

Stockholm School of Economics
Bachelor Thesis
Accounting and Financial Management
Spring 2023

Sustainability and Financial Success

An Analysis of the Interplay between Environmental Performance and Stock Performance in a Scandinavian Covid-19 Setting

Abstract

This study examines the relationship between environmental performance and stock performance in a Scandinavian Covid-19 setting. By regressing *raw-* and *abnormal returns* on a proxy for environmental performance and a set of control variables, we investigate this fiercely debated relationship. The main finding of the paper is the absence of a statistically significant relationship in the aggregated sample. Nevertheless, analyzing the three countries in isolation reveals some cross-country differences. Several factors may explain the findings of the paper. These include, the imperfect nature of the proxy used for environmental performance, the inadequate comparability between the neighboring countries, the possibility of measurement errors and sampling bias or simply that stocks of sustainable firms did not perform differently compared to those of less sustainable firms. The study highlights the complex and equivocal nature of this relationship and indicates that further research is necessary to establish its existence.

Authors: Karl Fredrik Utheim (25025) and Anton Jannerberg (24939)

Supervisor: Ting Dong

Keywords: Environmental performance, ESG, Stock performance, Covid-19, Scandinavia

Acknowledgements: We would like to dedicate our gratitude towards Ting Dong, assistant professor at the department of accounting at the Stockholm School of Economics for invaluable support and guidance throughout the writing of this thesis.

Table of contents

1. Introduction	1
1.1. Purpose and research question	2
1.2. Delimitation.....	3
1.3. Outline.....	3
2. Theoretical framework and previous research	4
2.1. Environmental performance	4
2.2. Stock performance.....	5
2.3. Prevalence of sustainable investors in the market.....	6
2.4. Stock markets in a pandemic setting	6
2.5. The relationship between environmental performance and stock performance.....	7
2.6. Hypothesis.....	9
3. Methodology	10
3.1. Research design.....	10
3.2. Sample.....	11
3.3. Model	13
3.4. Variables.....	15
4. Results	18
4.1. Descriptive statistics.....	18
4.2. Regression results.....	21
5. Discussion.....	24
5.1. Environmental performance in a sustainable and technologically advanced setting	24
5.2. Comparability between the three neighboring countries.....	25
5.3. Sample bias and misspecification of the model	26
5.4. Robustness testing	28
6. Conclusion.....	30
6.1. Suggestions for future research	31
References	32
Appendix	37

1. Introduction

The Covid-19 pandemic has posed unparalleled challenges across the globe, many of which are related to the success of corporations. As the companies of the world grapple with the aftermath of the pandemic, the question of what governs superior resilience to past and future crises has become one of increasing importance, particularly to crises resulting in soaring stock prices. In light of this, companies, investors and researchers alike are trying to understand which factors govern stock market performance in times of crisis. Given the increasing global awareness of sustainability and amplified stakeholder demands, this research paper aims to investigate if environmental performance could be such a governing factor of stock performance.

Numerous corporations and their executives hold the view that investors do not place significant emphasis on companies' sustainability performance and that merely a select few would tilt their portfolios to incorporate a sustainable element (Unruh et al., 2016). Furthermore, the authors argue, contrary to executives' beliefs, that a growing number of investors and a significant proportion of the market, are incorporating the element of sustainability into their investment decisions. In addition to altering investor behavior, Unruh et al. (2016) emphasize the materiality of sustainable business practices for long-term financial success.

The increasing significance of sustainability in financial markets is the outcome of a paradigm shift that has occurred in recent times. For long, Corporate Social Responsibility (CSR) and environmental performance were thought to be value-destroying and there was a perceived zero-sum game between corporate and social well-being (Friedman, 1970). Porter and Kramer (2006) proposed a new framework, and one fundamentally different from previous perceptions in which they argued that CSR activities could be beneficial for firms through the strengthening of their surrounding environment. Since then, the sustainable element has become a core component of many companies' operations and is considered material for financial success (Whelan et al., 2021).

While the notion of environmental performance and sustainability appears to be one of growing importance in the financial landscape, there is still substantial ambiguity surrounding the concept and the significance of the relationship between environmental- and stock performance,

particularly in times of crisis. While some research alludes to the presence of a statistically- and economically significant relationship between environmental- and stock performance, other research directly contradicts this claim. In order for firms, and investors to understand how to position themselves in today's financial markets and uncertain times, it is of increasing importance to examine the relationship between environmental- and stock performance in times of crisis. If such a relationship exists on a larger scale, in what other place is it more probable to be present than in a market characterized by sustainability and environmental consciousness?

Following this logic, the Scandinavian stock market holds significant appeal. Widely acknowledged as a global leader in sustainability (Strand et al., 2015), it is home to a population and a market that demonstrates a strong commitment to the matter. The Scandinavian countries consistently rank at the top of the Global Sustainable Competitiveness Index (GSCI) with Sweden at the top followed by the other Scandinavian countries and Switzerland breaking in at 3rd place (GSCI, 2022). As such, it is reasonable to hypothesize that if a relationship between environmental- and stock performance exists at a larger scale, it would be particularly pronounced in this market. Following this line of argument, the Scandinavian market setting is an interesting place to start investigating to then potentially branch out to other markets and countries.

Previous studies examining the relationship between environmental- and stock performance have primarily focused on stable capital markets without any ongoing crises or disruptions. The studies that have been done in crisis settings, particularly the 2008 Global Financial Crisis, predominantly examine the connection between environmental- and stock performance within the context of larger capital markets. As a result, limited research has been conducted on the relationship between environmental performance and stock performance in a Scandinavian Covid-19 setting, highlighting the significance of this paper's contribution. Finally, this paper contributes to the research field in that it isolates the impact of environmental performance on stock performance as opposed to aggregating the effect of Environmental, Social and Governance (ESG) activities and CSR like most previous studies.

1.1. Purpose and research question

The purpose of this study is to examine the potential relationship between firms' environmental performance and stock performance during the first quarter of the Covid-19 pandemic.

Determining the presence, or absence, of such a relationship would allow firms and investors to distinguish what the stock market values and potentially internalize such information during future times of crisis. Specifically, uncovering a potential relationship between environmental performance and stock performance could provide firms with valuable insights on how to incorporate sustainability and leverage environmental performance during times of crisis. Additionally, it could allow investors to gain insight regarding how to balance their portfolios during such times. Therefore, this paper intends to answer the research question stated below:

“Is there a relationship between environmental performance and stock performance in times of crisis?”

1.2. Delimitation

The scope of the paper is to investigate the relationship between environmental performance and stock performance in Scandinavia during the initial outbreak of the Covid-19 pandemic. Only the first three months of the crisis, from the beginning of January until the end of March, are investigated. This delimitation appears appropriate as all three stock markets had reached their lowest points by the end of March (Nasdaq, n.d.) and therefore, a potential relationship between environmental- and stock performance should be particularly pronounced during this period. Moreover, the remainder of the Covid-19 pandemic was influenced by varying Covid-19 policies, fiscal stimulus packages and other events that can be presumed to have had an impact on stock markets (Irfan et al., 2022). Governance and Social performance, being the two other components of ESG, are not investigated specifically albeit controlled for in the regression model.

1.3. Outline

The paper is divided into the following sections: chapter 2 will cover the theoretical background and previous empirical findings, highlighting the current state of research in the field and establishing a framework for subsequent analysis. Chapter 3 will cover the methodology including research design, a discussion of the sample and a description of the regression models and its variables. In chapter 4 the empirical results of the models are presented. Chapter 5 presents a discussion of the results, method, reliability of assumptions and robustness testing of the model. Finally in chapter 6 follows a conclusion and implications of findings and

suggestions for further research to be made on the topic. The last part of the paper will present the references and appendix.

2. Theoretical framework and previous research

In this chapter follows an outline of past and current research; an outline that will allude to the contribution of this paper by establishing the presence of a research gap and lack of consensus among researchers in the field. The outline will then serve as a framework for the remaining part of this paper.

2.1. Environmental performance

In today's market landscape, as a result of investor demands, EU directives on non-financial reporting and climate change in general, corporations' ESG performance has become a material part of many companies' operations (Pérez et al., 2022). The environmental part of ESG is the subset that will be investigated in this paper and considers corporations' performance with regard to the physical or natural environment. This comprises the firms' usage of natural resources and the environmental impact of operations, taking into account the direct effect of operations and indirect effects on various supply chains. In the context of greenhouse gas emissions, the World Resource Institute (2004) has established a comprehensive framework consisting of three distinct scopes: Scope 1, Scope 2, and Scope 3. These scopes are essential tools for organizations seeking to measure and manage their emissions and understand their impact on the environment. Scope 1 refers to direct emissions, that is; emissions from sources that are either owned or controlled by the company. Scope 2 emissions refer to greenhouse gas emissions that result from the production of purchased electricity which is then consumed by the company. Finally, Scope 3 emissions is an optional reporting category that allows for the reporting of additional indirect emissions. While Scope 1 and Scope 2 emissions may be considered comparatively unambiguous, the integration of Scope 3 emissions poses a greater level of complexity, leading to potential discrepancies in reporting standards across industries and companies (World Resource Institute, 2004).

Environmental performance highlights companies' tangible risks and opportunities associated with their environmental actions. Firms exhibiting lower environmental performance, or firms that neglect to investigate the impact of their operations, may be exposed to amplified financial

risk. Lacking precautions toward environmental incidents or lack of action to lessen emissions, increases corporations' risk of regulatory sanctions, reputational damage, and criminal prosecutions, all of which are likely to negatively impact shareholder value (Pérez et al., 2022). Additionally, research has shown that improved ESG performance could enhance corporations' financial performance (Nguyen et al., 2022; Whelan et al., 2021).

