



**MARKET REACTIONS TO ESG NEWS - A COMPARATIVE STUDY BETWEEN
THE NORDIC AND EUROPEAN MARKETS**

Lappeenranta–Lahti University of Technology LUT

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ABSTRACT

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Market reactions to ESG news - A comparative study between the Nordic and European markets

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This thesis examines the short-term market reactions to negative and positive ESG news. The market reactions are compared between the Nordic and European markets, to evaluate the differences between investor reactions between the two markets. Moreover, the companies are also divided into categories based on the ESG score and size, to study whether those two factors have an impact on the strength of the market reactions.

The sample consists of 174 ESG news collected for a total of 87 Nordic and European listed companies from 2018 to 2022. Besides the news, the data also includes the ESG score and the market cap of each company. To examine the market reactions to the ESG news, the event study methodology is used.

The results of this thesis show that there are significant market reactions to negative and positive ESG news, in both the Nordic and European markets. On the event date, the average abnormal return for negative news is -2.409% in the Nordic market, and -0.567% in Europe. For positive news the corresponding figures are 1.391% in the Nordic market, and 0.756% in the European markets. When comparing the abnormal returns across three ESG score categories, the results suggest that on average the abnormal returns for negative news are higher for companies with higher ESG scores in both markets. For positive news, the abnormal returns are higher for companies with lower (higher) ESG scores in the Nordic (European) markets. The results of comparing the market reactions between three size categories suggest that the abnormal returns for negative news are higher for small and mid-sized companies in both markets. For positive news the abnormal returns seem to be higher for large and mid-sized companies in the Nordic markets, and for mid-sized companies in the European markets.

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Tässä tutkimuksessa tarkastellaan lyhyen aikavälin markkinareaktioita negatiivisiin ja positiivisiin ESG-uutisiin. Markkinareaktioita vertaillaan Pohjoismaiden ja Euroopan välillä, jotta voidaan arvioida kuinka sijoittajien reaktiot vaihtelevat markkinoiden välillä. Lisäksi yritykset jaetaan kategorioihin ESG-luokituksen ja koon perusteella, jotta voitaisiin selvittää, onko näillä kahdella tekijällä vaikutusta markkinareaktioiden voimakkuuteen.

Aineisto koostuu 174 ESG-uutisesta, jotka on kerätty 87 pohjoismaiselta ja eurooppalaiselta pörssiyhtiöltä vuosien 2018 ja 2022 välillä. Uutisten lisäksi tutkimusaineistoon sisältyvät myös yritysten ESG-luokitukset ja markkina-arvot. Markkinareaktioiden tutkimiseksi käytetään tapahtumatutkimusta.

Tulokset osoittavat, että markkinareaktiot positiivisiin ja negatiivisiin uutisiin ovat merkittäviä sekä Pohjoismaissa että Euroopassa. Tapahtumapäivänä keskimääräinen epänormaali tuotto negatiivisille uutisille on -2.409 % Pohjoismaissa ja -0.567 % Euroopassa. Vastaavat luvut positiivisille uutisille ovat 1.391 % Pohjoismaissa ja 0.756 % Euroopassa. Kun vertaillaan markkinareaktioita ESG-luokituskategorioiden välillä, tulokset viittaavat siihen, että keskimäärin reaktio negatiivisiin uutisiin on molemmilla markkinoilla vahvempi yrityksillä, joilla on korkeampi ESG-luokitus. Reaktio positiivisiin uutisiin on Pohjoismaissa suurempi yrityksillä, joilla on matalampi ESG-luokitus, ja Euroopassa yrityksillä, joilla on korkeampi ESG-luokitus. Eri kokoisten yritysten välisen vertailun tulokset osoittavat, että markkinareaktio negatiivisiin uutisiin on kummillakin markkinoilla vahvempi pienillä ja keskisuurilla yhtiöillä. Reaktiot positiivisiin uutisiin ovat vahvempia keskisuurilla ja suurilla yhtiöillä Pohjoismaissa, ja keskisuurilla yhtiöillä Euroopassa.

ABBREVIATIONS

EMH	Efficient Market Hypothesis
ESG	Environmental, Social, Governance
CFP	Corporate Financial Performance
CR	Corporate Sustainability
CSP	Corporate Social Performance
CSR	Corporate Social Responsibility

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1 Introduction

The concept of Environmental, Social, and Governance (ESG) has gained significant attention in past decade as investors have become increasingly conscious of the long-term sustainability of companies. ESG practices such as risk and resource management influence the decision-making of the management as well. The objective of this study is to analyse how the stock market reacts to ESG-related news that have either a positive or negative sentiment related to them, and to compare the reactions between the Nordic and European markets. The importance of studying this topic lies in the increasing importance of ESG factors in decision-making of both investors and the management of companies, as well as the potential positive and negative impacts of ESG-related news on the value of a company.

Previous research on the relationship between sustainability related news announcements and market reactions has been done in the Europe, U.S., and APAC markets, and they have provided mixed results on the market's reaction to ESG news. Most of the studies have found that negative ESG news can lead to significant negative stock price reactions, especially in the European markets. On the other hand, the impact of positive news is not so clear – While some have found a connection between positive news and positive stock reactions, many papers have proved that there does not seem to exist a significant connection between the two.

There is limited research that focuses on the relationship of ESG news and stock market reactions in the Nordic markets. This paper aims to address this gap by conducting a comparative study between the Nordics and rest of the European market. The Nordic markets are known for their strong focus on sustainability and emphasizing the importance of ESG issues. The median corporate social performance rating of Nordic companies is considerably higher than the ratings of European companies, indicating that sustainability and social responsibility are valued higher in the Nordic market (Cai, Pan & Statman, 2016). This provides an interesting case study to examine whether ESG news have a greater impact on Nordic companies' market value compared to the broader European market.

1.1 Research objectives

The main research objective of this paper is to analyse the short-term stock market reactions to ESG-related news and assess how strong the reactions to the news are. The study disentangles how the environmental, social, and corporate governance information is assessed by the market and what effects it can have on the company's market value. The reactions also shed light on how valuable the markets consider sustainability and responsibility to be, and how highly they value the negative and positive ESG activities of the companies.

Furthermore, the market reactions are compared between the Nordic and European markets, to study the possible differences between the two distinguished areas. Even though the stock market reactions to sustainability related news and announcements have been studied widely in the global scale, the Nordic market solely has not been in the focus. Thus, this study will contribute to the literature on that aspect as well. Based on the research objectives, the first two research question are as follows:

“Do ESG-related news have a significant impact on a company's market value?”

“Does the reaction to ESG-related news differ between the Nordic and the European markets?”

How the markets value different sustainability-related factors can have an effect on the strength of the market reactions when information is released to the market. For example, if investors value more the lack of ESG controversies and negative ESG activities than the existence of positive ESG activities, the market reactions to negative ESG news could be stronger than the reactions to positive ESG news. Vice versa, if the market values positive ESG activities more than negative ESG activities, then the market reaction to positive news should be higher. There is also the possibility that the market values both equally, and then the strength of the market reactions should be of the same size. Therefore, the third research question is:

“Does the strength of the market reaction differ between negative and positive ESG-related news?”

There is limited research on whether market reactions to ESG news differ depending on the ESG-rating of the company that the news concerns. If there is a positive relationship between the strength of the market reaction and the ESG-rating of the company, it could indicate that the investors value companies with better ESG performance higher. However, if the negative reaction to negative news is stronger for companies with a higher ESG rating, it creates an interesting situation for the companies. If low ESG performing companies experience weaker market reactions to negative news, it has the possibility to create an incentive for companies to sustain a lower ESG score. As such, the fourth research question is:

“Does the ESG score of the company affect how the market reacts to ESG-related news?”

Larger companies might be subject to greater scrutiny and attention from investors, therefore making it possible that ESG-related news may have a stronger impact on their stock prices. Then again, smaller companies may not receive the same level of scrutiny and attention than the larger companies, especially when it comes to institutional investors. That could potentially lead to a weaker market reaction to the ESG news. As such, the question arises whether the markets react differently to ESG-related news depending on the size of the company that the news concerns. Thus, the fifth research question is:

“Does the size of the company affect how the market reacts to ESG-related news?”

1.2 Research methodology

As stated, the purpose of this paper is to study the short-term market reactions to ESG news. To achieve that objective, an appropriate research method is the event study. Event study is a widely used method in the field finance to assess the short-term stock price effect that is conveyed by a major corporate event, such as the publication of news. Majority of the previous research on similar topics has been carried out with the event study methodology. This study follows the event study framework that MacKinlay (1997) presented in their research, beginning with defining the event and event window, estimating the normal and abnormal returns, and finally testing the abnormal returns for statistical significance.

1.3 Structure of the thesis

The thesis is structured into five main sections. The first section, the introduction, outlines the topic of the research, the research objectives, and the research methodology used in the study. After the introduction, the next section delves into the theoretical framework of the subject, examining previous research on the topic and defining the relevant concepts that underpin this thesis. Within the second section, the focus is directed towards the definition of ESG and the relationship between ESG investing and corporate financial performance. Additionally, the section highlights key findings from prior research on market reactions to ESG-related news. The third section reviews the research methodology and the data employed in the thesis. The fourth section presents the empirical findings from the event study and answers to the research hypothesis that are set based on the research questions. Finally, the concluding section, section five, provides a comprehensive conclusion that answers the research questions and summarizes the overall contribution of the research. In the last section the limitations of the study are also evaluated, and recommendations for future research are given.

2 Literature review

The literature review goes through the relevant previous research, tying together the concepts of ESG and corporate financial performance (CFP). This section is divided into five sub-sections. The first sub-section will introduce the definition of ESG, a framework designed for evaluating the sustainability practices of companies. The definitions and connections between ESG, corporate social responsibility (CSR) and other commonly used terms for sustainability are also presented. The second sub-section goes more into sustainable investing and the drivers behind it, and the third sub-section ties together ESG and CFP. As event studies are based on the efficient market hypothesis, it is explained thoroughly in the fourth sub-section.

In the fifth sub-section the most relevant previous research on the relationship between ESG-related news and market reactions are gone through. This sub-section is further divided into four parts: studies on Nordic market, studies on Europe and other markets, and then studies on the connection between ESG ratings and the market reactions. Lastly, the most relevant research is summarized in the final part.

2.1 Definition of ESG

ESG is a set of standards designed to evaluate the sustainability and ethical impact of an investment or business. The framework consists of three factors: environment, social and governance. The contents of each factor are summarized in Figure 1. The environmental factor consists of matters like climate change and carbon emissions, pollution, considering biodiversity and energy efficiency. The social factor has to do with considering the stakeholders of the company, from customers to employees, and producers. The third factor, governance, gives the standards for running a company in a sustainable and ethical way. (CFA Institute, 2023)

Environmental Conservation of the natural world	Social Consideration of people & relationships	Governance Standards for running a company
<ul style="list-style-type: none"> • Climate change and emissions • Air and water pollution • Biodiversity • Deforestation • Energy efficiency • Waste management • Water scarcity 	<ul style="list-style-type: none"> • Customer satisfaction • Data protection and privacy • Gender and diversity • Employee engagement • Community relations • Human rights • Labor standards 	<ul style="list-style-type: none"> • Board composition • Audit committee structure • Bribery and corruption • Executive compensation • Lobbying • Political contributions • Whistleblower schemes

Figure 1. ESG factors. (CFA Institute, 2023)

ESG rating, score or grade is a measure of how well a company considers the environmental, social and governance issues in its operations. ESG ratings are produced by several rating providers, such as Standard & Poor's, MSCI and Refinitiv. Each provider uses different metrics and methods to calculate the ESG score, and therefore a company can receive several different ESG ratings. The ratings used in this study are provided by Refinitiv. Refinitiv calculates the ESG score based on 630 company-level measures, which are rolled up into 10 categories. Each category has a weighting based on the importance of the category, and the weightings are different for each industry. The 10 categories then reformulate the three pillar scores: environment (E), social (S), and governance (G), and the final ESG score.

Another commonly used terms to define how socially consciously and sustainably a company does its operations are corporate sustainability (CS) and corporate social responsibility (CSR). Similar to ESG, CS and CSR do not have an official definition. For example, Davis (1973) defined CSR as “the firm’s consideration of, and response to, issues beyond the narrow economic, technical, and legal requirements of the firm”. In short, CSR is more of a self-regulated internal framework, whereas ESG is a set of standards used by multiple stakeholders to measure how sustainable the company is.

2.2 Sustainable investing

Both individual and institutional investors have shown growing interest in the ESG practices of the companies they invest in. According to Hill (2020) "ethical business practices" has surpassed categories such as "strong management" as the most respected characteristic of a company. Over the past decade, the investment in socially responsible products has risen significantly, and this trend is expected to accelerate due to various factors.

The drivers for the increased focus on ESG investing are extensive. Good governance has become systemically important since the global financial crisis of 2008, highlighting the importance of improved corporate governance. Climate change has become a reality, and initiatives include sustainable investment portfolios and more disclosure of climate-related financial risks. (Hill, 2020)

Technology is driving the vast change, and most sectors are experiencing changes in the way business is conducted, putting companies that are either unwilling or unable to change at risk. Demographics are changing, as millennials become the largest population group and increasingly drive the growth of sustainable finance. Regulatory support is growing globally, with ESG considerations driving new regulations in a growing list of countries. Large corporations' value chains are increasingly global, and investors are quick to punish companies for issues such as child labour, human rights, and poor governance. These factors are creating new opportunities and challenges for companies, investors, and regulators, requiring a more comprehensive approach to investment analysis and decision-making. (Hill, 2020)

Sustainable investing represents a rapidly growing segment of the investment markets, particularly in developed markets such as Europe and the USA. According to de Vincentiis (2022), the emerging economies appear to show less interest in ESG-driven investments. Hence, cultural differences among investors can result in varied attention to the ESG performance of companies, and to the market's interpretations of ESG news. Besides cultural differences, the type of the investor can also make a difference on how important sustainability is seen when investing. Evidence suggests that public pensions and socially responsible investment funds tend to prefer companies with higher CSR ratings, whereas

institutional investors tend to prefer companies with lower CSR ratings (Giuli & Kostovetsky, 2014).

2.3 ESG and financial performance

The relationship between corporate social responsibility and corporate financial performance has been studied by numerous academics over the last few decades. Overall, the findings seem to be varying. Some argue that good social performance increases firm value by lowering costs and minimizing idiosyncratic risk (Oikonomou, Brooks & Pavelin, 2011; McWilliams & Siegel, 2001). On the other hand, some are considering efforts in CSR activities as a waste of resources (Friedman, 2002; Barnea & Rubin, 2010) and even as a mere tool used to accumulate benefits from shareholders (Groening & Kanuri, 2013).

