1423)	0.004 (df = 1422)	0.004 (df = 1421)	0.004 (df = 1420)	0.004 (df = 1419)	0.004 (df = 1418)	0.002 (df = 1269)
F Statistic	8.503*** (df = 1; 1425)	5.182*** (df = 2; 1424)	6.588*** (df = 3; 1423)	5.041*** (df = 4; 1422)	7.204*** (df = 5; 1421)	6.708*** (df = 6; 1420)	6.296*** (df = 7; 1419)	5.624*** (df = 8; 1418)	180.681*** (df = 12; 1269)
Note:									*p<0.1; **p<0.05; ***p<0.01

Table 12: ESG factors impact on WACC.

5.3 Regression Results Beta

The table aims to explain the relationship between Beta and various independent variables, including ESG, E, S, G, wf, hr, CSR, emission, innovation, WACC, ROE, P/B and CMC. These findings provide insights into the factors that influence Beta and can help understand the relationship between these independent variables and systematic risk.

- *Hc: There is a significant negative relationship between ESG factors rating and firms' market volatility?*
  H0 = no significant negative relationship, H1 = significant negative relationship

Model only ESGC

The result of the coeftest indicates the t-test of coefficients for the regression model using the heteroscedasticity-consistent covariance matrix estimator. Explanation of the coefficient estimates and their significance:

Coefficient estimates provide an estimation of the effect of independent variables on the dependent variable, indicating the expected change in the dependent variable for a one-unit change in the corresponding independent variable, while holding all other variables constant. While standard errors quantify the uncertainty or variability associated with the coefficient estimates. Larger standard errors indicate greater uncertainty in the estimated coefficients. The T-statistics (value) represent the signal-to-noise ratio for each coefficient, indicating how large the coefficient estimate is relative to its variability. Larger absolute t-statistics suggest a higher likelihood of a coefficient being statistically significant. Lastly, the P-values indicate the statistical significance of the coefficient estimates. They represent the probability of observing a t-statistic as extreme as the one calculated if the null hypothesis (e.g., the coefficient being zero) is true. Smaller p-values suggest evidence against the null hypothesis and indicate that the coefficient is statistically significant, typically when they are below a predefined significance level (such as 0.05).

These statistical measures collectively provide insights into the significance and precision of the estimated coefficients, allowing to assess the strength and reliability of the relationships between variables in the regression model.

Correcting for autocorrelation and heteroskedasticity (Beta with only ESG)

	Estimate	Std, Error	t-value	Pr(>|t|)
(Intercept)	2,82E-01	5,33E-02	5,2943	1,406e-07 ***
ESG_value	7,12E-05	5,79E-04	0,1231	0,90
wacc_value	1,23E+01	5,26E-01	23,4304	< 2,2e-16 ***
roe_value	-4,29E-01	1,06E-01	-4,0471	5,496e-05 ***
PtB_value	-8,27E-03	2,30E-03	-3,6049	0,0003243 ***
Company_Market_Capitalization	1,17E-06	2,59E-07	4,5058	7,217e-06 ***

Signif, codes: 0 '***' 0,001	'**' 0,01 '	*' 0,05 ','	0,1 ' '	1

Table 13: ESG impact on Beta (Correction)

From *table 13* we observe that the intercept term has a statistically significant impact on the dependent variable, as indicated by the small p-value. This suggests that the intercept is an important factor in explaining the variation in the Beta. The ESG show no statistical significance, as the p-value is higher than 0.05. This implies that there is insufficient evidence to conclude that ESG has a strong significant effect on Beta. This suggests that companies that engage in ESG activities may not have an impact on their systematic risk as represented by Beta. It is important to highlight that prior to the correction, ESG showed a significant positive relationship with Beta. Thus, the correction made a substantial impact on the regression result as shown in *table A* in the appendix. The WACC, ROE, P/B and CMC variable is highly statistically significant at level 0f 0.001, with a very small p-value. This indicates a strong relationship between WACC, ROE, P/B and CMC and the dependent variable Beta, suggesting that changes in WACC have a meaningful impact on the outcome. The analysis indicates that the variables WACC, ROE, P/B and CMC have statistically significant impacts on the dependent variable.

The analysis found an insignificant relationship between ESG rating and beta, which measures a firm's market volatility. This implies that the alternative hypothesis, which stated that there is a significant negative relationship between ESG factors rating and firms' market volatility, is not supported by the findings.

Model without ESG

The model explains about 63% of the variation in Beta. According to F-statistic, the model as a whole is a good fit for the data. The estimates of the coefficients for the independent

variables provide insights into the impact of each independent variable on the Beta of the company.

Looking at the coefficients of the independent variables in the output in *table 14*, we can see that most of them have statistically significant impacts on the Beta. The constant is positive and highly statistically significant, indicating that there is a positive relationship between Beta and other factors not included in the model. It also means that even when all the other variables are zero, there is still a baseline value for Beta.

Among the ESG factors, CSR shows the strongest positive significant relationship with Beta at 1% level. This suggests that companies with stronger CSR practices may have higher Beta values. Emission shows negative significant relationship at 5% level, while S demonstrate a negative significant impact on Beta at 10%, and wf exert positive significant relationship at 10% level. In contrast, other ESG factors like E, G, hr, and innovation don't seem to have a any impact on Beta.

Regarding the financial metrics, the analysis found that Beta is positively related to the WACC, as WACC increases, Beta tends to increase as well. This implies that companies with higher financing costs may have higher Beta values. ROE has a negative relationship with Beta. Higher ROE values are associated with lower Beta, suggest that companies that take ESG factors in consideration and with higher profitability relative to their equity tend to have lower systematic risk. The price-to-book ratio also has a negative relationship with Beta. Companies with higher market valuations compared to their book values tend to have lower Beta values, indicating potentially lower risk. Finally, the size of the company doesn't appear to have a significant impact on Beta in this analysis. Overall, these findings suggest that factors like WACC, ROE, P/B, and CSR may influence a company's Beta, indicating their risk level compared to the market.

The results of the hypothesis testing provided interesting findings when compared to the initial hypotheses. Specifically, the variables S and Emiss demonstrated a highly significant negative impact on Beta, suggesting that they have a significant influence on the risk of the portfolio. This finding aligns with our alternative hypothesis H1 and supports the notion that S and Emiss contribute to reducing portfolio risk. However, the variables wf and CSR exhibited a significant positive relationship with Beta, indicating that they actually contribute to increased risk in the portfolio. This unexpected result leads us to reject our alternative hypothesis for the negative impact of these ESG factors on Beta, as there is insufficient

evidence to support this claim. The same applies for the factors that did not show a significant value at all.

