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ESG News and Stock Market Reactions

Insights from Oslo Stock Exchange

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Abstract

Investors' awareness of firms' ESG performance, and the amounts invested in accordance with ESG criteria, have increased substantially in recent years. This thesis examines how the Norwegian stock market reacts to announcements of negative ESG news. We collect data on news events for the period 2008-2020 and use a multi-method research design to investigate (1) how stock prices are affected by announcements of negative ESG news, (2) whether market reactions are different for more severe ESG news, and (3) whether market reactions have changed over time. We contribute to the existing literature by examining how reactions differ for each ESG pillar and for different levels of severity. This gives insight into which types of ESG news investors are most sensitive towards, and how the graveness of the news affects these reactions.

We find causal evidence of a positive market reaction towards firms experiencing negative news concerning governance issues compared to firms that have no news in the overall event window. Further, we find causal evidence of positive market reactions to environmental and governance news, as well as to ESG news in general, at certain days surrounding the reported event date. We argue that these results can be attributed to investors' beliefs that the cost of ESG performance outweighs the benefits. Moreover, we find that market reactions towards severe ESG news are generally not more significant than reactions to less severe events. Finally, we find that market reactions have not changed significantly over time. These findings show that the Norwegian stock market values ESG news of all severity equally, and that the impact of ESG news has been indistinguishable over the last twelve years.

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1. Introduction

The integration of environmental, social and governance (ESG) factors in investment decisions is an increasing trend. In 2020, $35.3 trillion was invested through approaches that consider environmental, social and governance factors in portfolio selection (Global Sustainable Investment Alliance, 2021). Nicolai Tangen, CEO of Norges Bank Investment Management, argues that there is no longer a trade-off between ESG integration and portfolio returns (Holter & Kværnes, 2022). Similarly, the world's largest asset manager, BlackRock, believes that "sustainability should be our new standard for investing" (BlackRock, n.d.). On the other hand, several critics argue that ESG is misleading in investment decisions, and that investors pay unjustifiably high management fees on ESG investments (Pucker & King, 2022). As is evident, the integration of ESG into investment decisions is a highly debated field, but how integral is ESG actually in investment decisions?

In this thesis, we seek to understand how relevant ESG is to investors in the Norwegian stock market by examining the market reactions to negative ESG news involving companies listed on Oslo Stock Exchange. We use a multi-method research design in which we combine an event study method with a quasi-experimental method to measure short-term stock price effects for firms involved in negative ESG news covered in the media. By splitting the negative news events based on which ESG pillar they concern, we examine potential differences in market reactions to different ESG issues. Furthermore, we split the news into different levels of severity to examine if market reactions differ when the negative ESG news are considered to be more severe. Lastly, we investigate if market reactions have changed over time.

We find evidence that the announcement of certain types of ESG news leads to significant abnormal returns. More specifically, our results show that negative news concerning environmental or governance issues generate positive abnormal returns. Moreover, we find that market reactions are not more significant for ESG news considered more severe, and that market reactions have been relatively stable over time.

1.1 Hypotheses Development

We believe announcements of negative ESG news provide stock markets with valuable new information regarding a firm's ESG performance. Furthermore, we believe ESG information can change stock prices for two reasons. First, a firm's ESG performance may be valued by

investors. Second, a firm's ESG performance may change investors' expectations about the firm's financial performance. Thus, our expectation is that the Norwegian stock market reacts to announcements of negative ESG news by generating abnormal returns in the short-term. In order to test whether the Norwegian stock market reacts to announcements of negative ESG news, we develop the following null hypothesis:

H1: Negative ESG news do not generate abnormal stock returns in the Norwegian stock market.

As we believe announcements of negative ESG news provide stock markets with new value relevant information, it seems reasonable to expect investors to attach more importance to news events covering more severe ESG incidents. Thus, we expect more significant market reactions to more severe ESG news. To examine how sensitive investors are to the severity of news events, we develop a second hypothesis:

H2: The Norwegian stock market does not react differently to severe negative ESG news than to negative ESG news in general.