2.1.1. Value destroying or value creating?

The value of investments in sustainable activities can be viewed from two perspectives. Firstly, based on neoclassical economics, the cost-concerned approach argues that investments of this nature solely result in increased costs, thus decreasing the market value of the company (Friedman, 1962). Friedman (1970) argues that corporations' only social responsibility is to increase profits and that investments in social activities result in decreased shareholder value, consequently contradicting the purpose of the corporation.

Secondly, and as a proponent of the cost-concerned approach, Freeman (1984) utilizes a value-creation approach by taking a broader scope and incorporating stakeholders which are affected by the firm's actions rather than solely focusing on shareholders as in Friedman (1962). The benefits of a broader stakeholder perspective have been demonstrated time and again and studies have shown that undertaking investments in sustainable activities creates a competitive edge while simultaneously increasing profitability (Orlitzky et al., 2003; Patten, 1991). In addition, research has demonstrated that broad CSR commitments have the potential to attract socially conscious consumers (Hillman and Keim, 2001) while simultaneously appealing to higher-quality employees in the recruitment and retention of human capital (Greening and Tuban, 2000). Additionally, through the shareholder perspective, Unruh et al. (2016) argue that engagement in ESG attracts a broader range of investors who are making investment decisions with tools that are combining ESG performance with corporate performance. Based on these findings, there does appear to be a positive correlation between investments in sustainable activities and companies' future financial performance (Waddock and Graves, 1997).

2.2. Stock performance

Stock performance, being a function of a firm's change in stock price, is governed by various factors but boils down to the investors' decision to either invest in a stock or abstain from doing so. Stock performance can thus be explained through an understanding of what investors value

in the financial market. The decision to invest comes down to two factors; trust in the reliability of data and overall fairness of the system and perceived risk-reward (Guiso et al., 2008). The authors concluded that “it becomes crucial to understand the determinants of investors' (possibly biased) perception of the trustworthiness of the stock market”.

The second component of investors' willingness to invest, being the perception of a stock's risk-reward profile, is conditional on a multitude of factors pertaining to firm performance and market performance in general. These factors range from metrics of profitability and financial growth to dividend payout ratios and volatility; all of which are incorporated in traditional valuation models. Could it also be the case that environmental performance metrics serve a role in altering risk-reward perceptions, and by extension alter investor behavior?

2.3. Prevalence of sustainable investors in the market

The effect of environmental performance on stock prices is a relationship not seldom discussed and the growing presence of green investors in the stock market (Unruh et al., 2016) enhances the importance of clarifying the relationship. Unruh et al. (2016) argue that, to an unprecedented magnitude, investors are incorporating sustainability data into investment decisions. This implies that stock market fluctuations today may in part be governed by investors' perceptions of companies' sustainability profile and environmental performance. Many companies' managerial entities still believe that investors prioritize short-term profits over long-term investments and are thus incentivized to organize accordingly (Unruh et al., 2016). Following this logic and given the ever-growing presence of sustainable investors in the financial marketplace, companies will be prompted to pivot their focus and enhance environmental performance in order to attract investors that incorporate such attributes in their investment decisions.

2.4. Stock markets in a pandemic setting

The initial outbreak of the Covid-19 pandemic caused turmoil in an otherwise thriving stock market. In February 2020, the S&P 500 index reached an all-time high but a mere month later, stocks had plummeted and the index had dropped 33% (Macrotrends, n.d.). The Scandinavian countries experienced similar trends with the OMX Stockholm 30 and OMX Copenhagen 20 indexes declining by approximately $\frac{1}{3}$ between the 19th of February and the 23rd of March

(Nasdaq, n.d). The reactions on the Norwegian stock market appeared marginally less severe than the reactions in Sweden and Denmark (Nasdaq, n.d). As the pandemic continued, markets gradually corrected themselves and the initial reaction to the outbreak of the pandemic appeared as an overreaction (Phan and Narayan, 2020). While all three stock markets experienced similar stock price declines from the top in February to the bottom in March, when the entire first quarter of 2020 is examined, differences emerge. The Danish stock market recovered substantially quicker than the neighboring countries and the market return for the entire period was merely -5.5% compared to -18% in Sweden and -23.6% in Norway (Nasdaq, n.d.).

2.5. The relationship between environmental performance and stock performance

In times signified by stability in the global stock market, there appears to be a positive correlation between environmental performance and stock returns as shown by Deng and Cheng (2019). The same positive significant relationship was shown by Castro et al. (2021) who further pointed out that the magnitude of the aforementioned relationship was intensified in advanced technological contexts. However, they showed that the relationship became statistically non-significant in times of deep financial crisis. In contrast, Lins et al. (2017) argue that firms with high CSR performance saw stock returns 4 - 7 percentage points (pp) higher than firms with lower performance during the Global Financial Crisis of 2008-2009. Attention should be given to the fact that CSR performance incorporates elements not included in the definition of environmental performance. Environmental performance, being the variable of interest in this study, is one part of the larger concept of ESG which also differs slightly from CSR. The difference between the two concepts lies within their measurability; CSR makes businesses responsible while ESG makes these responsibility efforts measurable (Każmierczak, 2022).

While the concepts of ESG and CSR have their inherent differences, environmental activities constitute an integral part of CSR performance and the varying empirical findings shed light on the dissension within the research field. Moreover, it is important to acknowledge the differences between the Global Financial Crisis (GFC) and the initial phase of the Covid-19 outbreak. Lins et al. (2017) argue in a GFC setting, that during times signified by a high degree

of skepticism and distrust in capital markets, CSR served as a signaling tool of trustworthiness and a high level of social capital.

Based on prevailing conditions, this paper aims to investigate whether this relationship was prevalent during the initial part of the Covid-19 pandemic. Is it the case that, in times of severe global distress, green investors alter their preference for sustainable investments? The Covid-19 pandemic provides an interesting setting for investigation of the relationship between environmental performance and stock returns as it is “dangerously unique” (Borio, 2020) compared to prior crises. Borio (2020) argues of the Covid-19 pandemics' unique nature as a crisis of non-economic origin, one that is predominantly influenced by non-economic factors and is worldwide in scope. Given the non-economic origin of the crisis, could it be true that the high degree of skepticism and distrust toward capital markets discussed by Lins et al. (2017) in the GFC setting was not present during the initial outbreak of the pandemic? Followingly, the unique nature of the Covid-19 crisis raises the question of whether the relationship between environmental performance and stock performance was altered in the setting of the Covid-19 pandemic.

In light of the unique nature of the Covid-19 pandemic, the relationship between environmental performance (and ESG in general) and stock performance has been fiercely debated. Morningstar called ESG an “equity vaccine” which had the ability to cushion soaring stock prices and claimed that investors “continue to reinforce climate change as a priority ESG topic” (Willis, 2020). Backing up the claims of ESG as an “equity vaccine”, some research on the first quarter of the Covid-19 pandemic suggests that there was in fact a display of lower volatility of share prices of firms with high environmental and social performance (Albuquerque et al., 2020). The authors proceed to show that, during the first quarter of 2020, stock prices of firms with high environmental- and social performance were substantially higher than those with lower performance in a US setting. Similar findings were made by Ding et al. (2021) from empirical data on 6700 firms across 61 countries. They claim that stocks of firms with strong CSR performance prior to the outbreak of the Covid-19 pandemic performed better than firms with inferior CSR performance. Additionally, they showed that the effect was intensified for firms in countries with “social norms that place a higher priority on environmental and social issues” (Ding et al., 2021). This intensified effect should then by continuation be prevalent in a

Scandinavian setting where the countries are consistently acknowledged as world leaders in sustainability (GSCI, 2022).

While some research points to the prevalence of a positive, significant relationship between environmental- and stock performance, others argue that ESG had no such cushioning effect on declining share prices in light of the pandemic. Demers et al. (2021) showed, for a sample of US firms, that ESG had no statistically significant effect on stock price resilience during the pandemic, directly contradicting findings made by Albuquerque et al. (2020) and Ding et al. (2021). They argue that the effect of ESG on stock price resilience to crises is premised on the idea that it increases trustworthiness and builds social capital but proceed to show that no such cushioning powers were at play during the initial outbreak of the pandemic.

It is evident that no industry-wide consensus prevails with regard to the relationship between environmental performance and stock performance in times of crisis; not during the GFC nor during the Covid-19 pandemic. In addition to this, few studies have investigated the relationship in a Scandinavian setting in which environmental performance and a sustainable spirit lies within the core of the societies (Strand et al., 2015). The general lack of consensus within the industry on the relationship between ESG and stock performance during crisis in general and the Covid-19 pandemic in particular, alongside limited research on standalone environmental performance in a Scandinavian setting, highlights the contribution of the paper.

2.6. Hypothesis

Based on the above discussion relating to the lack of consensus regarding the relationship between environmental- and stock performance, particularly in times of crisis; this paper examines the relationship between environmental performance and stock performance in an early Scandinavian Covid-19 setting. The research question which the following hypothesis aims at answering is:

“Is there a relationship between environmental performance and stock performance in times of crisis?”

The first hypothesis aimed at testing this relationship is the following:

H1: Firms with higher environmental performance experienced significantly different returns compared to firms with lower environmental performance.

The second proposed hypothesis relates to the sign of the relationship, in case the null hypothesis of H1 is rejected:

H2: Firms with higher environmental performance experienced superior returns compared to firms with lower environmental performance.

3. Methodology

This chapter begins with a presentation of the research design utilized in the paper followed by a description of the sample. Finally, the chapter covers the specification of the different regression models and describes the key variables of the study.

3.1. Research design

In this paper, a quantitative research method is applied in order to investigate the potential relationship between firms' pre-pandemic environmental performance and their stock performance during the first quarter of the pandemic. We extract a sample of firms listed on Scandinavian stock exchanges and regress their stock performance on a proxy for environmental performance while controlling for a set of variables. Through that, we aim to contribute to establishing a relationship between environmental performance and stock performance, or lack thereof.