Mackey, Mackey, and Barney (2007) argue that the opportunity to invest in socially responsible activities is a product that companies offer to investors, and the supply and demand for such investment opportunities determine whether these activities will be positively or negatively related to a firm's market value. The findings of the study show that beginning, ending, or continuing socially responsible activities can have varying effects on a firm's market value, and understanding the supply and demand for socially responsible investment opportunities at the time of decision-making is crucial to comprehending the relationship between a firm's social responsibility strategies and its market value.

While socially responsible practices may be costly for firms, they can be outweighed by the potential benefits of improved stakeholder relations. In their paper Barnett and Salomon (2012) discuss Socially Invested Capital (SIC). They argue that a firm's ability to benefit from social performance depends on its stock of their SIC. Specifically, firms with weaker social performance and inadequate SIC are more likely to experience diminishing returns from increased investments in social issues, leading to further losses. In contrast, firms with higher social performance and substantial SIC are expected to derive greater profits from improved stakeholder relations, resulting in an inflection point in their financial performance. Hence, the firms with the highest social performance possess the greatest capacity to transform social investment into positive financial returns. (Barnett & Salomon, 2012)

The impact of country factors has been argued to have an effect on the profitability of ESG actions as well. In their study, Cai et al. (2016) studied why the CSP ratings are much higher in some countries (e.g., Finland and Sweden) compared to other countries (e.g., US and China). They found that the CSP is influenced by country factors, as they have an impact on the expenses that companies accrue while investing in CSP and the advantages they gain from such investments.

Another aspect that might influence how profitable ESG activities are, is the size of the company. Dorfleitner, Kreuzer, and Sparrer (2020) studied the relationship between ESG scores, ESG controversies and corporate financial performance. They found that having a higher ESG score and little to no ESG controversies resulted in a higher financial performance for smaller companies. However, for larger companies there was no significant effect.

To summarize, the effect of corporate social responsibility on corporate financial performance depends on multiple factors. The effect can be positive, negative, or in some cases where the costs and benefit of CSR cancel each other out there can be no effect at all. (McWilliams et al., 2001) This lack of consensus creates an interesting opportunity for researchers to test multiple hypotheses, using a variety of methodologies, including event studies.

2.4 Efficient market hypothesis

The underlying theory of the efficient market hypothesis (EMH) is closely associated with Fama's (1970) research, providing the basis for asset pricing theories. The core idea of EMH is that the market is seen as efficient when share prices fully reflect all available information. Whenever new information, such as news and announcements, becomes available to the public market, that information should be reflected immediately in the share prices.

Fama (1970) divides the markets to three levels of efficiency: weak form, semi-strong form, and strong form. In the weak form efficiency, the stock prices reflect only the historical information. Semi-strong efficiency exists when stock prices include all

historical and current information that is available to the market. In semi-strong form, when new relevant information becomes available to the public, it should be incorporated to the prices immediately. The strong form assumes that the stock prices reflect all information in the market: not only the public historical and current information, but all private information as well. If the markets behave under the strong form efficiency, it means that the investors would not be able to “beat” the market, thus making it impossible to earn abnormal returns. However, in practice the strong form efficiency does not exist in real world, as all information is not equally available to everyone.

The event study method assumes that the markets are efficient in semi-strong form (MacKinlay, 1997). When the efficiency assumption is relaxed from the strong form to the semi-strong form of, it becomes possible that there is a deviation between the fundamental value and the market value of the company (Naughton, Wang & Yeung, 2019) Even though it is not possible to constantly beat the market returns, the semi-strong efficiency makes it possible for investors to occasionally outperform the market by seeking out possibilities for abnormal returns (Fama, 1970).

2.5 Market reactions to sustainability-related events

This section summarizes the most relevant previous research on the relationship between ESG news and market reactions. The section is divided into four parts: studies on Nordic market, studies on Europe and other markets, and then studies on the connection between ESG ratings and the market reactions. In the last part, the most relevant research is summarized.

2.5.1 Studies on Nordic market

The previous literature on the relationship between ESG-related events and stock market reactions on the Nordic market is scarce. In general, if there are Nordic companies included in a study concerning this topic, they tend to be merged together with the European market and the results are not separated. This gap in the research proves that there is a profound need for more studies on the Nordic market in particular.

The Nordic market was separated from the European market in the study of de Vincentiis (2022). The study measures abnormal returns following the publication of positive and negative news concerning ESG issues. They found that both the strength of the market reaction and the statistical significance are higher in Nordic countries than in Europe. On average, the three-day cumulative abnormal returns from negative news were -2.60% and from positive news 1.62%.

2.5.2 Studies on Europe and other markets

Even though the literature on the relationship between ESG-related events and stock market reactions in the Nordic markets is scarcer, the topic has been studied more globally, especially in the Europe, US, and APAC markets. Capelle-Blancard and Petit (2017) studied the relationship between ESG news and stock market reaction, targeting over 100 listed companies globally. They found out that on average, the market value of the companies that faced negative events dropped 0.1%. On the other hand, positive news had neither positive nor negative effect.

In Europe and in the US the market reactions seem to differ from each other. In Europe negative ESG news seem to result in a negative reaction to the firm's market value, whereas good news has a smaller impact. Instead, in the US negative ESG news are associated with a positive reaction to the firm's market value, whereas positive ESG news have a negative effect. This could be because investments in sustainability are interpreted as unproductive costs by investors. (de Vincentiis, 2022) However, in another study the stock prices did react negatively after negative ESG news in the US markets (Derrien, Krueger, Landier & Yao, 2021).

Krüger (2015) examined the market reactions to positive and negative news regarding social responsibility in the US. He proved that the market has a strong negative reaction to negative CSR-related news. The market had negative reaction toward positive news as well, however the reaction was much weaker when compared to the reaction to negative news. Moreover, it was also showed that the stock prices increased, when the positive news were the result of efforts aimed at offsetting prior social irresponsibility. They also found evidence that evidence that the market reacts more strongly when the news have a strong sentiment related to them.

Jacobs, Singhal, and Subramanian (2015) focused their research on positive events in the US market. They examined the market reactions to two categories of environmental announcements: Corporate Environmental Initiatives (CEIs), that provide information about self-reported environmental activities, and Environmental Awards and Certifications (EACs), that give information about environmental performance provided by third parties. They found that the market had no significant reaction to neither of the announcements. However, there did exist statistically significant reactions for some of the CEI and EAC subcategories.

Consolandi, Jaiswal-Dale, Poggiani, and Vercelli (2009) studied the stock market reactions to announcements of inclusions and exclusions in the Dow Jones Sustainability Stoxx Index (DJSSI) that focuses on the European corporations with the highest CSR scores. In the case of inclusion, they observed positive abnormal returns in the short-term. In their study the abnormal returns start before the announcement, which they considered to be due to preceding information leakages. The positive abnormal returns start to diminish shortly after the event date. Conversely, the similar effect applies to exclusions as well. The negative abnormal returns start the day before exclusion and the negative effect starts to diminish in time.

Cheung (2011) studied how financial markets react to the news of a company being added or removed from the Dow Jones Sustainability Index (DJSWI) in the USA. The study did not find significant evidence that the announcement of a company being included or excluded from the DJSWI had an impact on the on the stock returns. However, there was evidence of significant temporary reactions observed on the day of the announcement and the surrounding days. The stocks that were included to the DJSWI experienced an increase in stock returns, whereas the excluded stocks suffered from a decrease in stock returns.

In APAC markets positive news seem to have no significant impact on the market value of the company. The impact of negative news on the other hand is debatable – In the study of de Vincentiis (2022) the outcome was that negative ESG news did not have any significant impact on prices. Surprisingly de Franco (2020) found out that the stocks with the highest levels of controversy performed significantly better than the overall market.

2.5.3 Studies on the impact of ESG ratings

Forecasts are known to shape the market expectations. The same applies to the effect that ESG ratings can have on market reactions when ESG-related news are published. The connection between ESG ratings and market reactions has been studied a lot, but the results of those studies vary. Some have found a positive connection between ESG ratings and market reactions (de Vincentiis, 2022), while others argue that the relationship would in fact be negative (Serafeim & Yoon, 2022).

de Vincentiis (2022) found that companies with higher ESG ratings experience higher market reactions with both negative and positive news. Vincentiis argues that sustainability and strong ESG reputation are seen as a valuable asset for the company that is built over time, and information (both negative and positive) concerning this asset can produce a significant impact on stock market prices.

Serafeim et al. (2022) studied how ESG ratings affect the market reactions to ESG-related news. They found that companies with higher ESG ratings exhibit a less significant market reaction to positive news than companies with lower ESG ratings. That finding could imply that the impact of positive news has already been incorporated into the stock prices of companies that have a better ESG performance. Another reason why the market would react negatively could be that positive ESG news signals a rise in a company's costs, which in turn would be a disadvantage in a competitive market (Jensen, 2002). That could be true in a market that does not value ESG activities and ESG reputation highly.

2.5.4 Summary of the previous studies

Table 1 summarizes the most relevant previous research. Most of the studies included are on US or European markets, and only one study has divided the Nordic market into its own area. The studies are focused on either examining the market reactions to either ESG news or inclusion and exclusion of some sustainability related index or list.

Most of the past studies have been conducted on the US or European markets, or both. Majority of the past studies have found that negative events cause significant negative market reactions (Capelle-Blancard et al., 2017; Cheung, 2010; Consolandi et al., 2008;

Derrien et al., 2021; Krüger, 2015; Serafeim et al., 2022). Regarding positive events, there is proof that positive events can cause significant positive market reactions (Cheung 2010; Consolandi et al., 2008; Serafeim et al., 2022). However, some studies have showed that there is no significant reaction to positive news (Capelle-Blancard et al., 2017; Jacobs et al., 2010).

However, Krüger (2015) found that in the US positive events cause a negative market reaction. The negative reaction to positive events was still smaller than the negative reaction to negative news. Correspondingly, in the study of de Vincentiis (2022) the results suggest that in US positive events would cause a negative market reaction. However, the results on Europe are in line with the other studies, implying that negative events cause negative reactions. There were no significant results found for positive events in the European markets. In Nordic markets negative events cause a significant negative market reaction, and positive events cause a significant positive market reaction.

Serafeim et al. (2022) studied how the ESG rating of a company affects the market reactions to ESG news in the US market. They found that the stock prices of companies with higher ESG ratings experienced smaller positive stock reactions, than companies with lower ESG ratings. However, when the news was negative, the ESG rating of a company did not affect the strength of the market reaction. Furthermore, having a lower ESG rating had no impact on the strength of the market reaction to neither positive news nor negative news. However, de Vincentiis (2022) argues that companies with higher ESG ratings experience higher market reactions with both negative and positive news.

Table 1. Summary of the most relevant previous research.

Author(s)	Research focus	Event	Method	Area	Main findings
Capelle-Blancard et al. (2017)	Examining the impact of negative and positive ESG news to firms' market value	Negative Positive	Event study	Global	Negative events cause negative ARs (0.1%), positive events have no significant impact.
Cheung (2010)	Examining how markets respond to the news that a company is added to (or deleted from) the list of leading corporate sustainable companies	Negative Positive	Event study	US	Negative events cause negative ARs, positive events cause positive ARs.
Consolandi et al. (2008)	Analysing whether the stock market evaluation reacts to the inclusion (deletion) in the DJSSI	Negative Positive	Event study	Europe Nordic Europe	Negative events cause negative ARs (-0.08%), positive events cause positive ARs (0.059%) In Nordic markets, negative events cause negative ARs (-2.60%), positive events cause positive ARs (1.62%). In Europe, negative events cause negative ARs (-1.31%), positive events have no significant impact.
de Vincentiis (2022)	Examining the impact of ESG news to stock returns and comparing different geographical areas.	Negative Positive	Event study	US APAC	In US negative have no significant impact, positive events result in negative ARs (-1.92%). In APAC markets, neither negative nor positive events have a significant impact.
Derrien et al. (2021)	Examining the expected consequences of negative ESG news on firms' future profits.	Negative	Regression	US	Negative events cause negative ARs.
Jacobs et al.	Examining	Positive	Event study	US	Positive events have no significant impact.

(2010)	the market reactions to CEIs and EACs				
Krüger (2015)	Studying how stock markets react to CSR events.	Negative Positive	Event study	US	Negative events cause negative ARs (-1.31%), positive events cause negative ARs (-0.47%).
Serafeim et al. (2022)	Studying how the ESG rating affects the stock reactions around ESG news	Negative Positive	Regression	US	Negative events cause negative ARs, positive events cause positive ARs. Reaction to positive events is smaller for firms with a high ESG rating.

3 Data and methodology

In the first part of this section, the data used in the research and the selection criteria for the data will be presented and described. The data consists of ESG-related news that have a negative or positive sentiment related to them, and the daily closing stock prices of each selected company. Additionally, for each company the ESG rating and the market cap for the measure of size are collected. The second part goes through the event study methodology and the relevant formulas used to conduct the study.

3.1 Data

The data is gathered for a total of 87 listed companies, 40 Nordic and 47 European. In this study, the Nordic companies are excluded from the European sample, as the two are treated as separate samples. For each company, one negative and one positive ESG-related news is gathered, for a total of 174 articles (80 news concerning Nordic companies and 94 news concerning European companies). The articles are gathered from the Refinitiv news stream, and the most common news sources are Reuters News and The Independent.

All the articles about both the Nordic and European companies are published within the time period of January 1st, 2018 – December 31st, 2022. Besides region and publishing time, the Refinitiv search query is also filtered to contain only significant news. Figure 2 shows that the majority (74%) of the news about the Nordic companies were published in 2021 or 2022. 21 news (26% of the total) were published between 2018-2020.