Due to the increasing awareness of ESG issues and the rising popularity of ESG investments, it is reasonable to expect stock markets to react more significantly to negative ESG news in more recent years. As such, we would expect the impacts on stock prices to be larger (in absolute value) for more recent news events. To examine potential differences in the Norwegian stock market's reactions over time, we develop a third hypothesis:

H3: Market reactions to negative ESG news have not changed over time.

1.2 Contribution

This thesis contributes to existing literature in several ways. As most research on market reactions to ESG news uses data on U.S. or large European firms, our study differs by studying firms listed on Oslo Stock Exchange. However, our thesis is not the first to use Norwegian data but, to our knowledge, related researches have studied differences between positive and negative ESG news. We offer a new contribution by separating negative news based on the three ESG pillars to study differences in market reactions to different issues.

Furthermore, our thesis offers new insights by studying differences in reactions to ESG news based on the severity of the news. Several studies distinguish between ESG issues considered financially material to a firm's industry but, to our knowledge, no study has researched differences in reactions based on ESG severity.

Moreover, our thesis differs from other studies using Norwegian data by studying news from a range of media sources, both Norwegian and international. Thereby, our thesis offers a new contribution to the existing literature which seems to use only news covered in Norwegian media.

Lastly, our research differs from most prominent literature on the field, and from all studies on Norwegian data that we are familiar with, as we develop a multi-method research design to examine market reactions.

1.3 Structure

Our thesis is structured in the following way: Section 2 describes fundamental theory on ESG and the importance of information for stock prices. Section 3 presents prominent literature on market reactions to ESG events. In Section 4, we present the methodology used in the thesis. Thereafter, we will describe the data sample in Section 5. Section 6 then proceeds with presenting the results from the tests on our hypotheses. In Section 7, these results are discussed. Finally, Section 8 serves as a conclusion.

2. Theory

In this section, we aim to provide an understanding of the fundamental theory behind our study on market reactions to ESG news. First, we will establish what ESG is. Second, we discuss the importance of new information for stock prices and present the efficient market hypothesis, which is a fundamental theory when studying how stock markets react to new information.

2.1 ESG

ESG, an abbreviation of Environmental, Social and Governance, is a concept first introduced in 2006 by the United Nations as part of the launch of the Principles for Responsible Investment (UNPRI) (United Nations, 2006). UNPRI was launched to provide a framework for investors to integrate environmental, social and corporate governance considerations into their investment activities, and thereby create more sustainable markets. Since then, the prevalence of ESG has increased substantially, both in terms of reporting on ESG aspects and investing based on ESG criteria. KPMG (2022), in a survey of the largest 100 companies in 58 countries worldwide, found that 79% of the companies conducted sustainability reporting in 2022, which is an increase from 64% in 2012. Similarly, the rate of sustainability reporting in Norway has increased from 77% in 2020 to 91% in 2022 (KPMG, 2022).

Concepts similar to ESG, such as corporate social responsibility (CSR), have existed prior to the introduction of the ESG term. A difference between them is that ESG provides a more quantitative measure of sustainability and splits between environmental, social and governance factors (O'Neill, 2022). In this thesis, we treat the terms ESG and CSR as if they are interchangeable. In the literature review, we will use the term used in the presented literature.

2.1.1 ESG Ratings and Controversies

To help investors integrate ESG factors into their investment decision, several rating agencies produce ESG ratings measuring companies' ESG performance. The frameworks used to produce the ESG ratings differ between agencies, but a common trait is that they evaluate how exposed the firm is to risks related to ESG issues and their ability and efforts to manage them

(MSCI, 2022a; Sustainalytics, n.d.). Additionally, the agencies usually consider company-specific events and controversies related to ESG factors, meaning that whenever a firm is exposed to an ESG controversy, the ESG rating of the firm is negatively affected. Involvement in controversies reveals exposure to, and poor handling of, ESG issues. When a firm is involved in negative ESG news, it is thus a signal of poor ESG performance.

Within the three ESG pillars, there are several issues on which firms are evaluated. Table 2.1 provides an overview of the key issues within each pillar, as defined by MSCI (n.d.). Generally, the environmental pillar covers issues related to how the firm impacts the planet (Ellis, 2022). The social pillar involves a more varied range of issues. Within this pillar, there are issues related to the firm's impact on people, such as staff and customers, as well as the wider community in which the firm operates. Furthermore, the social pillar covers issues related to product quality and supply chain management. Lastly, the governance pillar involves issues related to the corporate governance of the firm. These issues include board compensation, tax transparency and business ethics (Ellis, 2022).