In Model 1, firm *raw returns*, calculated as the buy-and-hold returns during the first quarter of 2020, are regressed on pre-pandemic *environmental scores* while controlling for a set of variables. The control variables included in the model are based on empirical findings made by Lins et al. (2017). In Model 1 the variables which are controlled for are: *firm size*, *long-term debt*, *short-term debt*, *cash*, *profitability*, *BTM*, *negative BTM*, *momentum*, and *idiosyncratic risk*.

In order to control for the potential effect of firms' *governance*- and *social score*, another regression model (Model 2) is introduced to mitigate the risk of omitted variable bias. After controlling for *governance*- and *social score*, a third model is then introduced to control for the

potential systematic country- and industry differences given the cross-country and cross-industry nature of the sample. In addition to general diagnostic testing of the model, the model is then tested on different subsets of the sample. Firstly, to investigate if the results differ on a country-by-country basis, the regression models are run on three subsamples based on the company's country of headquarters. The aggregated sample is also divided into two groups, with a cutoff value equal to the median *environmental score*, where we run a two-sample t-test to investigate if the stock performance differs on a group level.

3.2. Sample

In this section follows a description of the sample used in the paper. The section starts with a description of the data collection process to then describe the composition of the sample and the time horizon for which the sample has been constructed.

3.2.1. Data collection

The primary data on environmental performance is gathered from the Refinitiv Eikon database and comprises information on three main categories: emissions, environmental product innovation and resource use. The subcategories are in turn based on a subset of 68 environmental metrics pertaining to the three categories. The database standardizes and simplifies publicly reported ESG data, covers more than 85% of the global market and comprises more than 186 ESG metrics (Refinitiv, 2022). The sample size of this paper is thus limited by the ESG coverage of Refinitiv Eikon; in part stemming from a general lack of information in the market, in part from the extent of analyst coverage by Refinitiv, resulting in a sample size of 250 firms with available pre-pandemic *environmental scores*. Firms with missing pre-pandemic *environmental scores* are excluded from the sample. Data on firm characteristics, financials, stock performance and risk are collected from S&P Capital IQ and expressed in a uniform currency. Finally, the data collected on firm characteristics and stock performance is cleaned and then winsorized at the 5-95th percentile to mitigate the effect of outliers in the data (see chapter 5.3.1).

3.2.2. Sample composition

To investigate the relationship between environmental- and stock performance, the scope is limited to listed firms in Scandinavia, specifically Sweden, Norway, and Denmark. The

rationale behind limiting the scope of the study to Scandinavian public companies is multifaceted. Firstly, the lack of research on the relationship between environmental- and stock performance in a Scandinavian crisis setting is limited; and contributing to a narrowing of this research gap is important. Secondly, the comparable characteristics of the three neighboring countries; in terms of environmental attitudes, corporate culture and business environment (Strand and Freeman, 2015) should allow for an adequate comparison between firms from the three countries. Thirdly, given the comparability between the countries, the inclusion of firms from all of Scandinavia in the sample increases its size and improves the overall reliability of the results.

As discussed in chapter 3.2.1, firms with missing *environmental scores* are excluded from the sample in order to facilitate an adequate comparison of firms and the reliability of results. Companies lacking financial data and data on stock performance are also removed from the sample, resulting in a sample size of 244 firms. Finally, when calculating the *idiosyncratic risk* component, based on 5-year monthly stock data; all firms that were listed (or re-listed) after the 31st of April 2018 are excluded from the sample in order to facilitate the reliability of estimates. The final sample thus comprises information on 235 companies as shown in Table 1 below.

Table 1: Sample

Sample	Firms in sample
Full sample	1576
Removing firms without <i>environmental scores</i>	-1326
Removing firms with missing financial items	-6
Removing firms without stock data	-9
Final sample	235

3.2.3. Time horizon

The purpose of the paper is to investigate the relationship between environmental- and stock performance in times of crisis, specifically during the Covid-19 pandemic. In order to examine this relationship, it is of essence to limit the scope of the paper to capture the main economic effects of the pandemic and isolate its impact on stock markets. As discussed in chapter 2.4., this impact was the largest by the end of the first quarter of 2020. During the prolongation of the Covid-19 pandemic, various macro events can be assumed to have impacted Scandinavian stock markets: including war, rising inflation, energy shortage, and disrupted trade channels. In

addition, national Covid-19 mitigation strategies and fiscal stimulus packages can be assumed to have had different impacts on each country's stock market. In Scandinavia, the first of these policies were implemented by the end of the first quarter of 2020 (Irfan et al., 2022), after which the countries' stock markets started to recover, at different pace. Thus, in order to mitigate the impact of country-specific policies and disrupting macro events worldwide, the scope of the paper is limited to the first quarter of the pandemic.

3.3. Model

Environmental performance model

To test the first hypothesis of this paper, that companies with higher environmental performance experienced significantly different returns compared to firms with lower environmental performance, we introduce the first regression model of the paper (Model 1). The regression uses the ordinary least squares (OLS) method, which minimizes the sum of squared residuals, in other words: the distance between the dependent variable and predicted values from the model (Wooldridge, 2012). In this first model, *raw returns* are regressed on a proxy for environmental performance while controlling for a set of variables aimed at capturing firm-specific levels of liquidity, risk and capital structure which are suggested by previous studies to have a significant impact on stock returns. Empirical findings by Lins et al. (2017) provide the basis for the model specification and included variables. By including the aforementioned set of control variables in the model, we aim to isolate the impact of environmental performance on stock performance. Chapter 3.4. provides a comprehensive explanation of the variables.

Model 1

$$raw\ returns_i = \beta_0 + \beta_1 environmental\ score_i + \beta_2 firm\ size_i + \beta_3 long-term\ debt_i + \beta_4 short-term\ debt_i + \beta_5 cash_i + \beta_6 profitability_i + \beta_7 BTM_i + \beta_8 negative\ BTM_i + \beta_9 momentum_i + \beta_{10} idiosyncratic\ risk_i + \epsilon_i$$

Governance- and social score model

In the model above, all independent variables besides the variable of interest (*environmental score*) aim to account for firm-specific differences in financial health, risk and capital structure. As was discussed in chapter 2, Lins et al. (2017) argued in the context of the GFC that CSR worked as a signaling tool of firm trustworthiness and level of social capital. In order to capture such potential effects and to increase the likelihood that observed variation in the dependent

variable is explained by the model we introduce two additional independent variables to the model, namely *governance score* and *social score*. If the findings made by Lins et al. (2017) hold in the context of the Covid-19 pandemic, social initiatives and high levels of corporate governance could have an impact on *raw returns* and proxies for these remaining ESG components are thus included in Model 2.

Model 2

$$raw\ returns_i = \beta_0 + \beta_1 environmental\ score_i + \beta_2 governance\ score_i + \beta_3 social\ score_i + \beta_4 firm\ size_i + \beta_5 long-term\ debt_i + \beta_6 short-term\ debt_i + \beta_7 cash_i + \beta_8 profitability_i + \beta_9 BTM_i + \beta_{10} negative\ BTM_i + \beta_{11} momentum_i + \beta_{12} idiosyncratic\ risk_i + \epsilon_i$$

Country- and industry differences

In order to address the potential presence of unobservable (omitted) variables and mitigate the impact of systematic differences across countries and industries, categorical variables for country and industry affiliation are introduced. The country-specific variable is based on the firm's country of headquarters while the industry-specific variable is determined by the firm's one-digit SIC code.

Model 3

$$raw\ returns_i = \beta_0 + \beta_1 environmental\ score_i + \beta_2 governance\ score_i + \beta_3 social\ score_i + \beta_4 firm\ size_i + \beta_5 long-term\ debt_i + \beta_6 short-term\ debt_i + \beta_7 cash_i + \beta_8 profitability_i + \beta_9 BTM_i + \beta_{10} negative\ BTM_i + \beta_{11} momentum_i + \beta_{12} idiosyncratic\ risk_i + \beta_{13} country_i + \beta_{14} industry_i + \epsilon_i$$

CAPM - The market model

The capital asset pricing model (CAPM) developed by Sharpe (1964) and Lintner (1965), is a financial model used to calculate the expected return for an investment. CAPM assumes that investors only accept additional risk in an investment if it yields higher returns, due to the risk-averse nature of investors in the market. In the model, returns are a function of the general market performance and the assets' relationship with the market. The first component, risk-free rate, is the return investors demand without taking on additional risk. The second component being the beta coefficient of an asset represents the sensitivity of that asset toward the market. A beta above one indicates that the asset is more volatile than the market while a beta below

one suggests the asset is less volatile than the market. The third component of the model is the market risk premium ($R_m - R_f$), the difference between the expected return of the market and the risk-free rate. Intuitively, the market risk premium indicates what returns market participants demand to take on the additional risk. The model later referred to as the market model, is used in this paper to calculate firm-specific idiosyncratic risk and abnormal returns. Idiosyncratic risk is calculated from the residual variance of the market model and abnormal returns are the difference between the actual returns and the expected return calculated from CAPM.

CAPM:

$$R_i = R_f + \beta_i * (R_m - R_f)$$

Where:

R_i = Expected return on investment

R_f = Risk-free rate

β_i = Market beta coefficient

R_m = Market expected return

$(R_m - R_f)$ = Market risk premium

3.4. Variables

The subsequent section provides an explanation of the key variables included in the various regression models presented above. The methodological design and selection of control variables are inspired by Lins et al. (2017).