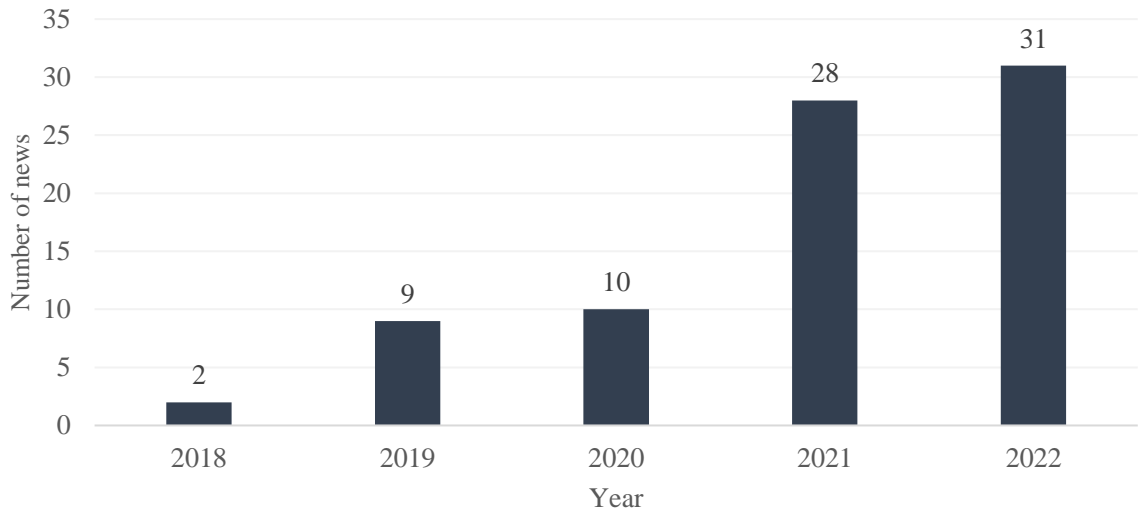


Figure 2. News about Nordic companies by publishing year

Similar distribution applies for the news about European companies as well. Figure 3 shows that 40 of the news were published in 2022 and 28 of them in 2021. That counts for 72% of the news in total. The rest, 26 news, were published between 2018-2020.

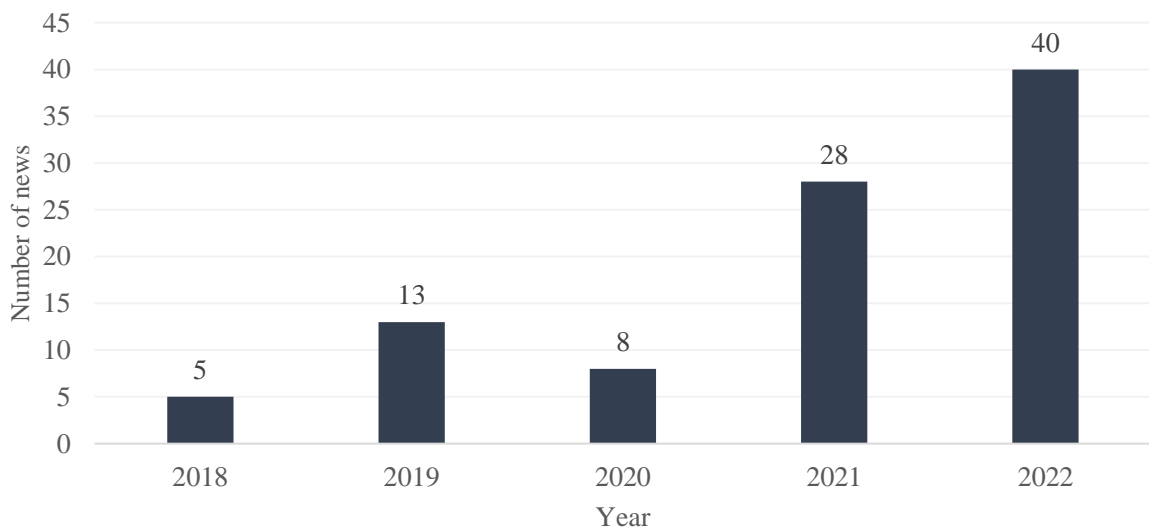


Figure 3. News about European companies by publishing year

All the companies included in the study are listed on the Nordic and European stock exchanges. Figure 4 shows the distribution of the included companies by country. The

news concerning the Nordic companies was collected from three countries: Denmark, Finland, and Sweden. The European data consists of news concerning companies in Belgium, France, Germany, Italy, Netherlands, Spain, Switzerland, and the UK.

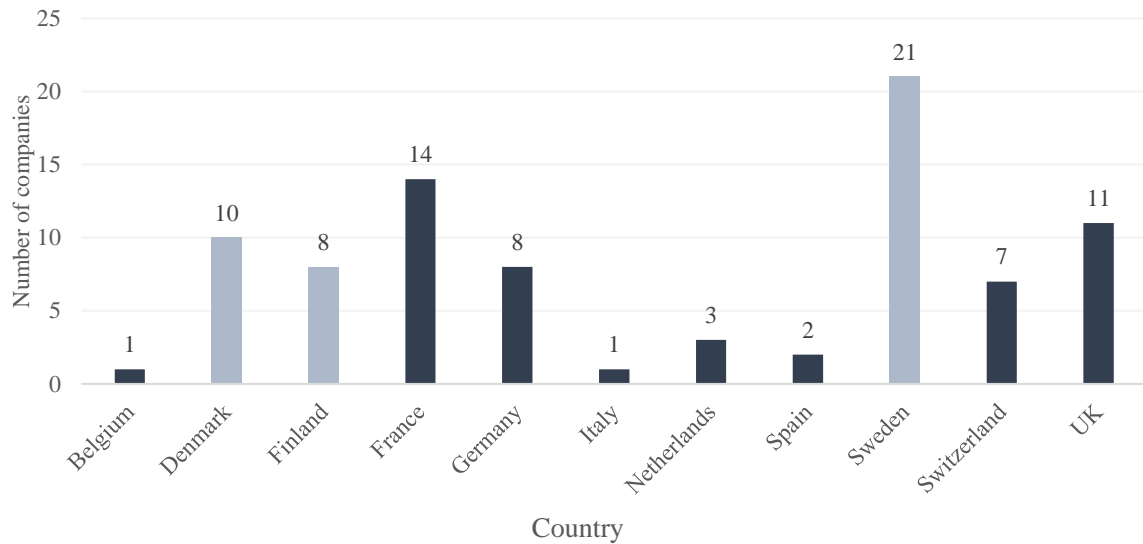


Figure 4. Companies by country

Table 2 summarizes basic descriptive statistics of the market capitalizations of the Nordic companies, presented in US dollars. The market cap is used as a proxy for the size of the company. For the Nordic companies it ranges from 8.7 billion to 273.9 billion, the average being 37.4 billion.

Table 2. Size statistics of Nordic companies

	Average	Median	Min	Max
Market Cap (USD)	37 468 429 235.92	24 227 423 674.97	8 793 852 647.74	273 914 487 907.86

Based on the market capitalization the companies were divided to three different size categories to study the possible relationship between the size of the company to the market reactions. Figure 5 displays the size distribution of the Nordic companies, classified into three different categories: small, mid, and large. Most of the companies are in the “Mid” category, which consists of 18 companies.

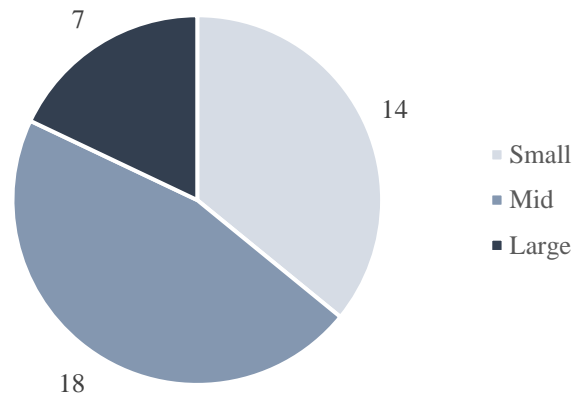


Figure 5. Size distribution of Nordic companies

In Table 3 is a summary of basic descriptive statistics of the market capitalizations of the European companies, presented in US dollars. The European companies are larger in size compared to the Nordic companies, market cap ranging from 44.9 billion to 447.3 billion. The average market cap is 116.9 billion.

Table 3. Size statistics of European companies

	Average	Median	Min	Max
Market Cap (USD)	116 984 802 347.70	86 003 603 887.89	44 996 930 551.95	447 316 442 929.56

Figure 6 displays the size distribution of the European companies, classified again into three different categories: small, mid, and large. Most of the companies are in the “Small” category, which consists of 21 companies. 11 companies are in the “Mid” category, and 15 companies are in the “Large” category.

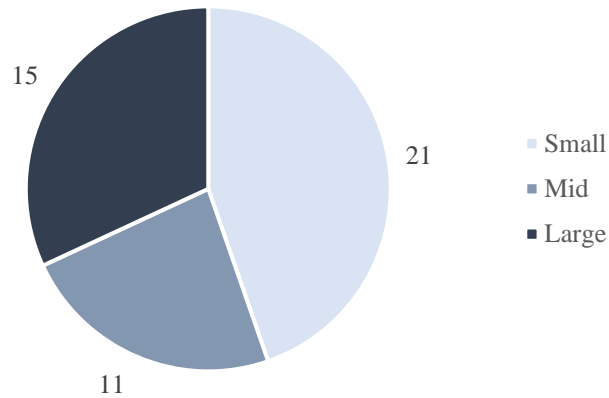


Figure 6. Size distribution of European companies

To examine the relationship between a company's ESG performance and the strength of market reaction, ESG scores of the chosen companies were also collected from Refinitiv. Refinitiv gives companies an ESG grade based on their ESG score. There are twelve grades ranging from D- to A+. For this study, the ESG grades were further divided into three different categories: Low, medium, and high. The thresholds used for each category are presented in Table 4. Companies with ESG score under 0.5 are placed in the “low” category. In the “Medium” category are companies that have an ESG score that is between 0.5 and 0.75. Any company with an ESG score higher than that goes to the “High” category.

Table 4. ESG scores and thresholds for ESG categories

Score range	Grade (Refinitiv)	Category
0.0 <= score <= 0.083333	D-	Low
0.083333 < score <= 0.166666	D	
0.166666 < score <= 0.250000	D+	
0.250000 < score <= 0.333333	C-	
0.333333 < score <= 0.416666	C	
0.416666 < score <= 0.500000	C+	
0.500000 < score <= 0.583333	B-	Medium
0.583333 < score <= 0.666666	B	
0.666666 < score <= 0.750000	B+	
0.750000 < score <= 0.833333	A-	High
0.833333 < score <= 0.916666	A	
0.916666 < score <= 1	A+	

Figure 7 presents the ESG categories of Nordic companies. Majority of the companies are classified to the “Medium” category (22 companies). 5 companies are in the “Low” category, and 13 in the “High” category.

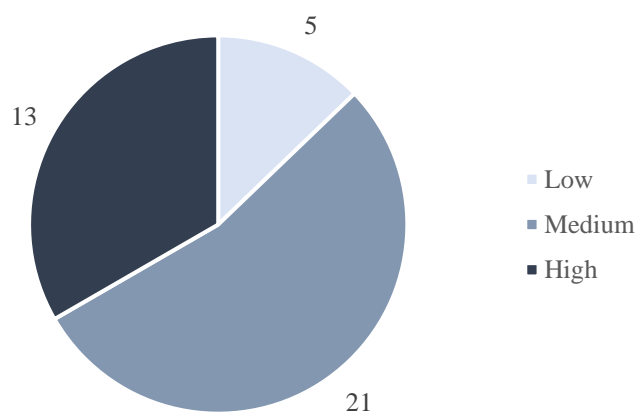
**Figure 7.** ESG category of Nordic companies

Figure 8 displays the ESG categories of European companies. “Medium” category is the largest, similarly to the distribution of the Nordic companies. 23 companies are in the

“Medium” category. “Low” and “High” categories are of similar size, there being 13 companies in the former and 11 in the latter category.

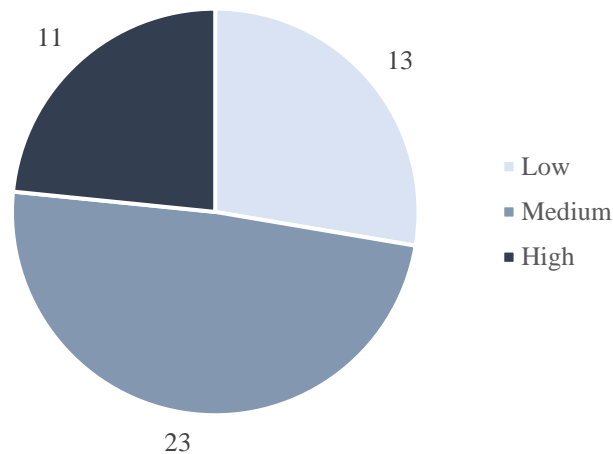


Figure 8. ESG category of European companies

3.2 Methodology

In this sub-section the event study methodology is further explained and the steps to conduct the study are gone through. The section will also cover the limitations of event study, and how they have been considered in the research design of this study.

3.2.1 Event study

Event studies have been used widely in the fields of economics and finance to study the stock price effect that occurs after a major corporate announcement. These include quarterly reports, announcements of mergers and acquisitions, or, as in this study, the publication of news. An event study is a method of measuring the impact of a distinct event on the value of a company. The value of this methodology lies in the assumption that in a rational market, the effects of an event will be immediately reflected in security prices. (MacKinlay, 1997)

Even though there does not exist any standard procedure for conducting an event study, the studies typically follow a general framework. The initial task in conducting an event study is to define the event of interest and identify the time period during which the selected event of relevant firms will be examined. It is customary for the event window to extend beyond the specific period of interest in order to examine the periods surrounding the event. (MacKinlay, 1997) For example, prior to the publication of the news, the market may have obtained information about the event. By analyzing the returns prior to the event, one can investigate this possibility.

In this study, the events of interest are the ESG-related news that have either a negative or a positive sentiment related to them. As said, the event window is usually larger than the actual event date, extended to days before and after the event. In this study four event windows of different lengths are used, which are presented in Figure 9. There are two shorter windows, that are three days (-1, +1) and seven days (-3, +3) long, one medium window that is 11 days (-5, +5) long and one longer window that is 21 days (-10, +10) long.

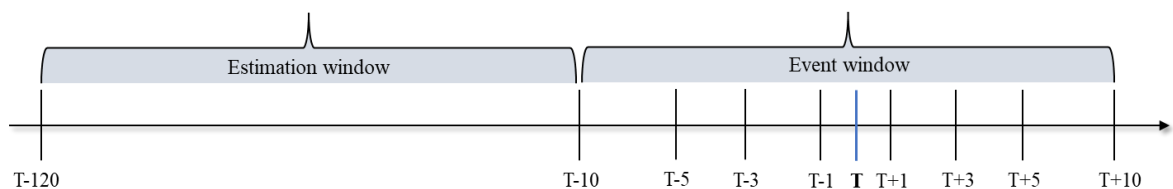


Figure 9. Estimation and event windows.

After identifying the event window, the next step is to define the estimation window. The most common method is to use the period prior to the event window, for example 120 days prior to the event. Usually, the estimation window length ranges from 100 to 300 days for daily studies (Armitage, 1995). The estimation window is used to estimate the normal performance model parameters, which then is used to estimate the abnormal returns. To avoid the event itself from influencing the normal performance model, it is advisable to not include the event period to the estimation period. (MacKinlay, 1997) In this study, the estimation window is defined to be the 120 days prior to the event, as can be seen from Figure 9 above.