	Dependent variable:								
	Beta_value								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
E_value	0.001***	-0.001	-0.001	-0.001	-0.001	-0.001*	0.0004	-0.001	0.001
	(0.0004)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
S_value		0.002***	0.002**	0.001	-0.002	-0.002*	-0.002	-0.002	-0.001*
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
G_value			0.001*	0.001	0.001*	0.001	0.001	0.001	-0.0003
			(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.0004)
wf_value				0.001	0.001*	0.001*	0.002**	0.002**	0.001*
				(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.0005)
hr_value					0.002***	0.002***	0.002***	0.002***	0.0004
					(0.001)	(0.001)	(0.001)	(0.001)	(0.0004)
CSR_value						0.001	0.001*	0.001*	0.002***
						(0.001)	(0.001)	(0.001)	(0.0003)
Emiss_value							-0.002***	-0.002*	-0.001**
							(0.001)	(0.001)	(0.001)
inn_value								0.001	0.0002
								(0.001)	(0.0004)
wacc_value									12.406***
									(0.277)
roe_value									-0.299***
									(0.063)
PtB_value									-0.005***
									(0.001)
Company_Market_Capitalization									0.00000
									(0.00000)
Constant	0.924***	0.901***	0.880***	0.873***	0.877***	0.883***	0.879***	0.879***	0.215***
	(0.016)	(0.017)	(0.021)	(0.022)	(0.022)	(0.023)	(0.023)	(0.023)	(0.025)
Observations	1,427	1,427	1,427	1,427	1,427	1,427	1,427	1,427	1,282
R^2	0.006	0.012	0.014	0.015	0.023	0.024	0.029	0.030	0.628
Adjusted R^2	0.005	0.011	0.012	0.012	0.019	0.019	0.024	0.024	0.624
Residual Std. Error	0.066 (df = 1425)	0.066 (df = 1424)	0.066 (df = 1423)	0.066 (df = 1422)	0.065 (df = 1421)	0.065 (df = 1420)	0.065 (df = 1419)	0.065 (df = 1418)	0.036 (df = 1269)
F Statistic	7.888*** (df = 1; 1425)	8.823*** (df = 2; 1424)	6.945*** (df = 3; 1423)	5.439*** (df = 4; 1422)	6.548*** (df = 5; 1421)	5.711*** (df = 6; 1420)	5.990*** (df = 7; 1419)	5.439*** (df = 8; 1418)	178.467*** (df = 12; 1269)
Note:									*p<0.1; **p<0.05; ***p<0.01

Table 14: ESG factors impact on Beta.

5.4 Regression Results P/B

The regression model is used to estimate the relationship between the dependent variable P/B and the independent variables ESG, and other financial and non-financial variables such as ESG, E, S G, wf, hr, CSR, Emission, innovation, roe, Beta, WACC and CMC. The results offer valuable insights into understanding this relationship.

- *Hd: There is a significant positive relationship between ESG factors rating and firms' P/B?*

  H0 = no significant positive relationship, H1 = significant positive relationship

Model with only ESG

The result of the coeftest indicates the t-test of coefficients for the regression model using the heteroscedasticity-consistent covariance matrix estimator. Explanation of the coefficient estimates and their significance:

Correcting for autocorrelation and heteroskedasticity (P/B only ESG)

	Estimate	Std, Error	t value	Pr(>|t|)
(Intercept)	2,78E+00	2,62E+00	1,06	0,29
ESG_value	-6,07E-02	4,10E-02	-1,48	0,14
wacc_value	3,83E+01	1,99E+01	1,92	0,055
roe_value	2,84E+01	7,69E+00	3,70	0,0002237 ***
Beta_value	-3,05E+00	1,08E+00	-2,81	0,0050163 **
Company_Market_Capitalization	-2,09E-06	1,11E-05	-0,19	0,85

Signif, codes: 0 '***' 0,001	'**' 0,01 '	*' 0,05 ','	0,1 ' '	1

Table 15: ESG impact on P/B (Correction)

The intercept coefficient has an estimate of 2.78e+00, a standard error of 2.62e+00, and a t-value of 1.06. The p-value is 0.29. The coefficient is not statistically significant at conventional significance levels (0.05), as the p-value is greater than 0.05. This suggests that the intercept does not have a significant effect on the P/B ratio. The coefficient estimate for ESG rating is also not statistically significant. So, t1here is insufficient evidence to conclude that the ESG rating has a significant effect on the P/B ratio. The correction for autocorrelation and heteroskedasticity in the regression model has had a substantial impact on the

significance level of the independent variable ESG and the dependent variable P/B. Prior to the correction (*table B* in appendix), ESG exhibited a significant negative relationship with P/B, providing support for the alternative hypothesis H1, which suggests a negative association between ESG and P/B. This finding implies that companies with higher ESG scores had lower P/B ratios.

Furthermore, the correction also affected the relationship between the independent variable WACC and P/B. Before the correction, WACC showed a positive significant relationship with P/B. This indicates that companies with higher weighted average cost of capital had higher P/B ratios.

These findings highlight the importance of addressing issues like autocorrelation and heteroskedasticity in regression analysis. The correction allowed for a more accurate evaluation of the relationships between the variables and yielded a clearer understanding of the impact of ESG and WACC on P/B ratios. It emphasizes the need to consider and address statistical assumptions and potential biases in order to obtain reliable and robust results in empirical research.

Based on the t-test results, the ROE and Beta coefficients are statistically significant, indicating a strong relationship with the P/B. However, the coefficients for the intercept, ESG, WACC, and CMC are not statistically significant, suggesting that there is insufficient evidence to conclude a significant relationship for those variables. The coefficient estimate for WACC has a moderately high t-value, but the p-value of 0.055 is slightly above the conventional significance level. This indicates that there is some evidence of a relationship between WACC and the P/B ratio, but it falls short of statistical significance. On the other hand, the coefficient estimate for ROE is statistically significant, with a high t-value and a very low p-value. This suggests a strong relationship between ROE and the P/B ratio. Similarly, the coefficient estimate for Beta is statistically significant, indicating strong evidence of a relationship between Beta and the P/B ratio. Lastly, the coefficient estimate for Company market capitalization is not statistically significant, suggesting that it does not have a significant effect on the P/B ratio.

The coefficient estimates for the ESG rating not being statistically significant suggests that there is insufficient evidence to support the alternative hypothesis of a significant positive relationship between ESG factors rating and firms' P/B. In other words, based on the data and analysis conducted, there is no strong indication that the overall ESG rating has a significant

impact on the P/B ratio of firms. This finding contradicts the alternative hypothesis and suggests that the ESG factors, when considered collectively, may not have a substantial influence on market valuations as measured by the P/B ratio.