3.4.1. Dependent variables

Raw returns

The dependent variable, measuring stock performance, is proxied by *raw returns* from 2019-12-30 (Price₁) to 2020-03-31 (Price₂). *Raw returns* are calculated as the buy-and-hold returns between the closing price on the last day and the closing price on the first day for the time horizon (see formula below). Stock price data is provided by S&P Capital IQ.

$$raw\ returns_i = \frac{Price_2 - Price_1}{Price_1}$$

3.4.2. Independent variable

Environmental score

The variable of interest is the *environmental score* as provided by Refinitiv Eikon. The score comprises three main categories: emissions, environmental product innovation, and resource use, which in turn comprise a subset of 68 environmental scores and metrics based on verifiable reported data in the public domain. The *environmental score* is one of the three pillars which together with social and governance form the more comprehensive ESG score. *Environmental score* is a continuous variable ranging from 0-100 where 0 constitutes very poor environmental performance and a score of 100 would constitute exceptional performance (Refinitiv, 2022). Following the logic of Lins et al. (2017), stock performance is related to the pre-pandemic environmental score, at the start of 2020, to guard against the possibility that firms may have altered their environmental policy as a response to the crisis.

3.4.3. Control variables

In order to isolate the effect of environmental performance on raw stock returns, a number of control variables are introduced in the models. These variables aim to control for differences between companies, specifically those pertaining to liquidity, risk and capital structure, as previous literature suggests these factors may have an impact on raw stock returns (Lins et al., 2017).

Table 2: Definition of Key Variables

Variable Name	Definition
<i>Governance score</i>	Comprises three main categories: management, shareholders and CSR strategy, which in turn encompass a subset of 56 governance scores and metrics.
<i>Social score</i>	Comprises four main categories: workforce, human rights, community and product responsibility, which in turn comprises a subset of 62 social scores and metrics.
<i>Firm size</i>	The natural logarithm of firm market capitalization. Market capitalization is calculated as: shares outstanding * closing price 2019-12-30.
<i>Long-term debt</i>	Ratio between long-term debt and total assets. Long-term debt includes long-term leases and encompasses debt due beyond the time horizon of 1 year.
<i>Short-term debt</i>	Ratio between short-term debt and total assets. Short-term debt includes current portion of long-term leases and encompasses debt due within the time horizon of 1 year.
<i>Cash</i>	Ratio between cash, and cash equivalents, and total assets.
<i>Profitability</i>	Ratio between operating profit and total assets (OROA).
<i>BTM</i>	Ratio between firm's book value of equity and market value of equity.
<i>Negative BTM</i>	Dummy variable = 1 when BTM is negative.
<i>Momentum</i>	Raw returns over the 1 year period preceding the pandemic (Dec 2018 - Dec 2019), using monthly data.
<i>Idiosyncratic risk</i>	Residual variance from the market model over the five year period preceding the pandemic (Dec 2014 - Dec 2019), using monthly data.

Proxies for governance- and social performance are included to control for the remaining ESG firm-specific characteristics investors might internalize in their investment decisions. The natural logarithm of market capitalization is included to mitigate any unexplained effect on stock returns stemming from differences in *firm size*. *Long-term debt*, *short-term debt* and *cash* are included to control for firms' differences in pre-pandemic levels of liquidity which would allow some firms to make investments during the period and be more resilient toward unexpected fluctuations in revenue and profitability. *Profitability* is included in the models to control for differences in firm efficiency, and operating return on asset is used as a proxy as it mitigates the impact of potential cross-border differences in tax legislation which impact post-tax metrics such as return on assets (net income divided by total assets) (Duchin et al., 2010;

Harford et al., 2014). *BTM* is included to control for the characteristics of a firm's stock. A firm with high *BTM*, often referred to as value stocks, has empirically been shown to outperform firms with low *BTM*, referred to as growth stocks (Fama and French, 1992). A dummy for *negative BTM* is included, given the similar characteristics of negative *BTM* firms and high *BTM* firms. "Negative [*BTM*] (which results from persistently negative earnings) and high [*BTM*] (which typically means that stock prices have fallen) are both signals of poor earning prospects" and "average returns for negative [*BTM*] firms are high, like the average returns of high [*BTM*] firms" (Fama and French, 1992). *Momentum* captures firms' historical stock performance and is included to account for potential market trends that could have an impact on the stock performance of certain stocks during the first quarter of the pandemic. For firms with missing values between December 2018 - December 2019, the variable will be defined as raw returns from the first available stock price until the end of 2019. *Idiosyncratic risk* is included to account for the possibility that stock price volatility may affect stock returns (Goyal and Santa-Clara, 2003). For firms where five years of monthly stock return data are not available, the beta will be calculated from the first available stock price. Firms with less than 20 monthly observations will be excluded from the sample to ensure statistical accuracy in the beta regressions.

4. Results

In the following chapter we present the result of our research in two sections. Firstly, we present descriptive statistics of key variables and then continue to present the results of our regression models.

4.1. Descriptive statistics

Table 3: Summary Statistics

	Mean	SD	P10	P25	P50	P75	P90
<i>Raw return</i>	-0.292	0.174	-0.542	-0.405	-0.296	-0.184	-0.046
<i>Environmental score</i>	45.056	25.392	11.489	24.667	42.754	63.505	82.936
<i>Governance score</i>	52.087	21.609	23.169	33.602	51.491	69.366	81.279
<i>Social score</i>	54.569	21.175	22.802	40.630	55.623	72.629	82.009
<i>Firm size</i>	7.378	1.465	5.634	6.359	7.291	8.413	9.419
<i>Long-term debt</i>	0.217	0.137	0.037	0.097	0.198	0.318	0.428
<i>Short-term debt</i>	0.065	0.065	0.006	0.016	0.041	0.087	0.170
<i>Cash</i>	0.097	0.094	0.009	0.028	0.065	0.131	0.258
<i>BTM</i>	0.542	0.427	0.116	0.193	0.390	0.787	1.244
<i>Profitability</i>	0.070	0.066	-0.001	0.029	0.060	0.099	0.157
<i>Momentum</i>	0.255	0.333	-0.194	0.040	0.249	0.438	0.780
<i>Idiosyncratic risk</i>	0.010	0.008	0.003	0.005	0.007	0.012	0.020
Num of Obs	235						

Sources: Refinitiv Eikon, Capital IQ, Sveriges Riksbank

Table 3 shows the descriptive statistics for the main models' key variables. The mean *environmental score* in the sample is 45.056 with a large standard deviation of 25.392 suggesting a large spread in the data. Furthermore, *environmental scores* for the sample are slightly positively skewed suggesting that a larger portion of the distribution has lower *environmental scores* and that some high-performing companies may be driving up the mean. Additionally, Table 3 shows that the *environmental score* has the lowest mean and highest standard deviation out of the three ESG pillar scores. The mean *governance-* and *social score* is 52.087 and 54.569 respectively. It is redundant to draw further conclusions regarding the means of the ESG pillar scores given the difference in metrics and evaluation criteria used to measure the three scores on which the companies are evaluated.

The sample exhibits significant variation in the *long-term debt* to asset ratio with a median value of 0.198. Specifically, the 25th percentile shows a *long-term debt* to asset ratio of 0.097 while the 75th percentile shows a ratio as high as 0.318. The same substantial variation in the sample can be observed for the *short-term debt* ratio and *cash* ratio. On average, the data indicates that firms in the sample had sufficient assets to cover short-term debt before the outbreak of the pandemic. It is plausible that a prolongation of the pandemic may have adversely affected the liquidity of firms in the sample which in turn may have had long-lasting effects on stock prices. However, when limiting the scope to the first quarter of the pandemic, on average, insufficient liquidity did not appear to be a material issue in the sample. *BTM* has a mean of 0.542 with a

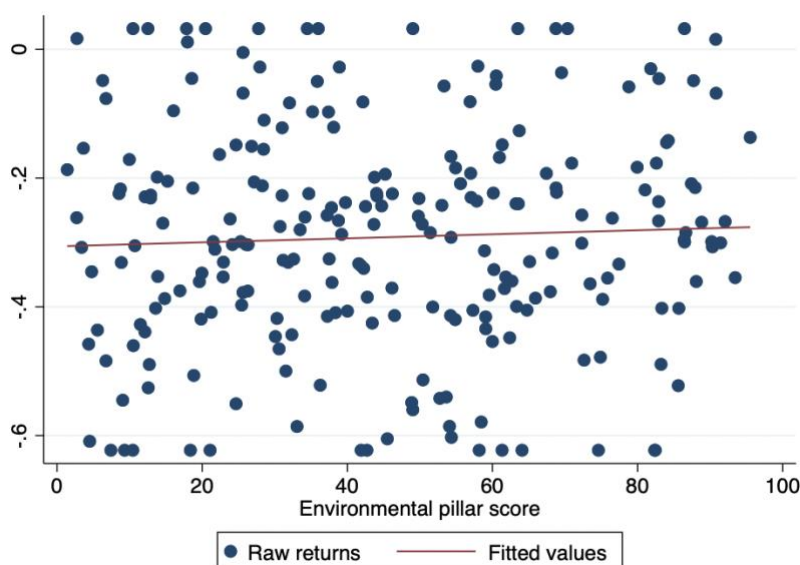
substantial standard deviation of 0.427. The variable *negative BTM* is omitted in all regressions and thus excluded from the summary statistic table. The *momentum* in the sample, as defined by the last year's raw stock return, is, on average, 25.5% and exhibits substantial variation in the sample. As for the dependent variable, being *raw returns* for the first quarter of the pandemic, the mean return is -29.2% with a median of -29.6%. The 25th percentile *raw return* is -40.5% and the 75th percentile is -18.4%. The standard deviation in the sample is 17.4%.