3.2.2 Normal and abnormal return

To estimate the abnormal returns caused by the event, the normal return must be estimated first. The normal return is defined as the expected return of a security, without conditioning on the event taking place. Several approaches are available to calculate the normal return of a given security, but the most common choices are the constant mean return model and the market model. (MacKinlay, 1997)

To accurately specify either of the two models, an assumption that the returns remain independently and identically distributed through time is imposed. Although this assumption is strong, in practice it generally does not lead to problems as the assumption is reasonable empirically. Also, inferences derived from the normal return models tend to be resilient. (MacKinlay, 1997)

The evidence suggests that the market model will perform equally well, or even better than, any alternative model in most circumstances. The expected normal return of a security is estimated by ordinary least squares (OLS) regression when applying the market model. (Armitage, 1995) In this study, the market model approach is used to estimate the normal returns.

The market model formula to estimate the normal return for any stock i is:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \epsilon_{it} \quad (1)$$

$$E(\epsilon_{it} = 0) \quad \text{var}(\epsilon_{it}) = \sigma_{\epsilon_t}^2$$

where R_{it} and R_{mt} are the returns of the stock i and the market portfolio m during period t . α_i , β_i are the regression coefficients, and ϵ_{it} is the error term. The expected value of the error term in the equation is zero, $E(\epsilon_{it} = 0)$, and the variance is expected to be constant, $\text{var}(\epsilon_{it}) = \sigma_{\epsilon_t}^2$. The market model is a statistical model that relates the return of the stock to the return of the market portfolio. The market model's linear specification is based on the assumed joint normality of the asset returns. (MacKinlay, 1997)

After estimating the normal return with the market model, the abnormal returns can be estimated. The abnormal return is defined as the actual realized return of the security over the event window minus the estimated normal return of the firm over the event window (MacKinlay, 1997). In other words, any significant difference from the expected return is an abnormal or excess return. In this study, the abnormal return is calculated by:

$$AR_{it} = R_{it} - E(R_{it}|X_t) \quad (2)$$

where AR_{it} is the abnormal return of stock i , R_{it} is the actual realized return of the stock, and $E(R_{it}|X_t)$ is the estimated expected normal return.

To draw overall conclusions about the event of interest, it is necessary to combine the observations of abnormal returns. When dealing with a multiple period event, the concept of cumulative abnormal return (CAR) becomes essential. The CAR for the chosen time period is the sum of the abnormal returns (MacKinlay, 1997), and in this study it is calculated with:

$$CAR_i(t_1, t_2) = \sum_{t=t_1}^{t_2} AR_{it} \quad (3)$$

where $CAR_i(t_1, t_2)$ is the cumulative abnormal return for the stock i over the period t_1, t_2 . However, the cumulative abnormal return only accounts for one stock – therefore, the observations of the abnormal returns must be aggregated for the event window and across the observations of the event.

The individual stocks' abnormal returns can be aggregated using AR_{it} for each event period. To calculate the daily average abnormal returns (AAR), the following equation is used:

$$AAR_t = \frac{1}{N} \sum_{i=1}^N AR_{it} \quad (4)$$

where AAR_t is the average abnormal return on day t , and N is the number of events.

Finally, the average abnormal returns can then be aggregated over the event window to examine the impact of the news announcement over the whole sample for any interval in the event window period. Similar approach that was used previously to calculate the cumulative abnormal return for each security is now used to calculate the cumulative average abnormal return (CAAR). In this study, CAARs for the four selected event window intervals are calculated with:

$$CAAR(t_1, t_2) = \sum_{t=t_1}^{t_2} AAR_t \quad (5)$$

where $CAAR(t_1, t_2)$ is the cumulative average abnormal return over the event window t_1, t_2 . (MacKinlay, 1997)

3.2.3 Significance tests

To determine whether there is a statistically significant market reaction to the ESG-related news, the estimated abnormal returns must be hypothesis tested. According to Armitage (1995), it is preferable to use a t-test or a rank test to test the null hypothesis that the abnormal returns are zero. In this study, the standard Student's t-test is used.

The t-statistic for the average abnormal returns is calculated with:

$$\theta_1 = \frac{AAR_t}{\sqrt{\sigma^2(AAR_t)}} \sim N(0,1) \quad (6)$$

where AAR_t is the average abnormal return on day t , and σ^2 is the variance.

Similarly, the cumulative average abnormal returns are tested with:

$$\theta_1 = \frac{CAAR(t_1, t_2)}{\sqrt{\sigma^2(CAAR(t_1, t_2))}} \sim N(0,1) \quad (7)$$

where $CAAR(t_1, t_2)$ is the cumulative average abnormal return over the event window t_1, t_2 . (MacKinlay, 1997)

Welch's t-test, also known as the unequal variance t-test, is used for comparing the means of two independent groups. In this study, the test is performed to determine whether there are statistically significant differences in the abnormal returns between the Nordic and European markets, and between the negative and positive news. Welch's t-test is used when the number of observations in the groups is different, and the variance of the groups is unequal as well. The null hypothesis of the test is that the two groups have identical means. (Welch, 1947) The Welch's t-test is calculated with:

$$t = \frac{AAR_{tA} - AAR_{tB}}{\sqrt{\frac{S_A^2}{n_A} + \frac{S_B^2}{n_B}}} \quad (8)$$

where AAR_{tA} and AAR_{tB} are the average abnormal returns on day t for the two samples A and B , S_A and S_B are the standard deviations of the two samples. n_A and n_B are the samples sizes. The Welch's t-test is calculated for the cumulative average abnormal returns similarly with:

$$t = \frac{CAAR(t_1, t_2)_A - CAAR(t_1, t_2)_B}{\sqrt{\frac{S_A^2}{n_A} + \frac{S_B^2}{n_B}}} \quad (9)$$

where $CAAR(t_1, t_2)_A$ and $CAAR(t_1, t_2)_B$ are the cumulative average abnormal returns over the event window t_1, t_2 of the samples A and B .

Additionally, the Welch's t-test requires the degrees of freedom to be defined beforehand. The equation to determine the degrees of freedom is as follows:

$$df = \left(\frac{S_A^2}{n_A} + \frac{S_B^2}{n_B} \right)^2 / \left(\frac{S_A^4}{n_A^2(n_A - 1)} + \frac{S_B^4}{n_B^2(n_B - 1)} \right) \quad (10)$$

where S_A and S_B are the standard deviations of the two samples, and n_A and n_B are the samples sizes.

3.2.4 Limitations of event study

This section goes through the limitations of event study, and the criticism that the methodology has received in the past. It is also explained how the possible problems have been taken into consideration in the research design of this study to make as accurate estimations as possible. The limitations that this section covers have to do with the sample size, estimation window length, event window length, information leakages, and industry effects.

As with other statistical research methods, having too small of a sample size increases the probability for consequential outliers exist in the sample, which can have a relatively large impact on the results (Lichtenberg & Siegel, 1991). Obtaining large enough sample is important especially if the intent is to divide the sample into smaller sub-samples for further analysis (McWilliams & Siegel, 1997), as in this study when the Nordic and European samples are divided into sub-samples based on the ESG score and the size of the company.

Event period betas can differ from the estimation period betas. Therefore, to make accurate estimates of the pre-event alphas and betas the estimation period should be defined to be long enough. Sufficient estimation period length is considered to be at least 100 days. (Armitage, 1995)

As mentioned before, the event study methodology is based on the assumption that the market is efficient. That is, the investors react quickly to new information and therefore the

stock prices are always reflecting all the available information that is available in the market (Fama, 1970). If the efficient market hypothesis holds, it should mean that a short event window would incorporate all abnormal returns. Therefore, most researchers use event windows that are typically three days or even shorter. (McWilliams, Siegel & Teoh, 1999)

The date when the information reaches the market can vary from the actual publication date of the news, making it hard to define a precise event date when the investors are able to react to the new information. In the markets there can often be this kind of “information leakage” or prior investor speculation that affects the investor decisions. To ensure that the event is contained within the event window the event window can be expanded. However, having too large of an event window can lead to so-called confounding effects, where there are multiple significant events inside the event window. (McWilliams et al., 1999)

When using a shorter event window, it is easier to isolate the effect of the event, making it more reasonable to assume that the possible abnormal return is caused by the certain event only, and there are no confounding events. Therefore McWilliams et al. (1997) argue that inferences drawn from the shorter event windows can be more valid than the ones drawn from longer windows, as the possibility of confounding events is smaller. However, when the sample is larger the confounding effects are more likely to be randomly distributed. In that case, using longer event windows is justified. (Brown & Warner, 1985) Therefore, in this study longer event windows are used in addition to the shorter ones.

If large number of companies in the sample belong to the same industry, clustering (known also as industry effects) may cause a problem. This is because the possible errors in the model that is used to estimate the normal returns are more likely to be correlated among the companies in the same industry. To avoid clustering, the researcher can for example use a shorter event window and ensure that the events of the sample companies do not happen on same dates (Armitage, 1995). Having a larger sample with companies from multiple different industries and countries also makes it less likely for industry effects to have a significant effect on the results. (McWilliams et al., 1999) In this study industry effects are likely not a problem, as the sample companies are from different countries and industries.

4 Results

In this section, the empirical results of the study are presented. The section is divided into six sub-sections. The first sub-section presents the market reactions to negative ESG-related news, comparing results between the Nordic and European markets. The second sub-section presents the market reactions to positive ESG-related news, once again comparing results between the two markets. In the third sub-section the reactions to negative and positive news are compared. The fourth sub-section covers the reactions to the news, categorized based on the ESG score of the company. In the fifth sub-section the reactions to the news are compared among companies categorized into three different categories based on the size of the company. Lastly, in the sixth sub-section the beta stability of the model is tested.

Based on the previous research and literature on this topic, and the research questions specified in the first section, the hypotheses are formulated. The hypotheses for this study are as follows:

H1: The market has a negative reaction to negative ESG-related news.

H2: The market has a positive reaction to positive ESG-related news.

H3: The reaction to ESG-related news is stronger in the Nordic market than in the European market.

H4: The reaction to negative ESG-related news is stronger than the reaction to positive ESG-related news.

H5: The reaction to negative ESG-related news is stronger for companies that have a higher ESG score.

H6: The reaction to positive ESG-related news is stronger for companies that have a lower ESG score.

H7: The reaction to negative ESG-related news is stronger for larger companies.

H8: The reaction to positive ESG-related news is stronger for larger companies.

4.1 Market reactions to negative news

The average abnormal returns (AARs) from the negative news for the whole 21-day event window, [-10, +10], are presented in Table 5. In both markets, Nordic and Europe, the abnormal returns are significantly negative on the event day (t). On the days right around the event date (t-1 and t+1) there are significant abnormal returns as well in both markets.

In the Nordic market the abnormal returns are significantly positive on the day before the event (0.530%). On the event date the negative abnormal returns are at their biggest (-2.409%), and the returns continue to be negative for two days after the event date. On the third day the negative effect seems to disappear, although the result is statistically insignificant. It should be noted that there are significant negative abnormal returns on days t-7 and t-8 as well.

In the European market there are slight positive abnormal returns on the day before the event date (0.186%), similar to the Nordic market. The abnormal returns shift to negative right on the event date (-0.567%), and the negative effect remains until one day after the event. After that, on the second day after the event, the abnormal returns revert to being positive, although insignificantly. There are significant negative returns three, seven and ten days before the event date as well. The significant negative returns days before the event date indicate that there might be information leaks or some investor suspicions circulating in the market that cause a premature negative market reaction (McWilliams et al., 1999; McWilliams et al., 1997).

Table 5. Average abnormal returns from negative news in the 21-day event window.

Event window	Nordic		Europe		Welch's t-stat
	AAR	t-stat	AAR	t-stat	
t+10	-0.067 %	-0.1891	0.266 %	0.6427	-0.6115
t+9	-0.169 %	-0.6426	-0.101 %	-0.4442	-0.1964
t+8	0.240 %	0.8098	0.041 %	0.1258	0.4538
t+7	0.122 %	0.3761	0.252 %	1.3724	-0.3502
t+6	-0.301 %	-0.5603	-0.169 %	-0.8203	-0.2287
t+5	-0.261 %	-0.8658	0.173 %	0.7797	-1.1596
t+4	0.060 %	0.2216	-0.352 %	-1.6255	1.1874
t+3	0.222 %	0.6714	0.003 %	0.0179	0.5770
t+2	-0.979 %	-2.8936 ***	0.094 %	0.4815	-2.7480 ***
t+1	-0.373 %	-1.2482 **	-0.165 %	-0.8397 **	-0.5821
t	-2.409 %	-4.6273 ***	-0.567 %	-3.6500 ***	-3.3911 ***
t-1	0.530 %	1.7464 *	0.186 %	1.0693 *	0.9841
t-2	0.521 %	1.3555	-0.120 %	-0.6906	1.5196 *
t-3	0.414 %	1.6486	-0.369 %	-1.7509 *	2.3885 ***
t-4	-0.160 %	-0.6814	0.087 %	0.4620	-0.8205
t-5	0.198 %	0.6869	-0.085 %	-0.3578	0.7570
t-6	0.176 %	0.5880	0.221 %	1.3439	-0.1334
t-7	-0.588 %	-1.8283 *	-0.674 %	-3.1286 ***	0.2215
t-8	-0.545 %	-1.7472 *	-0.161 %	-0.8269	-1.0440
t-9	0.104 %	0.5824	0.168 %	0.9875	-0.2601
t-10	-0.471 %	-1.4195	-0.336 %	-1.9119 *	-0.3604

Significance level: 1% ***, 5% **, 10% *

The Welch's t-test results of comparing the average abnormal returns of the two markets are highly significant on the event date, suggesting that there is a stronger market reaction to negative news in the Nordic market, compared to Europe. The Welch's t-stat is significant two days after, and two and three days before the event as well. Moreover, it seems that the negative reaction remains longer in the Nordic market than in Europe. In the Nordic market the abnormal returns stay negative for two days after the event date, whereas in Europe the abnormal returns turn positive only after one day.

In Table 6 the cumulative average abnormal returns (CAARs) from negative news are presented for nine event windows: -1 to +1, -3 to +3, -5 to +5, -10 to +10, 0 to +1, 0 to +3,

0 to +5, 0 to +10, and -1 to -10. Commonly in event studies the event windows contain pre-event dates in addition to post-event dates (and the event date itself), to capture the possible information leakages. The first four event windows are established for that purpose. The next four event windows exclude the pre-event dates, containing only the event date and post-event dates. Lastly, the purpose of the event window that contains only pre-event dates (-1 to -10) is to investigate whether there are significant cumulative abnormal average returns during the 10-day window preceding the event.