Model Without ESG

Upon examining the coefficients of the independent variables shown in *table 16*, we observe that some of them have significantly influence on the dependent variable, while others do not. The regression analysis Correcting for autocorrelation and heteroskedasticity offers valuable insights into the connections between the P/B ratio and various factors. The coefficients provide information regarding the direction and significance of these relationships.

The intercept demonstrates statistically insignificant value, suggesting that there is unlikely any association between P/B and other factors not included in the model. The results also suggest that the variables related to workforce and human rights have a significant positive impact on the P/B ratio of firms. This implies that companies with better workforce practices and a strong focus on human rights tend to have higher market valuations relative to their book value. On the other hand, S shows a significant negative impact on P/B, indicating that companies with better social performance are assigned lower valuations by the market compared to their book value. It suggests that investors may perceive firms with stronger social performance as having lower growth prospects or higher risk, leading to a lower P/B ratio. However, the variables related to environment, governance, CSR, emissions, and innovation do not demonstrate a significant relationship with P/B. These findings indicate that while certain ESG factors have an impact on the market valuation measured by P/B, others may not be as influential in determining the P/B ratio of firms. Have a look at *table C* in the appendix for an analysis of the impact of the correction on the regression model output. This table presents the regression results before the correction for autocorrelation and heteroskedasticity. By examining *Table C*, you can gain insights into the initial relationship between the variables of interest and the corresponding coefficients, significance levels, and other statistical measures. Understanding the regression results before the correction is crucial for assessing the impact and significance of the correction itself.

Among the financial variables, ROE has a positive coefficient, indicating that higher profitability is associated with higher P/B ratios. This relationship is highly statistically

significant. Conversely, "Beta" has a negative coefficient and is highly statistically significant at the 5% level, suggesting that higher risk leads to lower P/B ratios. The market capitalization of the company does not demonstrate a significant relationship with the P/B ratio.

Based on this analysis, we can accept the alternative hypothesis (H1: There is a significant positive relationship between ESG factors rating and firms' P/B) for workforce and human rights, as they demonstrate a significant positive impact on P/B. However, we must reject the alternative hypothesis for the variable social, as it shows a significant negative impact on P/B. Additionally, the variables related to environment, governance, CSR, emissions, and innovation do not exhibit a significant relationship with P/B. Therefore, while there is evidence of a significant positive relationship for some ESG factors, it is not observed across all the variables, indicating a more nuanced and varied impact on the P/B ratio.

Correcting for autocorrelation and heteroskedasticity (P/B without ESG)

	Estimate	Std, Error	t-value	Pr(>|t|)
(Intercept)	1,1E+00	2,4E+00	0,48	0,63
E_value	-1,8E-02	1,5E-02	-1,16	0,25
S_value	-8,2E-02	3,8E-02	-2,16	0,03110 *
G_value	-1,6E-02	2,1E-02	-0,75	0,46
wf_value	8,4E-02	3,9E-02	2,14	0,03278 *
hr_value	1,9E-02	8,0E-03	2,41	0,01609 *
CSR_value	-1,2E-02	9,4E-03	-1,29	0,20
Emiss_value	-2,3E-02	1,8E-02	-1,28	0,20
inn_value	7,2E-03	1,1E-02	0,66	0,51
wacc_value	5,8E+01	2,2E+01	2,68	0,00740 **
roe_value	2,2E+01	4,3E+00	5,18	2,582e-07 ***
Beta_value	-3,5E+00	1,6E+00	-2,22	0,02675 *
Company_Market_Capitalization	1,4E-05	8,7E-06	1,60	0,11

Signif, codes: 0 '***' 0,001	'**' 0,01 '	*' 0,05 ','	0,1 ' '	1

Table 16: ESG factors impact on P/B (Correction)

5.5 Summary

The analysis of the only ESG models provides interesting insights into the relationship between ESG and various financial metrics. It is observed that ESG demonstrates a non-significant relationship with all the financial metrics. This implies that the inclusion of ESG does not have a significant impact on these particular financial indicators. As a result, the initial hypothesis suggesting no relationship between ESG and the financial metrics is accepted, and the alternative hypothesis must be dismissed.

Regarding the result of the model where ESG is excluded, the analysis provides valuable insights into the relationships between ESG factors and various financial metrics. Firstly, the model without ESG factors demonstrates insignificant relationships between E and inn, and all the financial metrics (ROE, WACC, Beta, and P/B). This suggests that these environmental practises and innovation may not have a direct impact on financial performance or risk.

Among the ESG factors, S exhibits interesting findings. While it demonstrates insignificant relationships with ROE and WACC, it shows a marginally negative significant relationship with Beta and P/B. This suggests that companies with stronger social practices may have lower systematic risk, as reflected in the Beta. However, the negative impact on P/B indicates that these companies may have a lower market valuation relative to their book values. This finding underscores the complex relationship between social factors and financial metrics. The analysis also highlights the role of G in relation to financial metrics. It demonstrates an insignificant relationship with ROE and Beta, but a highly significant positive relationship with WACC. This suggests that companies with higher governance rating may face higher costs of capital, potentially due to increased regulatory compliance or risk management measures. The insignificant relationship of G with P/B indicates that Governance practises are unlikely to impact the market valuation of any company.

The impact of wf on financial metrics shows varying results. While it demonstrates an insignificant relationship with ROE, it exhibits a negative significant relationship with WACC, and positive significant relationship with Beta and P/B at different significance levels. This suggests that workforce-related practices may influence the cost of capital, risk, and market valuation to some extent. hr shows slightly significant impacts on ROE, WACC,

and P/B at a 10% level, but no significant impact on Beta. This suggests that human rights-related factors may have a modest influence on financial performance and risk measures.

Regarding CSR, it demonstrates a highly significant effect on both WACC and Beta at a 1% level. The negative relationship with WACC indicates that companies with stronger CSR practices may have lower costs of capital. Conversely, the positive relationship with Beta suggests that these companies may have higher systematic risk. The slightly significant and negative relationship with ROE implies that CSR may have a modest impact on profitability. However, the relationship with P/B is insignificant, suggesting that market valuation may not be strongly influenced by CSR practices. Lastly, Emiss demonstrates a positive significant relationship with WACC and negative significant relationships with Beta. This implies that companies with higher emission levels may face higher costs of capital and higher systematic risk. While it has no statistically significant relationship with both ROE and P/B. It is clear that the relationships between these ESG factors and the financial metrics are more complex than anticipated. Additional research and analysis are necessary to gain a deeper understanding of the factors that truly drive firm profitability, cost of capital and market value.