The Pearson correlation matrix (Appendix 1) shows the correlation coefficients of the model's key variables. Firstly, the matrix indicates a strong correlation between the three ESG scores, ranging from 0.40 between *environmental-* and *governance score* to 0.73 between *environmental-* and *social score*. This indicates that sample firms that exhibited higher *environmental scores*, on average also exhibited higher *social scores*. Additionally, the logged market capitalization variable, *firm size*, is strongly correlated (0.55) with *environmental score*, suggesting that larger companies in the sample exhibited higher *environmental scores*. There also appears to be a weak positive correlation (0.05) between *environmental score* and *raw returns* for the period which alludes to the presence of a potential relationship between the independent- and dependent variable. Additionally, firms with high *idiosyncratic risk* over the 5-year period prior to the pandemic, on average, exhibited lower *environmental scores* which can be seen from the negative correlation (-0.32) between the two variables. *Idiosyncratic risk* is also negatively correlated with *raw returns* (-0.11) during the first quarter of the pandemic, suggesting that firms with a larger degree of unsystematic risk performed worse during the period of investigation. Finally, *BTM* is negatively correlated (-0.30) with *raw returns* during the period, which is in line with findings made by Lins et al. (2017).

Figure 1 shows the scatter plot and the linear fit between *environmental scores* and *raw returns* and suggests a weak linear relationship between the two variables. From the Pearson correlation matrix (see Appendix 1), this correlation was shown to be 0.05. Additionally, as seen in the two-sample t-test (see Appendix 2), comparing mean *raw returns* between high- and low-performing environmental firms yields a non-significant p-value and the null hypothesis can thus not be rejected at the 10% level. The null hypothesis of the t-test states that the means of the groups are identical and as we are unable to reject the null hypothesis, the test suggests no significant difference in mean *raw return* between the low- and high-performing groups. The

relationship between these two variables, its statistical- and economic significance, is further examined while controlling for other parameters through regression analysis.

Figure 1: Scatter Plot



4.2. Regression results

Table 4: OLS models on firm raw returns

	Model 1		Model 2		Model 3	
	β	SE	β	SE	β	SE
<i>Environmental score</i>	-0.0003	0.0005	0.0003	0.0006	0.0006	0.0006
<i>Governance score</i>			-0.0009	0.0006	-0.0006	0.0006
<i>Social score</i>			-0.0009	0.0008	-0.0011	0.0008
<i>Firm size</i>	0.0237**	0.0098	0.0305***	0.0102	0.0258**	0.0108
<i>Long-term debt</i>	-0.2224***	0.0852	-0.2244***	0.0861	-0.2213**	0.0857
<i>Short-term debt</i>	-0.1547	0.1617	-0.2140	0.1640	-0.1318	0.1583
<i>Cash</i>	0.1141	0.1309	0.0986	0.1309	0.0328	0.1266
<i>BTM</i>	-0.0664**	0.0286	-0.0731**	0.0286	-0.0569*	0.0300
<i>Profitability</i>	-0.0861	0.1808	-0.0603	0.1801	-0.0323	0.1758
<i>Momentum</i>	0.0866**	0.0342	0.0640*	0.0356	0.0899***	0.0344
<i>Idiosyncratic risk</i>	-1.7739	1.6042	-1.7271	1.5971	-0.6489	1.5794
Num of Obs	235		235		235	
R^2	0.2166		0.2338		0.3575	
Adjusted R^2	0.1853		0.1960		0.2942	
Industry Dummies	No		No		Yes	
Country Dummies	No		No		Yes	

Source: Refinitiv Eikon, Capital IQ, Sveriges Riksbank

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

To investigate the first hypothesis regarding the potential relationship between environmental- and stock performance, and its statistical and economic significance, a regression model based

on empirical findings by Lins et al. (2017) is introduced. In the Model 1 regression presented in Table 4, *environmental score* is non-significant at the 10% level implying that no significant relationship between the variable of interest and the dependent variable can be established, thus the null hypothesis cannot be rejected. *Firm size* (0.0237**) is significant at the 5% level with a positive coefficient suggesting an increase in *firm size* is associated with higher *raw returns*. *Long-term debt* (-0.2224***) is significant at the 1% level with a negative coefficient implying the presence of a negative relationship between *long-term debt* and *raw returns*. This significant negative relationship and magnitude is in line with findings made by Lins et al. (2017). Additionally, *BTM* had a negative relationship (-0.0664**) with *raw returns*, significant at the 5% level. This negative relationship is also exhibited in empirical findings made by Lins et al. (2017) and implies that higher book-to-market ratios are associated with lower *raw returns*. *Momentum* (0.0866**) is significant at the 5% level, implying that *raw returns* after the outbreak of the Covid-19 pandemic are positively related with raw returns over the 1-year period prior to the pandemic. The adjusted R^2 , indicating the explanatory power of the model, exhibits a value of 0.1853. This suggests that 18.53% of the variation in the model can be explained by the explanatory variables. The adjusted R^2 of Model 1 is in close approximation to that of Lins et al. (2017). In summary, the variables exhibiting a statistically significant relationship with *raw returns* in Model 1 are *firm size*, *long-term debt*, *BTM*, and *momentum*. Furthermore, all statistically significant variables are deemed to be economically significant.

When introducing controls for *governance*- and *social scores*, the *environmental score* remains insignificant and the adjusted R^2 increases from 0.1853 to 0.1960. Both *governance score* and *social score* are statistically insignificant at the 10% level. Additionally, introducing *governance*- and *social scores* in the model increases the significance of the *firm size* variable which is now significant at the 1% level compared to the 5% level in Model 1. Additionally, *momentum* is now only significant at the 10% level compared to the 5% level in Model 1. All other control variables remain in their respective significance intervals after the introduction of *governance*- and *social score*. As the *environmental score* remains insignificant at the 10% level, we remain unable to reject the null hypothesis.

In order to control for systematic differences between different countries and industries, we introduce categorical variables for industry and country affiliation. When isolating the effect of systematic cross-industry and country differences; the adjusted R^2 , which indicates the

goodness-of-fit of the model, increases from 0.1960 to 0.2942. This implies that 29.42% of the sample variance of *raw returns* can be explained by the included variables, significantly higher than in the study by Lins et al. (2017). After introducing country and industry dummy variables in the model, *the environmental score* remains insignificant at the 10% level, hence we remain unable to reject the null hypothesis. Additionally, in Model 3, *firm size* is significant at the 5% level while the significance of *momentum* increases to the 1% level. Finally, *BTM* remains significant but at the 10% level compared to the 5% level in Model 1 and Model 2.

Table 5: OLS model with different subsets

	Sweden		Norway		Denmark	
	β	SE	β	SE	β	SE
<i>Environmental score</i>	0.0003	0.0008	0.0034**	0.0015	0.0014	0.0017
<i>Governance score</i>	-0.0004	0.0007	-0.0008	0.0013	-0.0030*	0.0015
<i>Social score</i>	-0.0022**	0.0010	-0.0025	0.0018	0.0003	0.0025
<i>Firm size</i>	0.0504***	0.0140	-0.0190	0.0266	0.0262	0.0342
<i>Long-term debt</i>	-0.2893**	0.1142	-0.2406	0.2208	0.1551	0.2249
<i>Short-term debt</i>	-0.1481	0.2210	0.2639	0.4677	-0.1501	0.3317
<i>Cash</i>	0.0681	0.1821	-0.1831	0.3009	0.5565	0.3524
<i>BTM</i>	0.0259	0.0458	-0.1526**	0.0561	-0.0560	0.0716
<i>Profitability</i>	-0.1170	0.2225	-0.3273	0.6193	0.3599	0.4430
<i>Momentum</i>	0.0969**	0.0484	0.1517*	0.0776	0.0207	0.0812
<i>Idiosyncratic risk</i>	0.8603	2.2815	-6.5744*	3.3303	7.3544	6.9126
Num of Obs	143		51		41	
R^2	0.2776		0.6494		0.5615	
Adjusted R^2	0.1661		0.4522		0.2028	
Industry Dummies	Yes		Yes		Yes	

Source: Refinitiv Eikon, Capital IQ, Sveriges Riksbank

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Finally, in order to test for the potential presence of significant relationships within each country, we run the Model 2 regression while including industry dummies for the subsample of each country. Table 5 exhibits some interesting results: *environmental score* remains insignificant for the Swedish and Danish subsample but is positive (0.0034**) and statistically significant at the 5% level in Norway. This implies that the null hypotheses, H1:0 and H2:0, can both be rejected at the 5% level for the Norwegian subsample. Additionally, there appears to be a negative relationship (-0.0022**) between *social score* and *raw returns* in the Swedish subsample and a negative relationship (-0.0030*) between *governance score* and *raw returns* in Denmark. *Firm size* (0.0504***) is positive and statistically significant at the 1% level in the Swedish subsample but not in the other countries. Additionally, *long-term debt* (-0.2893**) is negative and significant on the 5% level in Sweden but insignificant on the 10% level in the other subsamples. *BTM* and *idiosyncratic risk* are both negative and significant only in the

Norwegian subsample; at the 5%- and 10% level respectively. *Momentum* is positive and statistically significant in both Sweden and Norway at the 5%- and 10% level respectively but statistically insignificant in Denmark. The adjusted R^2 for the Norwegian subsample is considerably higher (0.4522) than in Sweden (0.1661) and Denmark (0.2028). Finally, it should be mentioned that the number of observations is significantly higher in the Swedish subsample than in the Norwegian and Danish subsamples.

5. Discussion

By analyzing the results presented in the previous section, it becomes abundantly clear that, for the given sample and model specifications, no statistically significant relationship exists between environmental performance and stock performance in the aggregated sample for the period of investigation. These findings have multiple potential explanations which will be discussed in the following section.

5.1. Environmental performance in a sustainable and technologically advanced setting

The first explanation of the findings is one assuming the absence of measurement errors, incorrectly specified models, and sample biases; that stocks of Scandinavian firms with high environmental performance did in fact not perform neither superiorly nor inferiorly compared to firms with lower environmental performance during the initial outbreak of the Covid-19 pandemic. This statistical insignificance is observed both in the Model 1 regression, when altering the set of control variables, when introducing country- and industry dummy variables and when *raw returns* are substituted for *abnormal returns* calculated using the market model.