The abnormal returns in both Nordic and European markets are significantly negative within the four event windows surrounding the event date ([-1, +1], [-3, +3], [-5, +5], [-10, +10]). The CAARs follow the same pattern as the results in Table 5, implying that the market reactions to negative news are stronger in the Nordic markets than in Europe. In the short [-1, +1] window, the negative returns are -2.251% in the Nordic markets, and -0.546% in Europe. The [0, +1] window seems to follow a similar trend, the negative returns being larger in the Nordic market (-2.782%) than in Europe (-0.732%). Moreover, the abnormal returns are larger in the Nordic market in all event windows (excluding the pre-event window [-1, -10]), and the Welch's t-test results suggest that the difference is significant in all windows except [-5, +5]. It should also be noted that the negative returns seem to increase as the event window gets longer, signalling that the negative effect caused by the news does not disappear immediately after the event.

Table 6. Cumulative average abnormal returns from negative news.

Event Window	Nordic		Europe		Welch's t-stat
	CAAR	t-stat	CAAR	t-stat	
[-1, +1]	-2.251 %	-4.4066 ***	-0.546 %	-2.0645 **	-2.9656 ***
[-3, +3]	-2.074 %	-2.7209 ***	-0.937 %	-2.7535 ***	-1.3617 *
[-5, +5]	-2.237 %	-2.1960 **	-1.114 %	-2.9125 ***	-1.0321
[-10, +10]	-3.737 %	-2.7540 ***	-1.607 %	-2.6395 **	-1.4320 *
[0, +1]	-2.782 %	-5.3720 ***	-0.732 %	-3.1013 ***	-3.6031 ***
[0, +3]	-3.539 %	-6.2666 ***	-0.634 %	-2.1256 **	-4.5475 ***
[0, +5]	-3.740 %	-4.5474 ***	-0.813 %	-2.7621 ***	-3.3507 ***
[0, +10]	-3.915 %	-3.2352 ***	-0.524 %	-1.1062	-2.6088 ***
[-1, -10]	0.178 %	0.2271	-1.083 %	-1.9073 *	1.3030

Significance level: 1% ***, 5% **, 10% *

In the Nordic market there are no significant cumulative average abnormal returns in the pre-event window [-1, 10]. However, in the European market there seems to be weakly significant negative CAARs (-1.083%) in the 10-day pre-event window. That finding gives more support to the possibility of information leaks existing in the European market. Another possibility is that there are confounding effects, which can often happen when longer event windows are used.

The results presented in Table 5 and Table 6 give support to accepting the first hypothesis, suggesting that there is a negative market reaction to negative ESG-related news. That further indicates that negative ESG-related news can have a significant impact on the company's market value. Furthermore, regarding negative news, the third hypothesis is also supported: it appears that reactions to negative ESG-related news are stronger in the Nordic market than in the European market, and that the difference is significant on the event date and in most of the event windows.

4.2 Market reactions to positive news

The average abnormal returns (AARs) from positive news for the 21-day event window are presented in Table 7. On the event date, the abnormal returns are significantly positive in both Nordic and European markets. There are statistically significant abnormal returns on the days right around the event date (t-1 and t+1) in both markets.

In the Nordic market the abnormal returns are significantly negative one day before the event date. On the event date the abnormal returns turn positive (1.391%) and one day after the event date the returns are even higher. After that the positive reaction seems to attenuate. However, on the fourth day after the event there is still a weakly significant positive effect to be observed.

As in the Nordic market, in the European market there are negative abnormal returns on the day before the event date as well. On the event date the positive abnormal return is at its highest (0.756%), and significant positive abnormal returns can still be observed one day after the event date. Before the event date, on t-3, there are significant positive abnormal returns as well.

In both markets there are significant positive abnormal returns a few days before the event, in Nordic markets on t-5 (0.613%) and in European markets on t-3 (0.428%). This could indicate that there are information leaks in the market, similarly to the negative news, and the investors are reacting to the leaked information ahead of the actual publication of the news (McWilliams et al., 1997; McWilliams et al., 1999).

Table 7. Average abnormal returns from positive news in the 21-day event window.

Event Window	Nordic		Europe		Welch's t-stat
	AAR	t-stat	AAR	t-stat	
t+10	0.133 %	0.6602	0.033 %	0.1545	0.3372
t+9	-0.165 %	-0.5651	0.034 %	0.1926	-0.5830
t+8	-0.289 %	-1.1601	-0.109 %	-0.5748	-0.5764
t+7	-0.135 %	-0.5621	-0.259 %	-1.1601	0.3776
t+6	0.153 %	0.4842	0.193 %	1.0004	-0.1078
t+5	-0.122 %	-0.4132	0.267 %	1.1900	-1.0500
t+4	0.445 %	1.6973 *	0.325 %	1.6549	0.3645
t+3	-0.217 %	-0.7434	-0.030 %	-0.1552	-0.5331
t+2	0.467 %	1.6479	0.160 %	0.8182	0.8934
t+1	1.434 %	6.6239 ***	0.557 %	3.0203 ***	3.0829 ***
t	1.391 %	4.0840 ***	0.756 %	2.6580 **	1.4314 **
t-1	-0.605 %	-1.7908 *	-0.355 %	-1.7427 *	-0.6333
t-2	0.143 %	0.4684	0.303 %	1.6770	-0.4534
t-3	0.229 %	0.8706	0.428 %	1.7951 *	-0.5591
t-4	0.131 %	0.3737	-0.194 %	-0.7526	0.7474
t-5	0.613 %	3.0677 ***	-0.310 %	-1.5842	3.3000 ***
t-6	-0.011 %	-0.0379	-0.213 %	-0.9749	0.5563
t-7	0.300 %	1.3888	-0.236 %	-1.0102	1.6847 **
t-8	-0.053 %	-0.1873	-0.124 %	-0.6957	0.2116
t-9	0.331 %	0.7398	0.066 %	0.3228	0.5395
t-10	0.186 %	0.7504	0.156 %	0.6219	0.0848

Significance level: 1% ***, 5% **, 10% *

Altogether, the positive reaction to the positive news on the event date and on the days following that seems to be stronger in the Nordic market compared to Europe. The

difference in the average abnormal returns is significant on the event date and on the day after, according to the Welch's t-statistic. There are also significant differences five and seven days before the event.

In Table 8 the cumulative average abnormal returns from positive news are presented for the nine event windows. The returns in both Nordic and European markets are positive and significant within all event windows, excluding the [-1, -10] window. The CAARs appear to behave similarly to the single day abnormal returns presented in Table 7. The Welch's t-statistic shows that the difference in the CAARs is significant in most of the event windows, suggesting that the positive market reactions are generally stronger in the Nordic market when compared to the European market. It should also be noted that in the Nordic markets the positive market reaction gets stronger the longer the window, whereas in the European markets the positive reaction is at its strongest in the medium-length windows ([-5, +5] and [0, +5]), but weakens after that. The finding indicates that the positive effect disappears slower in the Nordic market, which could benefit the companies as well as investors. In the pre-event window [-1, -10], there are no significant CAARs in neither market.

Table 8. Cumulative average abnormal returns from positive news.

Event Window	Nordic		Europe		Welch's t-stat
	CAAR	t-stat	CAAR	t-stat	
[-1, +1]	2.220 %	4.1697 ***	0.958 %	2.6669 **	1.9651 **
[-3, +3]	2.842 %	4.4413 ***	1.818 %	3.0696 ***	1.1737
[-5, +5]	3.908 %	4.1957 ***	1.906 %	2.8422 ***	1.7440 **
[-10, +10]	4.359 %	3.1381 ***	1.449 %	2.0722 **	1.8709 **
[0, +1]	2.825 %	7.1596 ***	1.313 %	4.0803 ***	2.9694 ***
[0, +3]	3.075 %	6.2099 ***	1.443 %	3.5283 ***	2.5420 ***
[0, +5]	3.398 %	5.1696 ***	2.035 %	3.5022 ***	1.5540 **
[0, +10]	3.095 %	3.8485 ***	1.928 %	2.8215 ***	1.1063
[-1, -10]	1.264 %	1.2667	-0.478 %	-0.7416	1.4664 *

Significance level: 1% ***, 5% **, 10% *

The results presented in Table 7 and Table 8 give support to the second hypothesis, suggesting that there is a positive market reaction to positive ESG-related news. Therefore, the second hypothesis can be accepted. The third hypothesis is also supported by the findings, as the reactions to positive ESG-related news are stronger in the Nordic market than in the European market, in both shorter and longer event windows. According to the Welch's t-test results the differences in the average abnormal returns in the two markets are significant on the event date and in most of the event windows. This concludes that the third hypothesis can be accepted as well, as the market reactions to both negative and positive ESG-related news are significantly stronger in the Nordic market.

4.3 Comparing the reactions to negative and positive news

To test the fourth hypothesis, the differences in the average abnormal returns from negative and positive news are compared using the Welch's t-test. Table 9 displays the results of the test in Nordic and European markets. On the event date, only the result of the Nordic market is statistically significant. Looking at the average abnormal returns in the Nordic market on the event date, it appears that negative news cause abnormal returns of -2.409% (Table 5). From positive news in the Nordic market the figure is 1.391% (Table 7). Thus, the results suggest that on the event date the reactions to negative news are stronger than the reactions to positive news, in the Nordic market. In the European market the differences in the AARs are not significant, indicating that there are no significant differences in the reactions to negative and positive news. One day after the event, on $t+1$, the differences in the AARs are significant in both markets. In both markets, the average abnormal returns one day after the event are higher for positive news than for negative news. This is contrary to the results concerning the event date, where the reactions seem to be stronger to negative news.

Table 9. Welch's t-test results, comparing the AARs from negative and positive news.

	Nordic	Europe
Event Window	Welch's t-stat	Welch's t-stat
t+10	-0.1672	0.4618
t+9	0.0107	0.2179
t+8	-0.1315	-0.1688
t+7	-0.0334	-0.0208
t+6	0.2431	-0.0786
t+5	0.3454	-0.2833
t+4	-1.0653	0.0855
t+3	0.0110	-0.0954
t+2	1.2035	-0.2274
t+1	-2.9638 ***	-1.3829 *
t	- 1.6789 **	-0.5710
t-1	-0.1736	-0.6065
t-2	0.7981	-0.7001
t-3	0.5325	-0.1758
t-4	0.0742	-0.3227
t-5	-1.2186	-0.6859
t-6	0.4135	0.0310
t-7	0.7640	1.3180
t-8	1.2165	0.1348
t-9	-0.5110	0.3692
t-10	0.7087	0.5659

Significance level: 1% ***, 5% **, 10% *

The results of comparing the cumulative average abnormal returns from negative and positive news are displayed in Table 10. There are slightly significant results in the European market, in the four event windows that do not include the pre-event dates. Looking back at the CAARs from negative and positive news in the European market, displayed in Table 6 and Table 8, the abnormal returns in all four event windows are larger for positive news. Hence, the results suggest that the market reactions are significantly stronger from positive ESG news in the European market on the days after the event. The results of the rest of the event windows are not significant neither in Nordic nor European markets.

Table 10. Welch's t-test results, comparing the CAARs from negative and positive news.

	Nordic	Europe
Event Window	Welch's t-stat	Welch's t-stat
[-1, +1]	0.0451	-0.8928
[-3, +3]	-0.7999	-1.2578
[-5, +5]	-1.2602	-1.0011
[-10, +10]	-0.3353	0.1631
[0, +1]	-0.0687	-1.4080 *
[0, +3]	0.6424	-1.5426 *
[0, +5]	0.3361	-1.8378 **
[0, +10]	0.5794	-1.6340 *
[-1, -10]	-0.9049	0.6739

Significance level: 1% ***, 5% **, 10% *

Overall, the results found in this section are a bit inconclusive. Overall, it seems that the market reacts more strongly to positive news than to negative news. The only exception to that was on the event date in the Nordic market, where the reactions to negative news were stronger. However, as most of the significant results suggested that the reactions to negative news were not stronger than the reactions to positive news, the fourth hypothesis must be rejected.

4.4 Impact of the ESG score

In this sub-section the market reactions to ESG news are observed across three ESG score categories: Low, Medium, and High. The cumulative average abnormal returns for the nine event windows ([-1, +1], [-3, +3], [-5, +5], [-10, +10], [0, +1], [0, +3], [0, +5], [0, +10] and [-1, -10]) are presented in Tables 11 and 12 for negative news, and Tables 13 and 14 for positive news.

The market reactions to negative news in Nordic markets, grouped by the ESG score, are presented in Table 11. The results of all ESG categories are significant in the short event

window [-1, +1]. Also, most of the results are significant for the event windows where the pre-event dates are excluded. The negative market reactions appear to be the strongest in the high ESG category for all the nine event windows, where all the results are significant as well. The reaction ranges from -3.132% in [-1, +1] to -4.946% in [-10, +10]. The reactions are slightly smaller when examining the windows where the pre-event dates are excluded. Comparing the low and medium categories, the significant reactions appear to be stronger mostly in the medium category. The only exception is the [-1, +1] window, where the reaction is stronger in the low category. Overall, the negative reactions seem to be stronger for companies with higher ESG scores in the Nordic markets.

Table 11. Cumulative average abnormal returns from negative news in Nordics, grouped by ESG score.

Event Window	Low		Medium		High	
	CAAR	t-stat	CAAR	t-stat	CAAR	t-stat
[-1, +1]	-2.253 %	-2.4885 *	-1.706 %	-2.4461 **	-3.132 %	-3.1955 ***
[-3, +3]	-1.288 %	-0.6908	-0.830 %	-0.7982	-4.386 %	-3.5947 ***
[-5, +5]	-2.285 %	-1.2436	-1.031 %	-0.6751	-4.167 %	-2.5642 **
[-10, +10]	-3.764 %	-1.2107	-2.268 %	-1.1579	-4.946 %	-3.1554 ***
[0, +1]	-2.422 %	-2.4836 *	-2.604 %	-3.7839 ***	-2.822%	-2.8067 **
[0, +3]	-1.671 %	-2.8876 **	-2.997 %	-3.7510 ***	-4.024%	-4.2413 ***
[0, +5]	-2.547 %	-1.9979	-2.834 %	-2.6015 **	-4.036%	-3.4819 ***
[0, +10]	-2.014 %	-1.0146	-3.346 %	-2.0247 *	-3.894%	-3.4317 ***
[-1, -10]	-0.406 %	-0.1940	1.079 %	0.8893	-1.052 %	-1.0211

Significance level: 1% ***, 5% **, 10% *

Table 12 displays the market reactions to negative news in Europe, grouped by ESG score. In Europe the reactions across ESG categories seem to be less significant than in the Nordic markets. The negative market reaction in the shortest event window is strongest in the low ESG category (-1.020% in [-1, +1] and -1.234% in [0, +1]), being the only significant results in the shortest event windows. However, in [-3, +3] and [-5, +5] the market reactions are the strongest in the “High” category, even though the reaction in [-5, +5] is not significant. In [-10, +10] the only significant reaction is in the medium category, being also the strongest reaction in said window. Looking at the four event windows

excluding the pre-event dates, the only significant reaction is in the shortest window, [0, +1], in the low category.