6 Interpretation and discussion

In this section, we will connect our findings to the relevant theory and existing literature, focusing on one dependent variable at a time, and examine the implications derived from our analysis.

6.1 Findings

The objective of this study is to analyse the influence of ESG scores and their individual components/pillars on the financial metrics of Nordic companies. Additionally, the paper seeks to address the central question of the study, which revolves around understanding the willingness to pay for ESG considerations. By investigating these aspects, we aim to contribute to the existing knowledge on the financial implications of ESG factors in the Nordic business context.

The willingness to pay for ESG.

In order to address the main question, this paper employed a combination of literature review and empirical analysis. The central question was further divided into two sub-questions to ensure a comprehensive and robust investigation. The literature review section provided an in-depth examination of economic concepts and models that elucidate the relationship between firms' financial performance and ESG factors. It also discussed how ESG considerations can contribute to firms' value creation process, along with insights on measuring ESG and the internalization process.

The empirical analysis involved conducting multiple regression analyses using a selected dataset encompassing ESG ratings and various financial metrics for 343 Nordic companies over a 10-year period. The objective was to uncover and differentiate the correlation between ESG factors and financial metrics, aiming to identify any significant relationship between them. Specifically, the analysis focused on exploring the potential impact of ESG factors on profitability, cost of capital, risk, and P/B ratios. Both the literature review and empirical analysis sections were designed to provide comprehensive responses to the following research questions:

- *Question 1: Do ESG rating effects the firm's profitability and its cost of capital?*

- *Question 2: Do ESG rating effect firm/market volatility and value?*

The answer to the first question:

- *Do ESG factors rating effects the firm's profitability and its cost of capital?*

ROE findings

The findings from the regression analysis indicate that there is no significant impact of various ESG factors, including environmental, social, and governance considerations, on the profitability of Nordic companies, as measured by return on equity. This aligns with the research conducted by Atan et al. (2018), which suggests that disclosing ESG information does not necessarily lead to better financial performance. It also reflects the viewpoint of Friedman's shareholder theory, which prioritizes maximizing profits for shareholders rather than incorporating broader stakeholder interests.

However, it is important to note that variables related to human rights and CSR did show a significant relationship with ROE. This finding supports the notion that investments in rights practices and CSR initiatives can have a positive impact on a company's profitability. It is consistent with the perspective put forth by Clark and Viehs (2014), who highlighted that the relationship between ESG factors and investment performance is not universally conclusive. Different studies have produced mixed results, with some indicating a positive relationship between ESG considerations and financial returns, while others find no significant correlation. These findings suggest that the relationship between ESG factors and financial performance is complex and context dependent. It underscores the importance of considering specific ESG components, such as HR and CSR, that may directly influence a company's profitability.

The findings suggest that ESG factors may not have a significant impact on determining a firm's profitability, as measured by ROE. One possible explanation for this lack of impact could be the steady state effect mentioned by ECCE (2016). Companies with high ESG scores may already have well-established sustainability practices, and their ratings may no longer be considered newsworthy. It is worth noting that Nordic firms are generally known for having higher ESG scores, which could contribute to the finding of no significant impact on ROE.

When examining each variable individually, it is interesting to observe that social and workforce components, which are related to employees to some extent, contradict the findings of Li and Zhang (2017) and Daly and Farley (2011). Li and Zhang (2017) found a positive association between employee satisfaction and abnormal returns, while Daly and Farley (2011) suggested that investing in human capital reduces production costs and can be related to both profitability and the cost of capital. Since human capital encompasses innovation according to Daly and Farley (2011), it also aligns with their findings. However, the finding regarding social concerns appears to support the finding of Li and Zhang (2017) regarding employee satisfaction.

Moreover, it is important to consider the perspective put forth by Schoenmaker (2017), who suggests that ESG ratings and indices have limited impact on investment decisions. They are often seen as just another indicator to consider rather than a significant factor driving investment performance. This perspective further supports the notion that ESG factors may not play a major role in determining profitability, as indicated by the findings.

WACC findings

Regarding the regression analysis of WACC, the findings indicate that there is a significant effect of some ESG factors on the weighted average cost of capital, which aligns with previous literature, particularly in the case of CSR. This suggests that ESG factors play a role in influencing the cost of capital for firms. However, it is worth noting that the relationship between ESG factors and WACC is not consistent across all components. Interestingly, the analysis reveals that ESG does not have a statistically significant relationship with WACC. This finding contradicts the results of El Ghoul and colleagues (2011), who found that companies with better sustainability scores enjoy cheaper equity financing and are more attractive to investors, who are willing to pay a premium for their equity.

The analysis also reveals interesting findings regarding the relationship between certain ESG factors and the cost of capital. Specifically, Governance, Workforce, CSR, and Emission demonstrate a significant relationship with the cost of capital, which is consistent with some previous studies. The presence of strong workforce practices and high CSR performance is associated with a decrease in the cost of capital, making it easier for companies with favourable scores in these areas to access capital. This finding supports the conclusions of Khan et al. (2016) and Dhaliwal et al. (2011), who found that better CSR performance is linked to lower cost of capital and improved financial performance.

Surprisingly, Governance exhibits an unexpected relationship with the cost of capital. As companies engage in corporate governance activities, the cost of capital increases, indicating that investors require higher returns. This finding contradicts the results of Cheng et al. (2014) and Clark & Viehs, who found that companies with stronger sustainability performance, particularly in corporate governance, have better access to finance.

Overall, the variables Governance, Workforce, CSR, and Emission show strong relationships with the cost of capital, regardless of their positive or negative impact. These findings suggest that these factors play a significant role in determining the cost of capital. However, variables such as Environment, Social, Human Resources, and Innovation do not exhibit statistically significant relationships with the cost of capital, which could be attributed to factors like asymmetric information and lack of transparency around ESG factors, in line with agency theory, or align with the traditional shareholder theory proposed by Friedman (1970), which emphasizes maximizing profits for shareholders as the primary responsibility of a business. A

lower cost of capital indicates that a company can access capital at a lower cost, potentially leading to improved profitability and financial health.

The second question:

- *Do ESG rating effect firm/market volatility and value?*

Beta findings:

The findings from the regression analysis on Beta provide valuable insights into the relationship between ESG factors and firms' volatility. The lack of significant relationships between ESG, Environment practices, corporate governance, human rights, and innovation with Beta suggests that these factors may not be strong drivers of volatility in Nordic companies. This finding challenges the assumptions of the stakeholder theory, which posits that considering the interests of multiple stakeholders, including ESG factors, can lead to improved financial performance and reduced risk.