Research on the relationship between environmental- and stock performance in a GFC setting found that firms with high CSR performance experienced stock returns 4-7 pp higher than firms with lower CSR performance. Furthermore, it was argued that this effect stemmed largely from how CSR worked as a signaling tool of firm trustworthiness and social capital at times when financial markets were governed by a large degree of skepticism and distrust (Lins et al., 2017). Given the “dangerously unique” nature of the pandemic (Borio, 2020), as a crisis of non-economic origin, could it be the case that no such substantial distrust in the capital market existed during the initial part of the pandemic? If this was the case; could that have rendered

the “trust-signaling” function of CSR, and by extension environmental performance, redundant?

In contrast to what was argued by Ding et al. (2021), our analysis indicates that the impact of environmental performance on stock performance was in fact not intensified for firms operating in countries with “social norms that place a higher priority on environmental and social issues”. Assuming that there is in fact a statistically- and economically significant relationship between environmental- and stock performance in a non-crisis setting, the results of this paper suggest that Scandinavian investors forewent their inclination to invest sustainably during the early part of the pandemic.

It should also be acknowledged that environmental scores as presented by Refinitiv Eikon may in fact be an imperfect proxy of a firm’s environmental- and sustainable profile as perceived by investors. Can it be confirmed that investors actually regard Hennes & Mauritz AB, a global fast fashion retailer, as a more sustainable investment option than Avanza Bank and Holding AB, a Swedish stockbroker and financial services company? In the dataset, H&M has the second highest environmental score while Avanza possesses the lowest score, but is this difference perceived by the average investor? As it is ultimately investors' perceptions that matter, if *environmental score* is in fact an imperfect proxy for how investors perceive companies’ sustainability profile, it could potentially explain parts of the absence of a significant relationship between *environmental score* and stock performance, both in terms of *raw-* and *abnormal returns*.

5.2. Comparability between the three neighboring countries

Another potential explanation for the absence of a statistically significant relationship between environmental- and stock performance is the comparability between the three Scandinavian countries. Is it possible that the neighboring countries are in fact not as comparable as previous literature suggests? If there are in fact differences that substantially disturb the comparable nature between firms from the three Scandinavian countries, the aggregate coefficient between variables could have been influenced by the difference, even after controlling for country-level differences in the model. To test for this, we run our Model 2 regression while controlling for systematic industry differences for the subsample of each country as shown in Table 5 in the results. The presence of a positive and statistically significant relationship in Norway is an

interesting finding and one which suggests differing investor behaviors in the samples of the three countries. The three countries experienced similar initial exposure to the pandemic with a comparable number of cases and this can thus not be assumed to be the standalone reason for the presence of this isolated effect in Norway (Statens serum institut, n.d.; Folkhälsomyndigheten, n.d.; Folkehelseinstituttet, n.d.). One potential explanation could be differing stock market reactions in the respective three countries in which the Norwegian market performed the worst (-23.6%) and Denmark performed the best (-5.5%) during the period of investigation (Nasdaq, n.d.). Could the severity of the stock market crash, and the varying speed of recovery, have influenced the significance of the relationship between environmental- and stock performance? Is it plausible that the stock market crash after the initial outbreak of the Covid-19 pandemic was perceived as more severe in Norway than in Sweden and Denmark and that this increased severity caused Norwegians to turn to sustainable firms perceived to have higher trustworthiness and level of social capital (Lins et al., 2019)? Determining such attributes would require further analysis as the current model specification is inadequate for making causal claims. As for the negative coefficients of *social-* and *governance scores* for the Swedish and Danish subsamples, one potential explanation could be that investors perceived that firms over-invested in social- and governance activities, effectively deterring investors from investing in the company. The explanation for the above-mentioned significant relationships is not limited to perceived over-investing and other potential explanatory factors thus have to be examined further.

5.3. Sample bias and misspecification of the model

In this section follows a discussion of potential limitations of the paper with regard to the presence of outliers, the quality of model specification and potential biases of the sample, alongside the tests aimed at investigating these limitations.

5.3.1. Outliers

Several variables in the sample of firms exhibit a notable presence of outliers. This aforementioned presence of extreme values in the data could lead to biased results and misleading precision. A large number of outliers can distort the relationship between the independent and dependent variables and potentially impair the accuracy of the coefficient estimates. Furthermore, outliers may increase the variability of residuals, resulting in inaccurate standard errors and biased results. In summary, the presence of outliers may result in a sample

being unrepresentative of the population, thus decreasing the predictive power of the model and increasing the risk of drawing wrong conclusions. In order to address the issue of outliers, the data is initially subjected to winsorization at the 1-99th percentile. As observed in the comparison of winsorization intervals (Appendix 3), when winsorizing at this interval, outliers will be present for all the variables except *long-term debt*. A more suitable winsorization span appears to be the 5-95th percentile as it removes, or significantly decreases, the number of outliers for all variables. Winsorization at the 5-95th percentile increases the explanatory power of the model and decreases the effect of outliers. However, the presence of outliers cannot be assumed to be the sole reason for the absence of a significant relationship between environmental- and stock performance.

5.3.2. Choice of estimation model

The OLS linear regression relies on the following assumptions: i) The regression model is linear in the coefficients and the error term, ii) The error term has a population mean of zero, iii) All independent variables are uncorrelated with the error term, iv) Observations of the error term are uncorrelated with each other, v) The error term has a constant variance (no heteroscedasticity), vi) No independent variable is a perfect linear function of other explanatory variables. vii) The error term is normally distributed (Wooldridge, 2012). If either of these assumptions are not upheld, it could result in biased or inaccurate coefficients. As part of the analysis, the data is thus investigated to determine whether these properties hold. By extracting and testing the error terms, we find that their means are equal to zero (Appendix 4) and that they are uncorrelated with explanatory variables. In order to test the null hypothesis of constant variance against the alternative hypothesis of unrestricted heteroscedasticity, the Breush-Pagan Cook Weisberg test is performed on the different models. The test exhibits p-values of 0.1575, 0.1686 and 0.5545 for Model 1, 2 and 3 respectively implying that the null hypothesis cannot be rejected at the 10% level for any model, thus fulfilling the OLS assumption of constant variance of error terms. The normality of the data is tested using a Shapiro-Wilk test and a D'Agostino-Pearson's K^2 test (Appendix 5). Both tests indicate that the error terms are normally distributed. By investigating the matrix of correlation coefficients (Appendix 1), we observe no perfect linear relationship between independent variables, thus fulfilling the OLS assumption. However, we do observe a substantial correlation between explanatory variables which could suggest that multicollinearity is affecting the model. In the section on robustness testing, the effect of multicollinearity on the models is tested.

In summary, as the assumptions of the OLS model are upheld, OLS is deemed to be the best linear unbiased estimator (BLUE) and appropriate for the investigation of the research question.

5.3.3. Sample

As discussed in chapter 3 the cleaned sample comprises 235 listed firms on the Scandinavian stock exchange. The sample size of the paper is limited by the ESG coverage by Refinitiv Eikon resulting in the sample not including all 1576 Scandinavian listed firms observed on the database. We note that the sample is comparatively small, which could disrupt the explanatory power of the model.

ESG coverage is premised on data reported publicly by firms. In 2023, a new EU legislation came into effect, making ESG reporting mandatory (European Parliament, 2022). Prior to the legislation however (during the period of investigation), ESG reporting was insufficiently regulated and to a large degree non-mandatory, and as such large firms and firms with superior environmental performance are likely over-represented in the sample. Consequently, the sample of firms may be biased and an imperfect representation of the larger population of Scandinavian listed firms. The potential sample bias could result in biased coefficients and impair the accuracy of the model, resulting in incorrect conclusions. While it is challenging to address the issues posed by a small sample, efforts were made to improve the accuracy and representability of the sample, such as the exclusion of outliers and the cleaning of data. Another aspect concerning the small sample size is the reduced statistical power it can generate. It could increase the difficulty of detecting significant differences and relationships between variables thus increasing the number of false negatives the model predicts. Given the issues related to the sample, we acknowledge the limitations of this paper and the validity of the results.

5.4. Robustness testing

This section provides an overview of the tests performed to evaluate the robustness of our findings. Specifically, the section covers the substitution of *raw returns* for *abnormal returns* in the regression models and testing for multicollinearity.

5.4.1. Abnormal returns

In order to test the validity of the results and a potential problem with *raw returns* as a proxy for stock performance, we examine if the absence of a relationship between environmental- and

stock performance remains after using a different stock performance proxy. *Raw returns* are substituted for *abnormal returns* calculated using the market model (Lins et al., 2017) in all three regression models (Model 1, Model 2 and Model 3). The table of *abnormal return* regressions (Appendix 6) validates the main results of the models as the *environmental score* remains insignificant at the 10% level in all models. In addition, *firm size* and *momentum* increase in significance for all three models, now significant at the 1% level. *BTM* becomes insignificant at the 10% level for all models. *Cash* is positive and significant at the 10% level for Model 3 in the *abnormal return* regression. Unlike the standard *raw return* models, *idiosyncratic risk* is positive and significant at the 1% level for all *abnormal return* models. Finally, the adjusted R^2 of all models increases after substituting *raw returns* for *abnormal returns*. The adjusted R^2 , ranging from 0.2876 (Model 1) to 0.3104 (Model 3) is comparable to the adjusted R^2 of the abnormal return models in the study by Lins et al. (2017). The main result of the paper, the absence of a statistically significant relationship between environmental- and stock performance, thus remains after *raw returns* are substituted for *abnormal returns*. This suggests that the explanation for the absence of a statistically significant relationship between the variables of interest lies not within the quality of *raw returns* as a proxy for stock performance.