Table 12. Cumulative average abnormal returns from negative news in Europe, grouped by ESG score.

Event Window	Low		Medium		High	
	CAAR	t-stat	CAAR	t-stat	CAAR	t-stat
[-1, +1]	-1.020 %	-2.2067 **	-0.494 %	-1.2668	-0.091 %	-0.1614
[-3, +3]	-0.598 %	-0.8370	-0.971 %	-1.8926 *	-1.268 %	-2.2477 **
[-5, +5]	-1.070 %	-1.3089	-1.055 %	-1.9573 *	-1.289 %	-1.6826
[-10, +10]	-0.524 %	-0.7195	-2.134 %	-1.9879 *	-1.786 %	-1.7561
[0, +1]	-1.234 %	-4.0595 ***	-0.714 %	-2.0740	-0.173 %	-0.2905
[0, +3]	-0.898 %	-1.8577	-0.653 %	-1.5351	-0.284 %	-0.3775
[0, +5]	-1.047 %	-1.8118	-0.552 %	-1.6811	-1.052 %	-1.2886
[0, +10]	-0.287 %	0.4198	-0.800 %	-1.0725	-0.908 %	-0.8707
[-1, -10]	-0.811 %	-1.4326	-1.334 %	-1.5203	-0.878 %	-0.5775

Significance level: 1% ***, 5% **, 10% *

The market reactions to negative news between ESG categories seem to have some differences when comparing the Nordic and European markets. In the shortest event window, it appears that the Nordic market reacts stronger to negative news when they concern companies that have a higher ESG score, whereas the European market seems to react more strongly to news concerning companies that have a lower ESG score. However, when looking at the longer event windows, the reactions behave similarly in Nordic and European markets, the reaction being strongest for the news concerning companies that have a high ESG score. The findings presented above give support to the fifth hypothesis that the reaction to negative ESG-related news is stronger for companies that have a higher ESG score.

The market reactions to positive news in Nordic markets, grouped by ESG score, are presented in Table 13. The results are coherent among all the event windows (excluding the pre-event window [-1, -10]): the positive market reactions appear to be the strongest in the low ESG category, and weakest in the high category. It should also be noted that most

of the results are significant. In the pre-event window [-1, -10] there are significant positive reactions in the low-category. It suggests that there could exist confounding effects or information leaks in the Nordic markets.

Table 13. Cumulative average abnormal returns from positive news in Nordics, grouped by ESG score.

Event Window	Low		Medium		High	
	CAAR	t-stat	CAAR	t-stat	CAAR	t-stat
[-1, +1]	4.423 %	2.1178	2.119 %	2.9194 ***	1.535 %	2.1317 *
[-3, +3]	4.484 %	2.2771 *	3.134 %	3.2624 ***	1.737 %	2.0658 *
[-5, +5]	4.843 %	4.4247 **	4.491 %	2.8066 **	2.607 %	2.6338 **
[-10, +10]	5.549 %	2.8754 **	5.430 %	2.3412 **	2.172 %	1.3042
[0, +1]	4.857 %	2.4361 *	2.797 %	5.7156 ***	2.089 %	5.4456 ***
[0, +3]	3.790 %	2.2700 **	3.318 %	4.8738 ***	2.408 %	2.9571 **
[0, +5]	3.528 %	3.2909 *	3.415 %	3.1341 ***	2.320 %	3.8108 ***
[0, +10]	2.369 %	1.7077 **	2.822 %	2.0205	1.815 %	5.0317 ***
[-1, -10]	3.180 %	4.4192 **	2.607 %	1.8000	-1.644 %	-1.0046

Significance level: 1% ***, 5% **, 10% *

Table 14 displays the market reactions to positive news in Europe, grouped by ESG score. The results are not as significant as in the Nordic market, and in the low ESG category none of the event windows yielded significant results. In Europe the positive market reactions seem to be varying more between the ESG categories and event windows. For the shortest event windows, [-1, +1] the reactions are strongest in the high category (1.932% and 1.776%). However, for the medium-length windows the strongest reactions are in the medium category. In the longest event windows, [-10, +10] and [0, +10] the reactions are in turn stronger in the high category than in the medium category.

Table 14. Cumulative average abnormal returns from positive news in Europe, grouped by ESG score.

Event Window	Low		Medium		High	
	CAAR	t-stat	CAAR	t-stat	CAAR	t-stat
[-1, +1]	0.091 %	0.2436	0.982 %	1.6353	1.932 %	2.7437 **
[-3, +3]	1.106 %	1.3431	2.260 %	2.2026 **	1.735 %	1.7453
[-5, +5]	0.387 %	0.4001	2.506 %	2.2745 **	2.448 %	1.9643 *
[-10, +10]	-0.050 %	-0.0466	1.762 %	1.9592 *	2.569 %	1.3133
[0, +1]	0.720 %	1.5114	1.427 %	2.6851 **	1.776 %	3.0067 **
[0, +3]	0.071 %	0.1123	2.187 %	3.3407 ***	1.508 %	2.3634 **
[0, +5]	-0.339 %	-0.4760	2.021 %	3.4429 ***	2.778 %	2.3084 **
[0, +10]	-1.301 %	-1.3275	2.507 %	3.5886 ***	4.531 %	2.3919 **
[-1, -10]	1.250 %	1.0143	-0.745 %	-1.1136	-1.963 %	-1.0686

Significance level: 1% ***, 5% **, 10% *

As with the negative news, the market reactions to positive news between ESG categories have differences between the Nordic and European markets. Overall, the market reactions are more significant and coherent in the Nordic markets when grouped by ESG score. In the Nordic markets the reactions to positive news are distinctly stronger when the news concern companies with lower ESG scores. By contrast the results from the European markets are more ambiguous and not as significant. However, it seems that in Europe the market reactions are stronger when the news concern companies with medium and high ESG scores. The sixth hypothesis that the reaction to positive ESG-related news is stronger for companies that have a lower ESG score seems to hold in Nordic markets, but not in European markets.

4.5 Impact of the size

In this sub-section the market reactions to ESG news are observed across three size categories: Small, Mid, and Large. The cumulative average abnormal returns for the nine event windows ([-1, +1], [-3, +3], [-5, +5], [-10, +10], [0, +1], [0, +3], [0, +5], [0, +10] and [-1, -10]) are presented in Tables 15 and 16 for the negative news, and Tables 17 and 18 for the positive news.

The market reactions to negative news in Nordic markets, grouped by the size category, are presented in Table 15. The results of all size categories are significant in the shortest event window [-1, +1], and the market reaction appears to be strongest in the small size category (-2.170%), and weakest in the large size category (-0.819%). However, for the rest of the event windows including both pre- and post-event dates, [-3, +3], [-5, +5] and [-10, +10], the results are significant for the large category only. The market reaction is strongest in the large category (-3.561%) in the long event window, [-10, +10].

However, in the event windows that exclude the pre-event dates, almost all of the results are significant. Regarding said windows, the market reactions appear to be the strongest in the small and mid categories, and weakest in the large category. There are no significant reactions in the pre-event window, [-1, -10].

Table 15. Cumulative average abnormal returns from negative news in Nordics, grouped by company size.

Event Window	Small		Mid		Large	
	CAAR	t-stat	CAAR	t-stat	CAAR	t-stat
[-1, +1]	-2.170 %	-2.5122 **	-2.872 %	-3.3837 ***	-0.819 %	-2.0155 *
[-3, +3]	-2.422 %	-1.6870	-1.828 %	-1.4817	-2.010 %	-3.6298 ***
[-5, +5]	-3.126 %	-1.5910	-1.708 %	-1.0627	-1.821 %	-2.5708 **
[-10, +10]	-3.186 %	-1.3148	-3.234 %	-1.8583	-3.561 %	-3.3701 **
[0, +1]	-2.626 %	-3.3042 ***	-3.622 %	-4.1212 ***	-0.931 %	-2.3266 **
[0, +3]	-4.108 %	-4.8797 ***	-3.935 %	-4.0795 ***	-1.386 %	-2.3590 **
[0, +5]	-4.150 %	-3.2857 ***	-4.347 %	-3.0067 ***	-1.361 %	-2.0743 *
[0, +10]	-3.959 %	-1.9090 *	-4.713 %	-2.3005 **	-1.774 %	-1.7242
[-1, -10]	0.773%	0.5985	0.479%	0.3922	-1.787%	-1.2436

Significance level: 1% ***, 5% **, 10% *

Table 16 displays the market reactions to negative news in the European market, grouped by the size category. The market reactions appear to be the strongest in the large size category in the four event windows including both pre- and post-event dates, ranging from -0.914% in the shortest event window to -2.948% in the longest event window. The reactions seem to be the weakest in the mid category, although all but one of the results are

insignificant. In the mid category only the result of [-3, +3] (-0.941%) is significant. In the four event windows excluding the pre-event dates, the only significant reactions are in the small category. In the [0, +3] window the reactions are slightly stronger in the small category than in the large category.

There are weakly significant negative reactions in the pre-event window, [-1, -10], in the large category, suggesting that there could exist confounding effects or information leaks in the European markets. It could also explain why the negative reactions appear to be strongest in the large category in the event windows including the pre-event dates, but not in the windows that exclude those. If there are confounding effects, it would be more preferable to make conclusions based on the windows excluding the pre-event dates.

Table 16. Cumulative average abnormal returns from negative news in Europe, grouped by company size.

Event Window	Small		Mid		Large	
	CAAR	t-stat	CAAR	t-stat	CAAR	t-stat
[-1, +1]	-0.463 %	-1.1594	-0.201 %	-0.3618	-0.914 %	-1.9380 *
[-3, +3]	-0.864 %	-1.6139	-0.941 %	-1.8527 *	-1.037 %	-1.4917
[-5, +5]	-1.410 %	-2.3313 **	-0.134 %	-0.1626	-1.417 %	-2.3873 **
[-10, +10]	-1.727 %	-1.9834 *	0.449 %	0.4895	-2.948 %	-2.4002 **
[0, +1]	-0.790 %	-2.9797 ***	-0.399 %	-0.7081	-0.893 %	-1.7600
[0, +3]	-0.728 %	-2.1291 **	-0.499 %	-0.9196	-0.603 %	-0.8303
[0, +5]	-0.894 %	-1.8606	-0.824 %	-1.5784	-0.691 %	-1.2938
[0, +10]	-0.732 %	-1.1048	-0.364 %	-0.3620	-0.351 %	-0.3708
[-1, -10]	-0.995 %	0.2135	0.814 %	1.0777	-2.597 %	-2.1434 *

Significance level: 1% ***, 5% **, 10% *

In the Nordic market, in some of the event windows the negative market reactions were stronger for larger companies. However, in most of the windows the reactions were strongest for small and mid-sized companies. In the European market the results are more unclear. In the event windows including the pre-event dates the markets seem to react stronger to news concerning larger companies. However, as there appears to be significant negative reactions prior to the event, the results of the large category could be biased.

All in all, it seems that the market reactions to negative ESG-related news are stronger when the news concerns small and mid-sized companies, especially in the Nordic markets. The findings do not support the seventh hypothesis, as it appears that the market reaction to negative ESG-related news are not stronger for large companies, but for small and mid-sized ones.

The market reactions to positive news in the Nordic market, grouped by the size category, are presented in Table 17. The results of mid and large size categories are significant in all event windows (excluding the pre-event window [-1, -10]). In the four even windows including both pre- and post-event dates, the positive reactions are notably strongest for the large category. However, in the windows that exclude the pre-event dates, the results are stronger in the mid category than in the large category. The explanation for that could be because there is strong significant reaction in the pre-event window for the large category, indicating that there could exist confounding effects or information leaks. The reactions are weakest in the small category.

Table 17. Cumulative average abnormal returns from positive news in Nordics, grouped by company size.

Event Window	Small		Mid		Large	
	CAAR	t-stat	CAAR	t-stat	CAAR	t-stat
[-1, +1]	0.802 %	0.8932	2.982 %	3.6639 ***	3.094 %	4.4943 ***
[-3, +3]	1.528 %	1.4556	3.059 %	3.2316 ***	4.909 %	4.1876 ***
[-5, +5]	2.558 %	1.7348	3.567 %	2.5291 **	7.485 %	4.3710 ***
[-10, +10]	0.688 %	0.3543	5.644 %	2.4252 **	8.396 %	4.6504 ***
[0, +1]	2.371 %	5.4372 ***	3.324 %	4.5432 ***	2.451 %	3.7415 ***
[0, +3]	2.821 %	3.4646 ***	3.343 %	3.9053 ***	2.894 %	5.3954 ***
[0, +5]	2.683 %	2.2582 **	4.089 %	3.8680 ***	3.051 %	4.5862 ***
[0, +10]	1.116 %	0.8548	4.578 %	3.4678 ***	3.242 %	5.3273 ***
[-1, -10]	-0.428%	-0.2548	1.066%	0.7447	5.154 %	2.8092 **

Significance level: 1% ***, 5% **, 10% *

Table 18 displays the market reactions to negative news in the European market, grouped by the size category. There are not as significant results as in the Nordic market, and the results are somewhat different as well. In the European market the strongest positive

market reactions are in the mid category in most of the event windows. However, in the two of the event windows excluding the pre-event dates, [0, +1] and [0, +10], the reactions are stronger in the small category. In the pre-event window, [-1, -10], there is a significant negative reaction in the small category. Moreover, it seems that the market reactions are the weakest in the large category.

Table 18. Cumulative average abnormal returns from positive news in Europe, grouped by company size.