On the other hand, the significant relationship between social practices and Emission with Beta aligns with previous literature, specifically the study by Ortize-de Mandojana and Bansal (2016), which suggests that companies with better sustainability practices experience lower financial volatility. This finding indicates that social practices and managing emissions can potentially contribute to risk reduction and stabilize a company's stock price in response to market movements.

The unexpected effects of workforce and CSR on Beta raise interesting questions and warrant further investigation. The finding that these factors have an opposite effect on Beta implies that workforce-related practices and CSR activities may introduce certain complexities and trade-offs when it comes to managing volatility. It is possible that factors such as employee satisfaction or the cost implications of CSR initiatives impact a company's financial risk in unpredictable ways.

P/B findings:

The analysis indicates a weak indication of the effect of ESG factors on firm value represented by P/B. Specifically, the factors of social, workforce, and human rights show

slight significance in their relationship with P/B. This finding is consistent with the concept of the adaptive market hypothesis, which suggests that companies improving their sustainability performance are more likely to be rewarded in less efficient markets. In this case, higher ratings in workforce and human rights correspond to higher P/B ratios, which are often associated with growth stocks and potentially overvalued stock prices, thereby increasing the overall value of the company.

However, our findings regarding the relationship between social practices and P/B do not align with the findings of Lo (2004). Lo's study suggests a negative relationship between social factors and P/B, where companies with high social practices exhibit low P/B ratios. This contradicts our results, but it is important to note that companies with low P/B ratios may be classified as value stocks, indicating potential undervaluation rather than a direct impact of social practices on driving down P/B. This perspective is supported by the conclusion of Khan et al. (2016), who found that immaterial sustainability issues tend to underperform in terms of stock price. Thus, the presence of low P/B companies may be due to their classification as undervalued value stocks rather than a direct negative impact of social practices on P/B.

ESG, Environment, Governance, CSR, Emissions, and Innovation do not exhibit a significant relationship with P/B. This finding is highly inconsistent with the findings of Derwall and colleagues (2005), who found that eco-efficient companies achieved significantly higher stock returns compared to their peers. Additionally, research conducted by ECCE in 2016 indicated that companies improving their sustainability ratings tended to outperform the stock market, whereas companies with already high scores did not. The lack of a significant relationship between ESG factors and P/B in our analysis suggests that this pattern may extend to Nordic companies as well. It implies that investors may perceive companies with already high sustainability ratings and practices as having lower risk and greater financial stability. As a result, these companies tend to have lower P/B ratios, indicating a perception of lower risk and higher financial stability among investors.

This finding raises the possibility that companies with well-established sustainability practices may not experience significant changes in their stock valuation due to their already recognized and integrated sustainability efforts. Their high scores in ESG factors may no longer be seen as newsworthy or driving stock performance. Instead, investors may prioritize other factors or indicators when valuing these companies.

In relation to the main question of this paper, which explores the extent to which investors are willing to pay for ESG considerations.

The willingness to pay for ESG.

Even some of the ESG factors does not seem to have that great impact on the financial metrics, but it seems that in some way they are balancing or empowering the binding line between the financial markets itself. As our result shows extremely high significant relationship between the financial metrics. However, based on our analysis, it can be concluded that ESG factors do not significantly affect the profitability and firms` value creation, as the impact on return on equity is weak. However, it is observed that ESG factors do have a notable influence on the fragmentation of the financial market and the firm's present value associated with firms cost of capital, regardless of whether their impact is positive or negative. This is evident from the significant relationship between ESG factors, Beta, and WACC.

However, as Schramade (2016) suggested, the success of the ESG incorporation process is dependent on the number of fundamental analysts and the quality of their learning. A larger number of analysts with expertise in ESG issues can help to improve the quality of ESG research and ensure that it is incorporated into investment decisions. Furthermore, ongoing learning and improvement in ESG analysis can help to refine investment strategies and identify emerging risks and opportunities.

The findings of this paper present a complex and varied picture in response to the main question. The impact of ESG variables on financial metrics appears to be diverse, with some variables positively influencing the improvement of financial indicators, benefiting both shareholders and stakeholders. However, there are also variables that have a negative impact, driving the value in the opposite direction. Furthermore, certain ESG factors do not demonstrate any significant effect on the financial metrics. These results underscore the intricate nature of the relationship between ESG factors and financial performance, leaving the answer to the main question ambiguous and far from providing a clear conclusion.

Finally, it is important to acknowledge that our results might have been different if we had employed alternative statistical techniques or made different choices in data selection. For

instance, using weighted least squares and assigning larger weights to variables affected by heteroscedasticity could have yielded different outcomes.

Additionally, the inclusion of firms with a longer record of ESG ratings, specifically those with a minimum of five years instead of two years, may have yielded different results. However, it is important to consider that such an approach would have reduced the number of companies included in our study, potentially limiting the representativeness of the findings and their applicability to the majority of Nordic companies.

These reflections highlight the potential impact of methodological decisions and data selection criteria on the outcomes of our study. While our current approach provides valuable insights, alternative methods and inclusion criteria could offer additional perspectives and potentially lead to different conclusions. It is crucial for future research to consider these factors and explore their implications to further enhance our understanding of the relationship between ESG factors and financial performance.

7 Conclusion

The primary objective of this master's paper was to investigate the relationship between ESG ratings factors and financial metrics, specifically ROE, WACC, Beta, and P/B, in Nordic companies. The aim was to determine the extent to which ESG factors influence these financial metrics and assess their significance. To achieve this, a regression analysis was conducted on a dataset comprising 343 public companies from Sweden, Finland, Norway, and Denmark. Through a comprehensive review of existing literature, meticulous data collection, and rigorous analysis, the research objectives were successfully addressed, and the research questions were answered.

The analysis on different financial metrics reveals interesting findings regarding the impact of ESG factors. In terms of return on equity (ROE), variables such as ESG, E, S, G, wf, Emission, and innovation do not show any significant influence. However, human rights have a statistically significant positive impact on ROE, indicating that companies that prioritize and respect human rights tend to have higher profitability. Conversely, CSR has a statistically significant negative impact on ROE, suggesting that companies focusing on social responsibility may experience lower returns.

Moving on to the cost of capital, the analysis shows that workforce and CSR have a highly significant negative impact on WACC. This implies that companies with strong workforce practices and a commitment to CSR may enjoy lower borrowing costs. On the other hand, variables related to governance, human resources, and emissions demonstrate a significant positive relationship with WACC, indicating that investors may demand higher returns from companies with better governance practices and higher emissions. However, variables such as environment, social, human resources, and innovation do not show statistically significant relationships with the cost of capital.