5.4.2. Multicollinearity

The OLS model also assumes no perfect linear relationship between independent variables. When the correlation is high between the independent variables, multicollinearity might affect the model. Multicollinearity results in the variation of the independent variable being explained by other variables, possibly resulting in lower efficiency and higher variance in the model (Woolridge, 2012). We suspect that multicollinearity is affecting the model due to the high correlation observed between several independent variables in the Pearson correlation matrix (Appendix 1). To investigate this potential problem, the independent variables are analyzed through the variance inflation factor (VIF). VIF measures the effect that the variable's correlation has on its coefficients which is an indication of multicollinearity. In Appendix 7, it can be seen that none of the variables have a VIF above 4.12. According to Woolridge (2012), a VIF of 10 or greater indicates the existence of multicollinearity. Therefore, we can infer that our variables are not impacted by multicollinearity, and we can retain the relevant variables.

6. Conclusion

This study aims to investigate the relationship between environmental performance and stock performance during times of crisis, specifically during the initial outbreak of the Covid-19 pandemic. By regressing *raw-* and *abnormal returns* during Q1 of 2020 on a proxy for environmental performance (*environmental score*) and different sets of control variables, we try to establish the presence of a relationship fiercely debated in previous literature.

The main result of the study is the general absence of a statistically significant relationship between environmental performance and stock performance, both in terms of *raw-* and *abnormal returns*. These findings remain constant throughout most of the analysis as different sets of control variables are included in the models and country- and industry dummies are introduced. When each country is investigated in isolation however, a positive significant relationship is observed between *environmental score* and *raw returns* for the Norwegian subsample. Additionally, Sweden and Denmark exhibit negative, significant coefficients for *social score* and *governance score* respectively.

The absence of a statistically significant relationship between *environmental score* and *raw returns* in the aggregated sample has many potential explanations. Firstly, it is plausible that the environmental score utilized in the paper is an imperfect proxy of firms' environmental performance as perceived by investors. While a company such as H&M may score at the top of the sample based on the metrics used in calculating the score, it is possible that investors do not perceive H&M as the most sustainable firm in the sample; and ultimately, it is investors' perceptions that matter. Secondly, in light of the findings of statistically significant relationships in the individual country subsamples, the comparability between firms from the different countries could be one factor explaining the lack of significance in the aggregated sample. Finally, measurement errors and model miss-specifications cannot be ruled out as potential explanatory factors and attention should be given to the limitations of the sample.

Given the limitations of the paper, caution should be taken while drawing conclusions based on its results. While no widespread, statistically significant relationship between environmental performance and stock performance could be confirmed; the paper contributes to the established ambiguity and lack of consensus within this field of research, effectively narrowing the research

gap. The presence of a positive and statistically significant relationship in the Norwegian subsample alludes to the presence of some intricate relationship between the variables of interest which helps bring clarity to which factors govern investor behavior. However, the relationship cannot be definitely established under the current model specification, variable definition and sample composition. In light of this and the importance of understanding which factors govern stock market fluctuations and investor behavior, we deem it to be of great importance to continue research on the relationship between environmental- and stock performance.

6.1. Suggestions for future research

This study aims to establish a relationship between environmental performance and stock performance in a Scandinavian Covid-19 context. The results from the study are ambiguous but no significant relationship can be established in the aggregated sample. The ambiguity of our results and the ambiguity within the research field at large point toward the need for further investigation of the relationship between environmental- and stock performance. As we discuss the potential limitations of the *environmental score* as a proxy for the environmental performance perceived by investors, a logical continuation of the study would be to substitute the *environmental score* for a more investor-based proxy. Additionally, as results are shown to vary across national borders, within-country analysis appears as an interesting continuation of the study. Finally, following the limitations of the sample; it would be interesting to investigate the same question in a different setting which allows for a greater and more reliable sample.

References

Albuquerque, R., Koskinen, Y., Yang, S. and Zhang, C., 2020. Resiliency of Environmental and Social Stocks: An Analysis of the Exogenous COVID-19 Market Crash. *The Review of Corporate Finance Studies*, vol. 9, no. 3, pp. 593-621.

Borio, C., 2020. The Covid-19 economic crisis: dangerously unique. *Business Economics*, vol. 55, no. 4, pp. 181-190.

Castro, P., Gutiérrez-López, C., Tascón, M.T. and Castaño, F.J., 2021. The impact of environmental performance on stock prices in the green and innovative context. *Journal of Cleaner Production*, 320, no. 128868.

Demers, E., Hendrikse, J., Joos, P. and Lev, B., 2021. ESG did not immunize stocks during the COVID-19 crisis, but investments in intangible assets did. *Journal of Business Finance & Accounting*, vol. 48, no. 3–4, pp. 433-462.

Deng, X. and Cheng, X., 2019. Can ESG indices improve the enterprises' stock market performance? -An empirical study from China. *Sustainability (Switzerland)*, vol. 11, no. 17.

Ding, W., Levine, R., Lin, C. and XIE, W., 2021. Corporate immunity to the COVID-19 pandemic. *Journal of Financial Economics*, vol. 141, no. 2, pp. 802-830.

Directive 2022/2464. DIRECTIVE (EU) 2022/2464 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 14 December 2022 amending Regulation (EU) No 537/2014, Directive 2004/109/EC, Directive 2006/43/EC and Directive 2013/34/EU, as regards corporate sustainability reporting. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32022L2464>

Duchin, R., Ozbas, O. and Sensoy, B.A., 2010. Costly external finance, corporate investment, and the subprime mortgage credit crisis. *Journal of Financial Economics*, vol. 97, no. 3, pp. 418-435.

Fama, E.F. and French, K.R., 1992. The Cross-Section of Expected Stock Returns. The Journal of Finance, vol. 47, no. 2, pp. 427-465.

Folkhelseinstituttet. Accessed: 18 April 2023. Ukerapporter om covid-19, influensa og andre luftveisinfeksjoner. <https://www.fhi.no/publ/2020/koronavirus-ukerapporter/>.

Folkhälsomyndigheten. Accessed: 18 April 2023. Bekräftade fall av Covid-19 i Sverige. <https://www.folkhalsomyndigheten.se/fall-covid-19/>.

Freeman, R.E., 1984. Strategic Management: A Stakeholder Approach. Pitman, Boston.

Friedman, M., 1962. Capitalism and freedom. University of Chicago Press, Chicago and London.

Friedman, M., 1970. The social responsibility of business is to increase its profits. New York Times Magazine, vol. 13, pp. 32-33.

Goyal, A. and Santa-Clara, P., 2003. Idiosyncratic Risk Matters! The Journal of Finance, vol. 58, no. 3, pp. 975-1007.

Greening, D.W. and Turban, D.B., 2000. Corporate social performance as a competitive advantage in attracting a quality workforce. Business & Society, vol. 39, no. 3, pp. 254-280.

Guiso, L., Sapienza, P. and Zingales, L., 2008. Trusting the Stock Market. The Journal of Finance, vol. 63, no. 6, pp. 2557-2600.

Harford, J., Klasa, S., Maxwell, W.F., 2014. Refinancing Risk and Cash Holdings. The Journal of Finance, vol. 69, no. 3, pp. 975-1012.

Hillman, A.J. and Keim, G.D., 2001. Shareholder value, stakeholder management, and social issues: what's the bottom line? Strategic Management Journal, vol. 22, no. 2, pp. 125-139.

Irfan, F., Minetti, R., Telford, B., Ahmed, F., Syed, A., Hollon, N., Brauman, S., Cunningham, W., Awad, M., Saleh, K., Waljee, A. and Brusselaers, N., 2022. Coronavirus pandemic in the Nordic countries: Health policy and economy trade-off. *Journal of global health*, vol. 12, no. 05017.

Kaźmierczak, M., 2022, A literature review on the difference between CSR and ESG, *Scientific Papers of Silesian University of Technology*, no. 162.

Lins, K.V., Servaes, H. and Tamayo, A., 2017. Social Capital, Trust, and Firm Performance: The Value of Corporate Social Responsibility during the Financial Crisis. *The Journal of Finance*, vol. 72, no. 4, pp. 1785-1824.

Lintner, J., 1965. The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets. *Review of Economics and Statistics*, vol. 47, no. 1, pp. 13–37.

Macrotrends. Accessed: 23 April 2023. S&P 500 Index - 90 Year Historical Chart. Macrotrends. <https://www.macrotrends.net/2324/sp-500-historical-chart-data>.

Nasdaq, Accessed: 23 April 2023. OMXS30, OMX STOCKHOLM 30 INDEX, (SE0000337842).

https://www.nasdaqomxnordic.com/indexes/historical_prices?Instrument=SE0000337842.

Nasdaq, Accessed: 23 April 2023. OMXO20PI, OMX OSLO 20 PI, (SE0002947507).

https://www.nasdaqomxnordic.com/indexes/historical_prices?Instrument=SE0002947507.

Nasdaq, Accessed: 23 April 2023. OMXC20, OMX COPENHAGEN 20, (DK0016268840)

https://www.nasdaqomxnordic.com/indexes/historical_prices?Instrument=DK0016268840.

Nguyen, D., Hoang, T. and Tran, H., 2022. Help or Hurt? The Impact of ESG on Firm Performance in S&P 500 Non-Financial Firms. *Australasian Business, Accounting and Finance Journal*, vol. 16, pp. 91-102.

Orlitzky, M., Schmidt, F.L. and Rynes, S.L., 2003. Corporate social and financial performance: A meta-analysis. *Organization Studies*, vol. 24, no. 3, pp. 403-441.

Patten, D.M., 1991. Exposure, legitimacy, and social disclosure. *Journal of Accounting and Public Policy*, vol. 10, no. 4, pp. 297-308.

Pérez, L., Hunt, D.V., Samandari, H., Nuttall, R., Biniek, K. 2022. Does ESG really matter – and why? McKinsey & Company.

<https://www.mckinsey.com/capabilities/sustainability/our-insights/does-esg-really-matter-and-why>.

Phan, D. H. B., Narayan, P. K., 2020. Country responses and the reaction of the stock market to COVID-19—a preliminary exposition. *Emerging Markets Finance and Trade*, vol. 56, no 10, pp. 2138-2150.