Event Window	Small		Mid		Large	
	CAAR	t-stat	CAAR	t-stat	CAAR	t-stat
[-1, +1]	0.980 %	1.6310	1.027 %	1.2143	0.877 %	1.8231 *
[-3, +3]	2.165 %	1.9762 *	2.651 %	2.5676 **	0.722 %	1.0021
[-5, +5]	2.300 %	1.8460 *	3.219 %	2.4063 **	0.392 %	0.6945
[-10, +10]	0.875 %	0.7195	3.066 %	1.9878 *	1.067 %	1.3243
[0, +1]	1.776 %	3.2900 ***	1.308 %	1.8468 *	0.670 %	1.6236
[0, +3]	1.934 %	2.4508 **	1.953 %	3.7135 ***	0.380 %	0.8253
[0, +5]	2.755 %	2.5881 **	2.775 %	2.6523 **	0.484 %	0.7815
[0, +10]	2.645 %	3.0421 ***	2.251 %	1.3702	0.686 %	0.5242
[-1, -10]	-1.770 %	-1.7999 *	0.816 %	0.7561	0.381 %	0.3184

Significance level: 1% ***, 5% **, 10% *

The market reactions to ESG-related news between size categories seem to differ when comparing the Nordic and European markets. In Nordic market it appears that the markets react to positive news significantly stronger when the news concern large and mid-sized companies. Then again, in Europe the market reactions are mostly strongest for the mid-sized companies, and weakest when the news concern larger companies. Based on the findings, the eighth hypothesis that the market reaction to positive ESG-related news is stronger for large companies seems to hold in the Nordic market, but not in the European market.

4.6 Beta stability

As mentioned in section 3.2.4, the market model has been criticized as it assumes that the pre-event beta is constant, which conflicts with the presumption that firm-specific market risks vary over time. Therefore, it is reasonable to perform a robustness check to test the beta stability.

The robustness check for the Nordic and European samples is performed by setting the pre-event alpha to zero and beta to one. In other words, the model used to estimate the normal returns is changed swapped to the market adjusted model, instead of using the market model. The results from the market adjusted model are then compared to the results of the market model.

The results of the robustness check are presented in Appendices 2 and 3 for negative news, and 4 and 5 for positive news. After modifying the market model to market adjusted model by changing the pre-event alphas to zero and betas to one, the results remain significant and mainly equivalent to the results of the market model.

5 Conclusions

The aim of this study was to analyse the short-term stock market reactions to ESG-related news and assess how strong the reactions to the news are. The market reactions were also compared between the Nordic and European markets, to assess the differences between the two areas. As well as studying the differences between the two geographical areas, the impact of the ESG score and the size of the company to the market reactions was also studied.

The first research question of the study is “*Do ESG-related news have a significant impact on a company’s market value?*”. The most relevant previous research is quite unanimous that negative ESG-related events cause a negative market reaction in the Nordic and European markets (Capelle-Blancard et al., 2017; Cheung, 2010; Consolandi et al. 2008; de Vincentiis, 2022; Derrien et al., 2021; Krüger, 2015; Serafeim et al., 2022). The evidence of significant market reactions to positive ESG-related information in the previous research is not as unanimous. However, the majority of the previous literature has reported a positive market reaction to positive ESG-related information (Cheung, 2010; Consolandi et al., 2008; de Vincentiis, 2022; Krüger, 2015; Serafeim et al, 2022).

The findings of this thesis are consistent with the previous research. The negative market reactions to negative ESG news in the Nordic and European markets are significant on the event date, and in most of the event windows employed. The cumulative average abnormal returns were studied in various event windows, including windows with both pre- and post-event dates and only post-event dates. The negative reaction was significant in all the event windows in the Nordic market. In the European market there was a significant negative reaction in all windows except [0, +10]. The pre-event window [-1, -10] was also analysed, and it was found that there is a significant negative reaction prior to the publication of the news. Based on the previous literature, that could be due to information leaks or confounding events.

The market reaction to positive ESG news was significant in both markets on the event date and in all of the event windows (excluding the pre-event window). As mentioned before, the results of the previous research on whether the markets have a positive reaction to positive ESG information are ambiguous. Hence, this study contributes to the literature

that has found a significant results on the topic in question. There was no significant reaction in the 10-day pre-event window, as there was for the negative news.

The second research question of the study is *“Does the reaction to ESG-related news differ between the Nordic and the European markets?”*. Majority of the previous research compares the market reactions to ESG-related information between different markets, mostly the US and European markets. It has been found that there are differences in the strength and significance of the reactions between markets. Although the previous research on the Nordic market is scarce, there is evidence that the market reactions are stronger than in European or US markets (de Vincentiis, 2022).

This thesis contributes to the literature concerning this topic on the Nordic market, supporting the findings that the market reaction to ESG-related information is stronger in the Nordic market than in Europe. On the event date, the negative reaction to ESG news in the Nordic market was -2.409%, and in the European market -0.567%. The difference of the average returns between the two markets is significant. When analysing the cumulative average abnormal returns, the negative reaction was higher in the Nordic market in all event windows, and the difference is significant in most of the windows. Supporting results were found regarding positive news as well, as the market reaction on the event date was 1.391% in the Nordic market, and 0.756% in the European market. The reaction in the Nordic market was stronger in all cumulative event windows when compared to the European market. Similar to the negative news, the difference in the reactions between the two markets was significant on the event date and in most of the event windows as well.

There is plenty of previous research on the difference between the market reactions to negative and positive ESG news and announcements. In this thesis the topic is studied as well, hence the third research question is *“Does the strength of the market reaction differ between negative and positive ESG-related news?”*. Most of the previous studies found that the market reacted more strongly when negative information was published, whereas positive information caused weaker reactions (Consolandi et al., 2008; Krüger 2015). As a matter of fact, some of the studies it was discovered that positive information did not cause any significant market reactions (Capelle-Blancard et al., 2017; de Vincentiis, 2022; Jacobs et al., 2010), indicating that the investors tend to penalise companies for their irresponsible actions more than they reward them for their responsible actions.

In the Nordic market negative news caused a stronger reaction on the event date, and the difference was statistically significant. In the European market there was no significant difference between the strength of the market reactions to negative and positive news on the event date. However, one day after the event, the reaction to positive news was stronger than the reaction to negative news in both markets, and the difference was significant. When analysing the cumulative average abnormal returns, the only significant results happened in the European market. Overall, against the results of the previous research, the results suggested that the reactions to positive news were in fact stronger than the reactions to negative news.

The Nordic and European samples were divided into three sub-samples based on the ESG scores of the companies, to be able to answer the fourth research question “*Does the ESG score of the company affect how the market reacts to ESG-related news?*”. The results of the previous studies are a bit inconclusive, as some studies have found that the market reactions are stronger when the ESG score of the company in question is higher (de Vincentiis, 2022), whereas some argue that the reactions would conversely be weaker for companies with higher ESG scores (Serafeim et al., 2022; Jensen, 2002).

The market reactions to negative news between the three ESG categories had some differences in the Nordic and European markets. In the Nordic market the negative market reactions were stronger for companies with higher ESG scores in the shortest event window. Conversely, in the European market the reactions were strongest for companies with lower ESG scores. However, when analysing the results of both markets in the longer event windows, the market reactions were strongest for companies that had higher ESG scores. Overall, the market reaction to negative ESG news is stronger for companies that have a higher ESG score.

Regarding market reactions to positive news, the ESG score of a company seems to have some impact as well. In the Nordic market, the positive market reactions were significantly stronger for companies with lower ESG scores. While the results of the European market are not as clear and significant, the results indicated that the positive reactions were stronger for companies with medium and high ESG scores.

To find an answer to the last research question, “*Does the size of the company affect how the market reacts to ESG-related news?*”, the Nordic and European samples were again

divided into three sub-samples, based on the size of the company. It is assumed that as larger companies could be subjected to more attention from investors, the market reactions to ESG news related to larger companies would be stronger than the reactions to news about smaller companies, that might not receive as much attention.

The results are somewhat conflicting with that assumption. In the Nordic markets, the market reactions to negative ESG news were in fact stronger for small and mid-sized companies in most of the event windows. In the European market however, the results are more unclear, as in some windows the reactions were stronger for larger companies, but in some for smaller companies. Regarding the reactions to positive news, when comparing the Nordic and European markets the results had differences as well. In the Nordic market, the reactions to positive ESG news were strongest for the large and mid-sized companies, whereas in the Europe the market reacted mostly stronger for news concerning small and mid-sized companies. The reactions were weakest for large companies in Europe.

5.1 Limitations and future research

The limitations of this thesis are mainly related to the data and the methodology. As the news were collected and divided into negative and positive ones by the researcher, there is a risk of a selection bias. However, that risk is reduced by applying certain selection criteria in the data selection process. Moreover, as the sample size is relatively small, 174 news in total, it could lead to biased results as well.

In event studies the determination of the event date is a fundamental matter. As the date when the information reaches the market can vary from the publication data of the news, it can make the event date determination challenging. To ensure that the event is contained within the event window, there are longer event windows employed in this thesis. However, when employing longer event windows there is a risk of confounding events distorting the abnormal returns. In this thesis the market model was used to estimate the normal returns. However, as the model assumes that the pre-event beta is constant it conflicts with the presumption that firm-specific market risks vary over time. For that reason, the beta stability is tested in section 4.6.

While this thesis expands the understanding on the market reactions to ESG news, further research is still needed in the future, especially on the Nordic market. As the research around this topic on the Nordic market is still incomplete, it provides an interesting case to be studied even further. For example, larger sample sizes and longer time frame could provide more robust and significant results, allowing for more proper statistical analysis to be performed. The sample could also be categorized in different ways to further analyse on the underlying relations of the market reactions and ESG-related information. For example, categorizing the news based on the strength of the sentiment of the news (e.g., very negative vs. slightly negative) would make it possible to study if the markets react differently to news with varying sentiments. Furthermore, in previous research on this topic it has been common to divide the news based on the ESG categories to environmental, social, and governance related news. However, this has not been done in the Nordic market and it would provide an interesting topic for further research.

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Appendices

Appendix 1. Event data

Company	Country	Source	Category	Date
Adyen NV	Netherlands	Reuters News	Negative, Europe	8.10.2019
Airbus SE	France	Reuters News	Negative, Europe	14.10.2021
Allianz SE	Germany	Reuters News	Negative, Europe	22.11.2022
Anheuser-Busch Inbev SA	Belgium	Reuters News	Negative, Europe	24.9.2021
ASML Holding NV	Netherlands	Reuters News	Negative, Europe	13.10.2021
AXA SA	France	Reuters News	Negative, Europe	9.12.2022
Banco Santander SA	Spain	Reuters News	Negative, Europe	26.3.2021
BASF SE	Germany	Reuters News	Negative, Europe	9.9.2021
Bayer AG	Germany	Reuters News	Negative, Europe	24.12.2021
BNP Paribas SA	France	Reuters News	Negative, Europe	26.9.2019
BP PLC	UK	Targeted News Service	Negative, Europe	15.6.2018
British American Tobacco PLC	UK	Reuters News	Negative, Europe	30.3.2021
Compagnie Financiere Richemont SA	Switzerland	Reuters News	Negative, Europe	16.8.2022
Deutsche Post AG	Germany	Reuters News	Negative, Europe	8.4.2022
Deutsche Telekom AG	Germany	Reuters News	Negative, Europe	4.9.2019

Diageo PLC	UK	Reuters News	Negative, Europe	9.12.2022
Enel SpA	Italy	Reuters News	Negative, Europe	31.8.2022
EssilorLuxottica SA	France	Reuters News	Negative, Europe	8.11.2022
Glencore PLC	Switzerland	Reuters News	Negative, Europe	22.10.2020
GSK plc	UK	Reuters News	Negative, Europe	11.5.2022
Hermes International SCA	France	Reuters News	Negative, Europe	11.10.2021
HSBC Holdings PLC	UK	Reuters News	Negative, Europe	18.8.2022
Iberdrola SA	Spain	Reuters News	Negative, Europe	12.9.2022
Kering SA	France	Reuters News	Negative, Europe	18.3.2021
L'Oréal SA	France	Reuters News	Negative, Europe	8.12.2022
L'Air Liquide Societe Anonyme pour l'Etude et l'Exploitation des Procedes George	France	Reuters News	Negative, Europe	16.11.2020
LVMH Moët Hennessy Louis Vuitton SE	France	Reuters News	Negative, Europe	18.11.2019
Mercedes Benz Group AG	Germany	Reuters News	Negative, Europe	11.2.2020
National Grid PLC	UK	Reuters News	Negative, Europe	6.5.2022
Nestle SA	Switzerland	just-food	Negative, Europe	21.12.2018
Novartis AG	Switzerland	Reuters News	Negative, Europe	22.8.2022

Prosus NV	Netherlands	Reuters News	Negative, Europe	2.3.2022
Reckitt Benckiser Group PLC	UK	Reuters News	Negative, Europe	8.12.2022
Relx PLC	UK	Reuters News	Negative, Europe	8.2.2022
Rio Tinto PLC	UK	Reuters News	Negative, Europe	30.6.2021
Roche Holding AG	Switzerland	Reuters News	Negative, Europe	23.8.2022
Safran SA	France	Reuters News	Negative, Europe	4.5.2021
Sanofi SA	France	Reuters News	Negative, Europe	3.12.2021
SAP SE	Germany	Reuters News	Negative, Europe	29.4.2021
Schneider Electric SE	France	Reuters News	Negative, Europe	23.2.2022
Shell PLC	UK	Evening Standard	Negative, Europe	1.3.2019
Siemens AG	Germany	Reuters News	Negative, Europe	12.1.2020
TotalEnergies SE	France	Reuters News	Negative, Europe	29.4.2021
UBS Group AG	Switzerland	Reuters News	Negative, Europe	23.3.2021
Unilever PLC	UK	Reuters News	Negative, Europe	7.9.2022
Vinci SA	France	Reuters News	Negative, Europe	1.8.2022
Zurich Insurance Group AG	Switzerland	Reuters News	Negative, Europe	9.8.2019
Abb Ltd	Sweden	Reuters News	Negative, Nordic	10.1.2020
AP Moeller - Maersk A/S	Denmark	M-Brain Nordic News	Negative, Nordic	24.6.2019

Assa Abloy AB	Sweden	Reuters News	Negative, Nordic	28.4.2021
AstraZeneca PLC	Sweden	Reuters News	Negative, Nordic	22.9.2022
Atlas Copco AB	Sweden	Reuters News	Negative, Nordic	21.10.2021
Boliden AB	Sweden	Reuters News	Negative, Nordic	11.2.2020
Carlsberg A/S	Sweden	Reuters News	Negative, Nordic	25.9.2021
Coloplast A/S	Denmark	Reuters News	Negative, Nordic	2.7.2021
Danske Bank A/S	Denmark	Reuters News	Negative, Nordic	23.7.2021
DSV A/S	Denmark	M-Brain Nordic News	Negative, Nordic	5.1.2021
EQT AB	Sweden	Reuters News	Negative, Nordic	19.10.2022
Essity AB	Sweden	M-Brain Nordic News	Negative, Nordic	21.2.2019
Evolution AB		Reuters News	Negative, Nordic	17.11.2021
Fortum Oyj	Finland	M-Brain Nordic News	Negative, Nordic	24.2.2020
Genmab A/S	Denmark	Reuters News	Negative, Nordic	12.12.2022
H & M Hennes & Mauritz AB	Sweden	Reuters News	Negative, Nordic	26.3.2020
Hexagon AB	Sweden	Reuters News	Negative, Nordic	29.4.2022
Investor AB	Sweden	Reuters News	Negative, Nordic	22.4.2020
Kone Oyj	Finland	Reuters News	Negative, Nordic	12.2.2020
Neste Oyj	Finland	Reuters News	Negative, Nordic	9.12.2021