In terms of market beta, the variables related to social, and emissions exhibit a highly significant negative impact, suggesting that companies with better social performance and lower emissions experience lower market volatility. Conversely, workforce and CSR display a significant positive relationship with Beta, indicating that companies emphasizing workforce practices and social responsibility may experience higher market volatility.

Turning to price-to-book ratio, the analysis indicates a weak indication of the effect of ESG factors on P/B. Social, workforce, and human rights demonstrate slightly significant impacts on P/B. Specifically, workforce and human rights have a significant positive influence, while social has a significant negative influence. However, variables related to environment, governance, CSR, emissions, and innovation do not show a significant relationship with P/B.

These findings underscore the varied and nuanced nature of the relationship between ESG factors and financial metrics. It suggests that different dimensions of ESG can have diverse impacts on financial performance, and further research is needed to understand the underlying mechanisms and contextual factors that drive these relationships.

In conclusion, the results highlight the complexity of the relationship between ESG factors and financial performance. While ESG factors does not exert strong impact ROE and P/B, it does show some significant relationships with Beta and WACC. these findings highlight the need for investors, companies, and policymakers to carefully consider the specific ESG factors that are most relevant to financial performance and tailor their strategies accordingly. Effective integration of ESG considerations into investment decisions and corporate practices requires a nuanced understanding of how different sustainability dimensions impact financial outcomes. These findings contribute to the ongoing discourse on the integration of ESG considerations in financial analysis and decision-making, and serves as a foundation for future studies in this area.

7.1 Future research

Future studies should investigate the views and preferences of different types of investors regarding the integration of ESG factors in their investment decisions. This research direction involves exploring the views and preferences of different types of investors regarding the integration of ESG factors in their investment decisions. The aim is to understand investor motivations, investment strategies, decision-making processes, preferences for specific ESG factors, investor influence on companies' ESG practices, performance measurement of sustainable investment portfolios, and the regulatory and policy implications. By examining these aspects, we can gain insights into the role of investors in driving sustainable investments, the impact of ESG integration on financial performance, and the influence of regulations and policies on investor behaviour. This knowledge can inform investors, asset managers, and policymakers in promoting sustainable finance practices.

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9 Appendix

Table A: Beta with only ESG regression model before the correction.

	Dependent variable:
	Beta_value
ESG_value	0.001*
	(0.0003)
wacc_value	12.186***
	(0.276)
roe_value	-0.371***
	(0.065)
PtB_value	-0.005***
	(0.001)
Company_Market_Capitalization	0.00000**
	(0.00000)
Constant	0.240***
	(0.025)
Observations	1,282
R^2	0.614
Adjusted R^2	0.613
Residual Std. Error	0.037 (df = 1276)
F Statistic	406.076*** (df = 5; 1276)
Note:	*p<0.1; **p<0.05; ***p<0.01

Table B: P/B with only ESG regression model before the correction.

	Dependent variable:
	PtB_value
ESG_value	-0.061***
	(0.008)
wacc_value	38.257***
	(11.141)
roe_value	28.448***
	(1.466)
Beta_value	-3.048***
	(0.708)
Company_Market_Capitalization	-0.00000
	(0.00001)
Constant	2.775***
	(0.651)
Observations	1,282
R^2	0.322
Adjusted R^2	0.320
Residual Std. Error	0.943 (df = 1276)
F Statistic	121.289*** (df = 5; 1276)
Note:	*p<0.1; **p<0.05; ***p<0.01

Table C: P/B with no ESG regression model before the correction

	Dependent variable:								
	PtB_value								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
E_value	-0.037***	-0.049***	-0.043***	-0.050***	-0.051***	-0.045***	-0.047***	-0.068***	-0.018
	(0.006)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.014)	(0.021)	(0.021)
S_value		0.016	0.033***	-0.046***	-0.095***	-0.090***	-0.090***	-0.089***	-0.082***
		(0.011)	(0.011)	(0.014)	(0.021)	(0.021)	(0.021)	(0.021)	(0.020)
G_value			-0.041***	-0.051***	-0.050***	-0.046***	-0.046***	-0.047***	-0.016*
			(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.010)
wf_value				0.097***	0.109***	0.110***	0.110***	0.111***	0.084***
				(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.013)
hr_value					0.033***	0.034***	0.035***	0.034***	0.019*
					(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
CSR_value						-0.017*	-0.017*	-0.018*	-0.012
						(0.009)	(0.009)	(0.009)	(0.009)
Emiss_value							0.002	0.010	-0.023*
							(0.013)	(0.014)	(0.014)
inn_value								0.014	0.007
								(0.011)	(0.011)
wacc_value									58.209***
									(11.381)
roe_value									22.017***
									(1.516)
Beta_value									-3.503***
									(0.718)
Company_Market_Capitalization									0.00001
									(0.00001)
Constant	5.627***	5.444***	6.288***	5.364***	5.433***	5.293***	5.296***	5.298***	1.149*
	(0.259)	(0.285)	(0.339)	(0.350)	(0.349)	(0.358)	(0.358)	(0.358)	(0.665)
Observations	1,597	1,597	1,597	1,597	1,597	1,597	1,597	1,597	1,282
R^2	0.024	0.025	0.037	0.078	0.084	0.086	0.086	0.087	0.276
Adjusted R^2	0.023	0.024	0.036	0.076	0.081	0.083	0.082	0.083	0.269
Residual Std. Error	1.135 (df = 1595)	1.134 (df = 1594)	1.128 (df = 1593)	1.104 (df = 1592)	1.101 (df = 1591)	1.100 (df = 1590)	1.100 (df = 1589)	1.100 (df = 1588)	0.925 (df = 1269)
F Statistic	38.641*** (df = 1; 1595)	20.533*** (df = 2; 1594)	20.654*** (df = 3; 1593)	33.691*** (df = 4; 1592)	29.283*** (df = 5; 1591)	24.991*** (df = 6; 1590)	21.410*** (df = 7; 1589)	18.969*** (df = 8; 1588)	40.214*** (df = 12; 1269)
Note:									*p<0.1; **p<0.05; ***p<0.01

Table D: Original ROE Before any adjustment

There is a significant positive relationship between ESG factors rating and firms' profitability?