Porter, M.E., Kramer, M.R., 2006. The link between competitive advantage and social responsibility. *Harvard Business Review*, vol. 84, no. 13, pp. 78-92.

Refinitiv, 2022. Environmental, Social and Governance Scores from Refinitiv. https://www.refinitiv.com/content/dam/marketing/en_us/documents/methodology/refinitiv-esg-scores-methodology.pdf.

Refinitiv Eikon, 2023. Accessed 27 Mars 2023. <https://eikon.refinitiv.com/>.

Sharpe, W.F., 1964. Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk. *The Journal of Finance*, vol. 19, no. 3, pp. 425– 442.

SolAbility Sustainable Intelligence, 2022. The Global Sustainability Competitiveness Index 2022. <https://solability.com/the-global-sustainable-competitiveness-index/the-index>.

Statens Serum Institut. Accessed: 18 April 2023. Covid-19.

<https://experience.arcgis.com/experience/aa41b29149f24e20a4007a0c4e13db1d/page/National>.

Strand, R., Freeman, R.E., Hockerts, K., 2015. Corporate Social Responsibility and Sustainability in Scandinavia, An Overview. *Journal of Business Ethics*, vol. 127, no. 1.

S&P Capital IQ. Accessed 27 Mars 2023. <https://www.spglobal.com/marketintelligence/en/>.

Unruh, G., Kiron, D., Kruschwitz, N., Reeves, M., Rubel, H. and Meyer Zum Felde, A., 2016. Investing For a Sustainable Future: Investors Care More About Sustainability than Many Executives Believe. *MIT Sloan Management Review*.

Waddock, S.A. and Graves, S.B., 1997. The corporate social performance-financial performance link. *Strategic Management Journal*, vol. 18, no. 4, pp. 303-319.

Whelan, T., Atz, U., Holt, T.V., Clark, C., 2021. ESG and Financial Performance: Uncovering the Relationship by Aggregating Evidence from 1,000 Plus Studies Published between 2015 – 2020. Rockefeller Asset Management & NYU Stern – Center for Sustainable Business.

Willis, A., 2020. ESG as an equity vaccine. Morningstar Market Insights. <https://www.morningstar.ca/ca/news/201741/esg-as-an-equity-vaccine.aspx>.

Wooldridge, J., 2012. *Introductory econometrics: A modern approach*. Cengage Learning.

World Resource Institute, 2004. Greenhouse gas protocol: A Corporate Accounting and Reporting Standard (Rev. ed.). <https://ghgprotocol.org/sites/default/files/standards/ghg-protocol-revised.pdf>.

Appendix

Appendix 1: Pearson correlation matrix

	E-Score	G-Score	S-Score	Firm Size	Long Debt	Short Debt	Cash	BTM	Profit	Momentum	Raw Return	Idiosyncratic
E-Score	1.00											
G-Score	0.40	1.00										
S-Score	0.73	0.46	1.00									
Firm Size	0.55	0.39	0.55	1.00								
Long Debt	0.04	0.05	-0.05	-0.06	1.00							
Short Debt	-0.00	-0.20	-0.02	-0.05	0.09	1.00						
Cash	-0.23	-0.08	-0.21	-0.11	-0.44	-0.19	1.00					
BTM	0.04	-0.07	-0.03	-0.19	0.21	0.08	-0.21	1.00				
Profit	0.06	0.17	0.13	0.33	-0.16	-0.10	-0.00	-0.38	1.00			
Momentum	-0.09	-0.13	-0.16	0.18	-0.13	-0.03	0.14	-0.39	0.18	1.00		
Raw Return	0.05	-0.04	0.02	0.27	-0.27	-0.11	0.18	-0.30	0.17	0.30	1.00	
Idiosyncratic	-0.32	-0.16	-0.32	-0.46	-0.10	-0.06	0.26	-0.06	-0.20	-0.04	-0.11	1.00

Appendix 2: T-test of environmental score

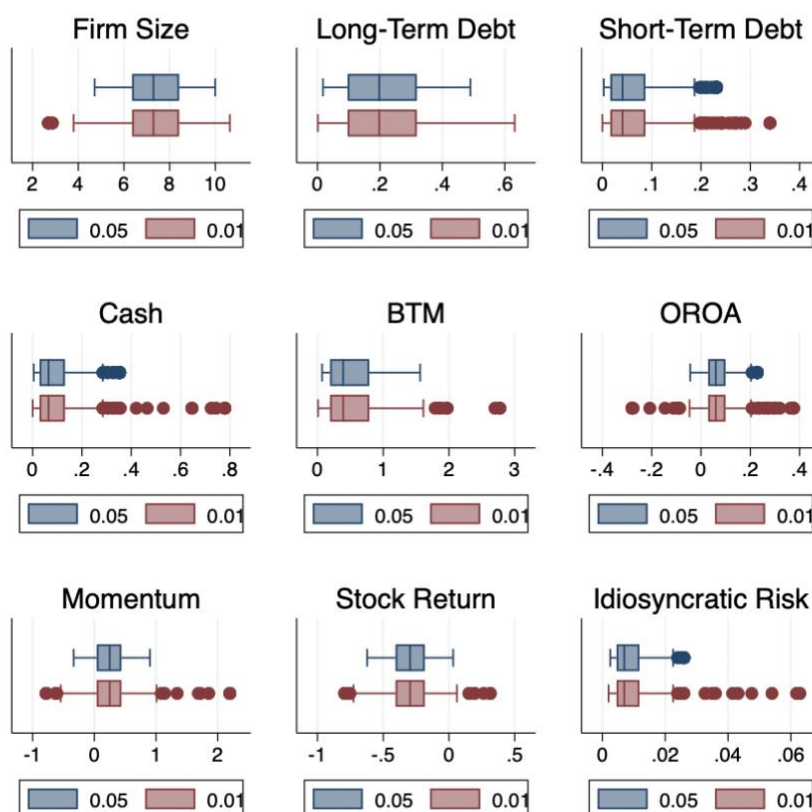
Two-sample t test with equal variances

Group	Obs	Mean	Std. err.	Std. dev.	[95% conf. interval]	
0	118	-.2894271	.0162796	.1768418	-.321668	-.2571862
1	117	-.2946091	.0157874	.1707673	-.3258781	-.2633401
Combined	235	-.2920071	.0113173	.1734917	-.314304	-.2697102
diff		.005182	.0226809		-.0395038	.0498678

diff = mean(0) - mean(1) t = 0.2285
H0: diff = 0 Degrees of freedom = 233

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0
Pr(T < t) = 0.5903 Pr(|T| > |t|) = 0.8195 Pr(T > t) = 0.4097

Appendix 3: Comparison of winsorization intervals



Where:

0.01 = Winsorization interval at the 1-99th percentile

0.05 = Winsorization interval at the 5-95th percentile

Appendix 4: Summary statistics residual

	Mean
Residual Model 1	0.0000
Residual Model 2	-0.0000
Residual Model 3	-0.0000
Observations	235
Capital IQ, Refinitiv Eikon	

Appendix 5: Shapiro-Wilk and D'Agostino-Pearson's K^2 test for normality

	Shapiro-Wilk Test	D'Agostino's K^2 Test
	<i>Prob>z</i>	<i>Prob>chi2</i>
Residual Model 1	0.30442	0.3554
Residual Model 2	0.27157	0.4281
Residual Model 3	0.52022	0.4155
Observations	235	235
Capital IQ, Refinitiv Eikon		

Appendix 6: Model 1-3 with abnormal returns

	Model 1		Model 2		Model 3	
	β	SE	β	SE	β	SE
<i>Environmental score</i>	0.0003	0.0005	0.0003	0.0006	-0.0000	0.0006
<i>Governance score</i>			-0.0006	0.0006	-0.0005	0.0006
<i>Social score</i>			0.0001	0.0008	-0.0001	0.0008
<i>Firm size</i>	0.0280***	0.0091	0.0302***	0.0097	0.0367***	0.0109
<i>Long-term debt</i>	-0.1746**	0.0787	-0.1639**	0.0799	-0.1438*	0.0827
<i>Short-term debt</i>	-0.0854	0.1473	-0.1194	0.1513	0.0309	0.1549
<i>Cash</i>	0.1356	0.0900	0.1386	0.0903	0.1548*	0.0915
<i>BTM</i>	-0.0093	0.0227	-0.0111	0.0229	0.0144	0.0253
<i>Profitability</i>	0.1424	0.1255	0.1473	0.1258	0.1469	0.1271
<i>Momentum</i>	0.1130***	0.0268	0.1094***	0.0275	0.1165***	0.0275
<i>Idiosyncratic risk</i>	6.6539***	1.2257	6.7790***	1.2389	5.9936***	1.2675
Num of Obs	235		235		235	
R^2	0.3180		0.3212		0.3752	
Adjusted R^2	0.2876		0.2845		0.3104	
Industry Dummies	No		No		Yes	
Country Dummies	No		No		Yes	

Source: Refinitiv Eikon, Capital IQ, Sveriges Riksbank

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Appendix 7: VIF test

Variable	VIF	1/VIF
Environmen~e	2.56	0.390845
Governance~e	1.55	0.645234
Socialpill~e	2.84	0.352571
ln_Market~_w	2.73	0.366572
Longtermd~_w	1.51	0.660934
Shortterm~_w	1.17	0.856136
Cashholdi~_w	1.55	0.643341
BTM_w	1.80	0.554966
OROA_w	1.47	0.680805
Momentum_w	1.44	0.695674
Idiosync~k_w	1.64	0.609636
SIC		
2	3.50	0.285695
3	4.12	0.242579
4	2.08	0.481603
5	2.21	0.452378
6	3.86	0.259136
7	2.09	0.479593
8	1.67	0.599072
9	1.51	0.663387
Country_code		
2	2.05	0.486742
3	2.00	0.499985
Mean VIF	2.16	