Nibe Industrier AB	Sweden	Reuters News	Negative, Nordic	17.5.2022
Nokia Oyj	Finland	Reuters News	Negative, Nordic	25.11.2019
Nordea Bank Abp	Finland	Reuters News	Negative, Nordic	31.5.2022
Novo Nordisk A/S	Denmark	Reuters News	Negative, Nordic	17.12.2021
Novozymes A/S	Denmark	Reuters News	Negative, Nordic	15.10.2019
Orsted A/S	Denmark	Reuters News	Negative, Nordic	20.8.2019
Pandora A/S	Denmark	Reuters News	Negative, Nordic	10.12.2021
Sampo plc	Finland	Reuters News	Negative, Nordic	2.11.2022
Sandvik AB	Sweden	M-Brain Nordic News	Negative, Nordic	11.6.2020
Skandinaviska Enskilda Banken AB	Sweden	Reuters News	Negative, Nordic	15.11.2019
SKF AB	Sweden	Reuters News	Negative, Nordic	1.4.2022
Stora Enso Oyj	Finland	M-Brain Nordic News	Negative, Nordic	17.9.2018
Svenska Cellulosa AB		Reuters News	Negative, Nordic	12.10.2021
Svenska Handelsbanken AB	Sweden	Reuters News	Negative, Nordic	4.6.2021
Swedbank AB	Sweden	Reuters News	Negative, Nordic	2.2.2022
Telefonaktiebolaget LM Ericsson	Sweden	Reuters News	Negative, Nordic	14.4.2022
Telia Company AB	Sweden	Reuters News	Negative, Nordic	20.7.2022
UPM-Kymmene	Finland	Reuters News	Negative, Nordic	27.1.2022

Oyj			Nordic	
Vestas Wind Systems A/S	Denmark	Reuters News	Negative, Nordic	21.1.2022
Volvo AB	Sweden	Reuters News	Negative, Nordic	28.1.2022
Adyen NV	Netherlands	Reuters News	Positive, Europe	9.2.2022
Airbus SE	France	Reuters News	Positive, Europe	26.2.2021
Allianz SE	Germany	Reuters News	Positive, Europe	23.9.2019
Anheuser-Busch				
Inbev SA	Belgium	just-drinks	Positive, Europe	4.1.2019
ASML Holding NV	Netherlands	Public Technologies	Positive, Europe	7.7.2022
AXA SA	France	Reuters News	Positive, Europe	7.10.2022
Banco Santander SA	Spain	Reuters News	Positive, Europe	29.9.2021
BASF SE	Germany	Reuters News	Positive, Europe	4.11.2022
Bayer AG	Germany	Reuters News	Positive, Europe	17.5.2021
BNP Paribas SA	France	American Banker	Positive, Europe	19.9.2018
		Zacks Investment		
BP PLC	UK	Research	Positive, Europe	25.5.2022
British American Tobacco PLC	UK	Reuters News	Positive, Europe	30.8.2022
Compagnie Financiere Richemont SA	Switzerland	Reuters News	Positive, Europe	6.10.2021
Deutsche Post AG	Germany	Reuters News	Positive, Europe	7.7.2021
Deutsche Telekom AG	Germany	Public Technologies	Positive, Europe	25.10.2022
Diageo PLC	UK	The Independent	Positive, Europe	15.4.2019
Enel SpA	Italy	Reuters News	Positive, Europe	19.6.2020
EssilorLuxottica SA	France	Reuters News	Positive, Europe	11.3.2022
		Public		
Glencore PLC	Switzerland	Technologies	Positive, Europe	12.12.2022
GSK plc	UK	Reuters News	Positive, Europe	14.11.2022
Hermes International SCA	France	Reuters News	Positive, Europe	12.10.2021

HSBC Holdings				
PLC	UK	Reuters News	Positive, Europe	27.9.2019
Iberdrola SA	Spain	The Guardian	Positive, Europe	8.8.2022
Kering SA	France	Aroq Limited	Positive, Europe	6.6.2019
L'Oréal SA	France	Mint	Positive, Europe	15.3.2021
L'Air Liquide				
Societe Anonyme				
pour l'Etude et				
l'Exploitation des				
Procedes George	France	Reuters Investor	Positive, Europe	17.5.2022
Briefs				
LVMH Moet				
Hennessy Louis				
Vuitton SE	France	Reuters News	Positive, Europe	9.12.2022
Mercedes Benz				
Group AG	Germany	Associated Press	Positive, Europe	23.7.2021
National Grid PLC	UK	Reuters News	Positive, Europe	30.11.2020
Nestle SA	Switzerland	just-food	Positive, Europe	2.11.2018
Novartis AG	Switzerland	Reuters News	Positive, Europe	26.4.2022
Prosus NV	Netherlands	Reuters News	Positive, Europe	10.6.2021
Reckitt Benckiser				
Group PLC	UK	Reuters News	Positive, Europe	1.6.2022
Market News				
Relx PLC	UK	Publishing	Positive, Europe	4.4.2022
Rio Tinto PLC	UK	Reuters News	Positive, Europe	30.10.2019
Reuters Health				
Roche Holding AG	Switzerland	Medical News	Positive, Europe	16.3.2021
Safran SA	France	Reuters News	Positive, Europe	28.7.2022
Sanofi SA	France	Reuters News	Positive, Europe	30.9.2021
SAP SE	Germany	Reuters News	Positive, Europe	6.10.2020
Schneider Electric				
SE	France	Reuters News	Positive, Europe	21.6.2021
Interfax Central				
Shell PLC	UK	Asia General News	Positive, Europe	17.5.2018
Siemens AG	Germany	Reuters News	Positive, Europe	19.7.2022
TotalEnergies SE	France	Reuters News	Positive, Europe	28.5.2021
UBS Group AG	Switzerland	Business Wire	Positive, Europe	10.11.2022

		Emirates News		
Unilever PLC	UK	Agency (WAM)	Positive, Europe	15.1.2020
Vinci SA	France	Reuters News	Positive, Europe	19.11.2019
Zurich Insurance				
Group AG	Switzerland	PR Newswire	Positive, Europe	3.5.2022
Abb Ltd	Sweden	The Independent	Positive, Nordic	10.11.2021
AP Moeller -				
Maersk A/S	Denmark	Reuters News	Positive, Nordic	27.7.2022
Assa Abloy AB	Sweden	Reuters News	Positive, Nordic	2.3.2021
AstraZeneca PLC	Sweden	Zacks	Positive, Nordic	23.6.2021
Atlas Copco AB		Reuters News	Positive, Nordic	16.7.2021
Boliden AB	Sweden	Reuters News	Positive, Nordic	31.5.2021
		M-Brain Nordic		
Carlsberg A/S	Sweden	News	Positive, Nordic	26.10.2018
Coloplast A/S	Denmark	Reuters News	Positive, Nordic	7.11.2022
Danske Bank A/S	Denmark	Reuters News	Positive, Nordic	16.9.2022
DSV A/S	Denmark	Reuters News	Positive, Nordic	25.10.2022
EQT AB	Sweden	Reuters News	Positive, Nordic	30.9.2021
		M-Brain Nordic		
Essity A	Sweden	News	Positive, Nordic	4.11.2021
Evolution AB	Sweden	Reuters News	Positive, Nordic	22.6.2022
		M-Brain Nordic		
Fortum Oyj	Finland	News	Positive, Nordic	20.11.2020
Genmab A/S	Denmark	Reuters News	Positive, Nordic	12.8.2021
H & M Hennes &				
Mauritz AB		Reuters News	Positive, Nordic	30.1.2020
Hexagon AB	Sweden	Reuters News	Positive, Nordic	30.9.2021
Investor AB	Sweden	Reuters News	Positive, Nordic	20.10.2022
Kone Oyj	Finland	Reuters News	Positive, Nordic	28.1.2021
		M-Brain Nordic		
Neste Oyj		News	Positive, Nordic	24.1.2019
Nibe Industrier AB	Sweden	Reuters News	Positive, Nordic	16.11.2022
		M-Brain Nordic		
Nokia Oyj	Finland	News	Positive, Nordic	7.4.2020
Nordea Bank Abp		IFR News	Positive, Nordic	23.9.2022
Novo Nordisk A/S	Denmark	Reuters News	Positive, Nordic	6.9.2019

Novozymes A/S	Denmark	Reuters News	Positive, Nordic	26.4.2022
Orsted A/S	Denmark	Reuters News	Positive, Nordic	16.5.2022
Pandora A/S	Denmark	Reuters News	Positive, Nordic	7.2.2022
Sampo plc	Finland	Reuters News	Positive, Nordic	4.8.2021
Sandvik AB	Sweden	Reuters News	Positive, Nordic	31.5.2022
Skandinaviska				
Enskilda Banken				
AB	Sweden	Reuters News	Positive, Nordic	9.2.2021
SKF AB	Sweden	Reuters News	Positive, Nordic	25.10.2022
M-Brain Nordic				
Stora Enso Oyj	Finland	News	Positive, Nordic	28.4.2021
Svenska Cellulosa				
AB	Sweden	Reuters News	Positive, Nordic	26.1.2022
Svenska				
Handelsbanken AB	Sweden	Reuters News	Positive, Nordic	20.5.2021
Swedbank AB	Sweden	Reuters News	Positive, Nordic	4.2.2022
Telefonaktiebolaget				
LM Ericsson	Sweden	Reuters News	Positive, Nordic	9.12.2022
Telia Company AB	Sweden	Reuters News	Positive, Nordic	11.3.2022
UPM-Kymmene				
Oyj	Finland	Reuters News	Positive, Nordic	15.4.2021
Vestas Wind				
Systems A/S	Denmark	Reuters News	Positive, Nordic	10.12.2019
Volvo AB	Sweden	Reuters News	Positive, Nordic	17.12.2021

Appendix 2. AARs from negative news in the 21-day event window, market adjusted model.

Event window	Nordic		Europe	
	AAR	t-stat	AAR	t-stat
t+10	0.155 %	0.4479	0.441 %	1.0061
t+9	-0.136 %	-0.4673	0.125 %	0.4863
t+8	0.472 %	1.7260 *	-0.133 %	-0.4013
t+7	0.196 %	0.5239	0.104 %	0.4956
t+6	-0.364 %	-0.6920	-0.138 %	-0.5692
t+5	-0.554 %	-1.6987 *	0.519 %	2.3018 **
t+4	0.057 %	0.1662	-0.187 %	-0.7453
t+3	0.272 %	0.8040	0.151 %	0.7122
t+2	-1.150 %	-3.0918 ***	0.154 %	0.6771
t+1	-0.409 %	-1.2921	-0.120 %	-0.6090
t	-2.470 %	-4.5806 ***	-0.563 %	-3.2809 ***
t-1	0.596 %	1.6761	-0.073 %	-0.3674
t-2	0.267 %	0.7759	-0.048 %	-0.2441
t-3	0.423 %	1.3837	-0.346 %	-1.6960 *
t-4	-0.107 %	-0.4591	0.161 %	0.8354
t-5	0.304 %	1.0540	-0.182 %	-0.6358
t-6	-0.083 %	-0.2837	0.215 %	1.2000
t-7	-0.504 %	-1.3896	-0.695 %	-2.8149 ***
t-8	-0.637 %	-1.9636 *	-0.108 %	-0.5014
t-9	0.153 %	0.6157	0.304 %	1.4272
t-10	-0.459 %	-1.2961	-0.228 %	-1.0920

Significance level: 1% ***, 5% **, 10% *

Appendix 3. CAARs from negative news, market adjusted model.

Event Window	Nordic		Europe	
	CAAR	t-stat	CAAR	t-stat
[-1, +1]	-2.283 %	-4.4717 ***	-0.755 %	-2.1213 **
[-3, +3]	-2.470 %	-3.6266 ***	-0.844 %	-2.7547 ***
[-5, +5]	-2.771 %	-3.2269 ***	-0.532 %	-2.8514 ***
[-10, +10]	-3.978 %	-3.2921 ***	-0.645 %	-2.1064 **

Significance level: 1% ***, 5% **, 10% *

Appendix 4. AARs from positive news in the 21-day event window, market adjusted model.

Event Window	Nordic		Europe	
	AAR	t-stat	AAR	t-stat
t+10	0.107 %	0.4822	-0.066 %	-0.2729
t+9	-0.220 %	-0.5975	0.062 %	0.3498
t+8	-0.106 %	-0.4257	-0.074 %	-0.3044
t+7	0.045 %	0.1784	-0.141 %	-0.5977
t+6	0.045 %	0.1659	0.317 %	1.3800
t+5	-0.138 %	-0.4099	0.191 %	0.8753
t+4	0.343 %	1.0666	0.311 %	1.6120
t+3	-0.166 %	-0.5208	-0.111 %	-0.5259
t+2	0.341 %	1.0263	0.255 %	1.0997
t+1	1.516 %	6.9868 ***	0.672 %	3.2499 ***
t	0.966 %	2.7732 ***	0.712 %	2.2135 **
t-1	-0.773 %	-2.1092 **	-0.318 %	-1.3710
t-2	0.188 %	0.6133	0.228 %	1.0487
t-3	0.197 %	0.6214	0.475 %	2.0285 **
t-4	0.241 %	0.5628	-0.197 %	-0.6562
t-5	0.487 %	2.0578 **	-0.258 %	-1.1196
t-6	-0.040 %	-0.1157	-0.315 %	-1.2997
t-7	0.226 %	0.9528	-0.397 %	-1.6531
t-8	-0.270 %	-1.0197	-0.043 %	-0.2150
t-9	0.100 %	0.2504	0.330 %	1.5708
t-10	0.109 %	0.2991	0.191 %	0.7025

Significance level: 1% ***, 5% **, 10% *

Appendix 5. CAARs from positive news, market adjusted model.

Event Window	Nordic		Europe	
	CAAR	t-stat	CAAR	t-stat
[-1, +1]	1.709 %	3.2676 ***	1.066 %	2.7573 ***
[-3, +3]	2.269 %	3.7194 ***	1.914 %	3.3923 ***
[-5, +5]	3.202 %	4.0004 ***	1.961 %	3.2200 ***
[-10, +10]	3.197 %	3.6694 ***	1.824 %	2.6173 **

Significance level: 1% ***, 5% **, 10% *