	Dependent variable:									
	roe_value									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
ESG_value	0.001	0.002*	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.002
	(0.001)	(0.001)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
E_value		-0.002*	-0.002*	-0.002**	-0.002*	-0.002*	-0.002*	-0.002	-0.003	-0.003
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
S_value			0.002	0.001	0.002	0.001	0.001	0.001	0.001	0.001
			(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
G_value				-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
				(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
wf_value					-0.001	-0.001	-0.001	-0.001	-0.0004	-0.001
					(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
hr_value						0.0004	0.0004	0.0004	0.0004	0.0001
						(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
CSR_value							0.0001	0.0002	0.0002	0.001
							(0.001)	(0.001)	(0.001)	(0.001)
Emiss_value								-0.0003	0.00003	0.0002
								(0.001)	(0.001)	(0.001)
inn_value									0.0005	0.001
									(0.001)	(0.001)
wacc_value										0.287
										(1.012)
Beta_value										-0.091
										(0.062)
PtB_value										0.014***
										(0.004)
Company_Market_Capitalization										0.00000**
										(0.00000)
Constant	0.162***	0.149***	0.135***	0.142***	0.158***	0.158***	0.160***	0.161***	0.159***	0.180**
	(0.048)	(0.049)	(0.050)	(0.051)	(0.056)	(0.056)	(0.058)	(0.058)	(0.058)	(0.080)
Observations	1,455	1,455	1,455	1,455	1,455	1,455	1,455	1,455	1,455	1,288
R^2	0.0003	0.002	0.003	0.004	0.004	0.004	0.004	0.004	0.005	0.030
Adjusted R^2	-0.0004	0.001	0.001	0.001	0.001	0.0002	-0.0005	-0.001	-0.002	0.020
Residual Std. Error	0.547 (df = 1453)	0.547 (df = 1452)	0.547 (df = 1451)	0.547 (df = 1450)	0.547 (df = 1449)	0.547 (df = 1448)	0.547 (df = 1447)	0.547 (df = 1446)	0.548 (df = 1445)	0.574 (df = 1274)
F Statistic	0.467 (df = 1; 1453)	1.804 (df = 2; 1452)	1.694 (df = 3; 1451)	1.391 (df = 4; 1450)	1.201 (df = 5; 1449)	1.046 (df = 6; 1448)	0.902 (df = 7; 1447)	0.798 (df = 8; 1446)	0.750 (df = 9; 1445)	2.983*** (df = 13; 1274)
Note:										*p<0.1; **p<0.05; ***p<0.01

Table E: Original WACC: Before any adjustment

There is a significant negative relationship between ESG factors rating and firms' cost of capital?

	Dependent variable:									
	wacc_value									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
ESG_value	-0.00005	0.0002***	0.0002**	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002***
	(0.00004)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
E_value		-0.0002***	-0.0002***	-0.0002***	-0.0002***	-0.0002***	-0.0002***	-0.0002***	-0.0002*	-0.0002***
		(0.00004)	(0.00004)	(0.00005)	(0.00005)	(0.00005)	(0.00005)	(0.0001)	(0.0001)	(0.0001)
S_value			0.00001	0.00002	0.0001	-0.0001	-0.0001	-0.0001	-0.0001	0.00002
			(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
G_value				0.00002	0.00002	0.00003	0.00004	0.00004	0.00004	-0.00005
				(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.00003)
wf_value					-0.0001***	-0.0001*	-0.0001*	-0.0001*	-0.0001*	-0.0001***
					(0.00005)	(0.00005)	(0.00005)	(0.0001)	(0.0001)	(0.00003)
hr_value						0.0001***	0.0001***	0.0001***	0.0001***	0.00003
						(0.00004)	(0.00004)	(0.00004)	(0.00004)	(0.00002)
CSR_value							-0.00003	-0.00003	-0.00003	-0.0001***
							(0.00003)	(0.00003)	(0.00003)	(0.00002)
Emiss_value								0.00001	-0.00000	0.0001***
								(0.00005)	(0.0001)	(0.00003)
inn_value									-0.00002	-0.00001
									(0.00004)	(0.00003)
roe_value										0.0002
										(0.001)
Beta_value										0.047***
										(0.001)
PtB_value										0.001***
										(0.0001)
Company_Market_Capitalization										-0.000
										(0.00000)
Constant	0.069***	0.066***	0.066***	0.066***	0.069***	0.069***	0.068***	0.068***	0.068***	0.017***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Observations	1,436	1,435	1,435	1,435	1,435	1,435	1,435	1,435	1,435	1,288
R^2	0.001	0.017	0.017	0.018	0.023	0.031	0.032	0.032	0.032	0.598
Adjusted R^2	0.0005	0.016	0.015	0.015	0.020	0.027	0.027	0.026	0.026	0.593
Residual Std. Error	0.026 (df = 1434)	0.026 (df = 1432)	0.026 (df = 1431)	0.026 (df = 1430)	0.026 (df = 1429)	0.025 (df = 1428)	0.025 (df = 1427)	0.025 (df = 1426)	0.025 (df = 1425)	0.016 (df = 1274)
F Statistic	1.702 (df = 1; 1434)	12.694*** (df = 2; 1432)	8.459*** (df = 3; 1431)	6.374*** (df = 4; 1430)	6.803*** (df = 5; 1429)	7.651*** (df = 6; 1428)	6.712*** (df = 7; 1427)	5.874*** (df = 8; 1426)	5.243*** (df = 9; 1425)	145.525*** (df = 13; 1274)
Note:										*p<0.1; **p<0.05; ***p<0.01

Table F: Original Beta: Before any adjustment

There is a significant positive relationship between ESG factors rating and firms' market volatility?

	Dependent variable:									
	Beta_value									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
ESG_value	0.001*	0.003***	0.003*	-0.001	-0.002	-0.001	-0.001	-0.001	-0.001	-0.004***
	(0.0005)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)
E_value		-0.001*	-0.001**	-0.001	-0.001	-0.001	-0.001	0.0002	-0.0005	0.002*
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
S_value			0.001	0.002	0.001	-0.003*	-0.003*	-0.003*	-0.003*	-0.0001
			(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)
G_value				0.002**	0.002**	0.002**	0.002**	0.002**	0.002**	0.001*
				(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
wf_value					0.001	0.002***	0.002**	0.002***	0.002***	0.001**
					(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
hr_value						0.003***	0.003***	0.003***	0.003***	0.0003
						(0.001)	(0.001)	(0.001)	(0.001)	(0.0004)
CSR_value							0.001	0.001	0.001	0.002***
							(0.001)	(0.001)	(0.001)	(0.0003)
Emiss_value								-0.002**	-0.002*	-0.001***
								(0.001)	(0.001)	(0.001)
inn_value									0.0004	0.0003
									(0.001)	(0.0004)
wacc_value										12.159***
										(0.278)
roe_value										-0.027*
										(0.015)
PtB_value										-0.008***
										(0.001)
Company_Market_Capitalization										-0.000
										(0.00000)
Constant	0.941***	0.882***	0.881***	0.870***	0.854***	0.860***	0.865***	0.862***	0.861***	0.191***
	(0.021)	(0.022)	(0.022)	(0.023)	(0.025)	(0.024)	(0.025)	(0.025)	(0.025)	(0.025)
Observations	1,436	1,435	1,435	1,435	1,435	1,435	1,435	1,435	1,435	1,288
R^2	0.003	0.013	0.013	0.017	0.018	0.030	0.031	0.035	0.035	0.620
Adjusted R^2	0.002	0.011	0.011	0.014	0.015	0.026	0.026	0.029	0.029	0.616
Residual Std. Error	0.071 (df = 1434)	0.069 (df = 1432)	0.069 (df = 1431)	0.069 (df = 1430)	0.069 (df = 1429)	0.069 (df = 1428)	0.069 (df = 1427)	0.069 (df = 1426)	0.069 (df = 1425)	0.037 (df = 1274)
F Statistic	3.643* (df = 1; 1434)	9.276*** (df = 2; 1432)	6.308*** (df = 3; 1431)	6.007*** (df = 4; 1430)	5.341*** (df = 5; 1429)	7.324*** (df = 6; 1428)	6.431*** (df = 7; 1427)	6.370*** (df = 8; 1426)	5.699*** (df = 9; 1425)	159.709*** (df = 13; 1274)
Note:										*p<0.1; **p<0.05; ***p<0.01

Table G: Original P/B: Before any adjustment

There is a significant positive relationship between ESG factors rating and firms' market volatility?

	Dependent variable:									
	Beta_value									PtB_value
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
ESG_value	0.001*	0.003***	0.003*	-0.001	-0.002	-0.001	-0.001	-0.001	-0.001	0.059***
	(0.0005)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.022)
E_value		-0.001*	-0.001**	-0.001	-0.001	-0.001	-0.001	0.0002	-0.0005	-0.033**
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.015)
S_value			0.001	0.002	0.001	-0.003*	-0.003*	-0.003*	-0.003*	-0.087***
			(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.017)
G_value				0.002**	0.002**	0.002**	0.002**	0.002**	0.002**	-0.020**
				(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.009)
wf_value					0.001	0.002***	0.002**	0.002***	0.002***	0.056***
					(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.009)
hr_value						0.003***	0.003***	0.003***	0.003***	0.030***
						(0.001)	(0.001)	(0.001)	(0.001)	(0.007)
CSR_value							0.001	0.001	0.001	-0.022***
							(0.001)	(0.001)	(0.001)	(0.006)
Emiss_value								-0.002**	-0.002*	-0.011
								(0.001)	(0.001)	(0.009)
inn_value									0.0004	-0.001
									(0.001)	(0.007)
wacc_value										66.571***
										(7.503)
roe_value										0.839***
										(0.213)
Beta_value										-3.651***
										(0.466)
Company_Market_Capitalization										0.0001***
										(0.00001)
Constant	0.941***	0.882***	0.881***	0.870***	0.854***	0.860***	0.865***	0.862***	0.861***	3.736***
	(0.021)	(0.022)	(0.022)	(0.023)	(0.025)	(0.024)	(0.025)	(0.025)	(0.025)	(0.604)
Observations	1,436	1,435	1,435	1,435	1,435	1,435	1,435	1,435	1,435	1,288
R^2	0.003	0.013	0.013	0.017	0.018	0.030	0.031	0.035	0.035	0.207
Adjusted R^2	0.002	0.011	0.011	0.014	0.015	0.026	0.026	0.029	0.029	0.199
Residual Std. Error	0.071 (df = 1434)	0.069 (df = 1432)	0.069 (df = 1431)	0.069 (df = 1430)	0.069 (df = 1429)	0.069 (df = 1428)	0.069 (df = 1427)	0.069 (df = 1426)	0.069 (df = 1425)	4.388 (df = 1274)
F Statistic	3.643* (df = 1; 1434)	9.276*** (df = 2; 1432)	6.308*** (df = 3; 1431)	6.007*** (df = 4; 1430)	5.341*** (df = 5; 1429)	7.324*** (df = 6; 1428)	6.431*** (df = 7; 1427)	6.370*** (df = 8; 1426)	5.699*** (df = 9; 1425)	25.624*** (df = 13; 1274)
Note:										*p<0.1; **p<0.05; ***p<0.01

Table I: multicollinearity no ESG Model

multicollinearity no ESG Model					
ROE			**WACC**		
Variables	Tolerance	VIF	Variables	Tolerance	VIF
E_value	0,11	9,48	E_value	0,11	9,46
S_value	0,19	5,26	S_value	0,19	5,23
G_value	0,75	1,34	G_value	0,75	1,34
wf_value	0,42	2,38	wf_value	0,42	2,36
hr_value	0,35	2,83	hr_value	0,35	2,83
CSR_value	0,47	2,15	CSR_value	0,47	2,13
Emiss_value	0,24	4,21	Emiss_value	0,24	4,19
inn_value	0,28	3,63	inn_value	0,27	3,64
wacc_value	0,40	2,48	roe_value	0,55	1,83
Beta_value	0,41	2,42	Beta_value	0,97	1,03

PtB_value	0,80	1,25	PtB_value	0,57	1,74
Company_Market_Capitalization	0,85	1,18	Company_Market_Capitalization	0,78	1,28
Beta			**P/B**		
Variables	Tolerance	VIF	Variables	Tolerance	VIF
E_value	0,11	9,47	E_value	0,11	9,47
S_value	0,19	5,23	S_value	0,19	5,19
G_value	0,75	1,34	G_value	0,75	1,34
wf_value	0,42	2,38	wf_value	0,43	2,34
hr_value	0,35	2,83	hr_value	0,36	2,81
CSR_value	0,47	2,13	CSR_value	0,47	2,14
Emiss_value	0,24	4,19	Emiss_value	0,24	4,21
inn_value	0,27	3,64	inn_value	0,28	3,63
wacc_value	0,95	1,06	wacc_value	0,40	2,49
roe_value	0,55	1,83	roe_value	0,76	1,32
PtB_value	0,57	1,75	Beta_value	0,41	2,44
Company_Market_Capitalization	0,78	1,28	Company_Market_Capitalization	0,78	1,28

Test for multicollinearity using the variance inflation factor (VIF), which in this case indicates that there is no problem, as all values are below the critical threshold of 5 except ESG, E and S which is very reasonable since ESG value comes from the E, S and G combined.