Table 2.1: ESG Issues

Environmental	**Social**	**Governance**
Climate change	Human capital	Corporate governance
Natural capital	Product liability	Corporate behaviour
Pollution and waste	Stakeholder opposition	
Environmental opportunities	Social opportunities	

2.1.2 ESG Investing

MSCI defines ESG investing as the consideration of environmental, social and governance factors alongside financial factors in the investment decision-making process (MSCI, 2022b). The increasing trend of ESG investing is underlined by the Global Sustainable Investment Alliance who indicate that $35.3 trillion was invested through approaches that consider environmental, social and governance factors in portfolio selection in 2020, which represents a 93.2% increase from 2014 (Global Sustainable Investment Alliance, 2017; Global Sustainable Investment Alliance, 2021). The popularity of ESG investing is evident also for professionally managed "sustainability funds". As of October 2022, assets under management at global exchange-traded "sustainable" funds that publicly set environmental, social, and governance investment objectives amounted to $2.24 trillion (Morningstar, 2022). The years 2013 and 2014 have been highlighted as a period where ESG investing was greatly accelerated (Kell, 2018), and it is now estimated that 79% of global investors consider ESG risks an important factor in investment decision-making (PricewaterhouseCoopers, 2021).

2.2 Information

In this thesis, as in any study on stock market reactions to news events, information is an integral part. Beaver (1968) argues that company-specific information can move stock prices by changing investors' assessments of the probability distribution of future returns. Larsen and Thorsrud (2017) find that news topics in the media has an important causal role in predicting daily returns on the Norwegian stock market. The importance of new information for stock prices is described by the efficient market hypothesis.

2.2.1 Efficient Market Hypothesis

The efficient market hypothesis is a highly influential hypothesis, introduced by Fama et al. (1969), stating that in efficient markets, all available information is fully reflected in security prices. Thus, when new information becomes available, it will be considered by investors and rapidly reflected in stock prices. Fama (1970) considers markets to take three different forms of efficiency. In markets of strong-form efficiency, stock prices reflect all public and

private information. When markets have semi-strong efficiency, the stock prices reflect all "obviously publicly available information", while stock prices in the weak-form efficiency only reflect historical prices. A general understanding is that stock markets are roughly semi-strong (Fama, 1991).

2.2.2 Value Relevance of ESG Information

Although the efficient market hypothesis states that new information will be accounted for by investors and reflected in stock prices, not all new information will be regarded as sufficiently important to generate changes in stock prices. Francis and Schipper (1999) explain that information can be regarded as value relevant if it is able to move stock prices. Although research on value relevance usually studies financial statement information, the term can be used also when relating to news about a firm's ESG performance.

Company-specific ESG news provide investors with new information about the firm's ESG performance. Subsequently, announcements of ESG news should be considered by investors and, if they attach value to the information, lead to stock price changes.

3. Literature Review

From the theory section, we have an understanding of how stock markets respond to new information. If investors regard ESG information as value relevant, we should expect to see changes in the stock price following ESG news. In this section, we present prominent literature on stock market reactions to ESG events.

3.1 Market Reactions to ESG Events

Shane and Spicer, as early as in 1983, found announcements of poor external ratings of a firm's pollution control to have a significant negative impact on stock returns (Shane & Spicer, 1983). The authors argue that the effects result from changes in investors' perceptions of the probability distribution of future cash flows.

Since then, several valuable contributions have been made on market reactions to ESG events. However, these contributions arrive at divergent conclusions. Some, similarly to Shane and Spicer (1983), find a positive relation between ESG news and stock prices, such that positive ESG news lead to price increases while negative news on ESG issues lead to decreasing stock prices. Meanwhile, other studies find a negative relationship in which positive ESG news decrease stock prices and oppositely for negative news. A third line of findings is that ESG news are value irrelevant, hence they do not lead to significant market reactions. Moreover, studies that separate news events based on the ESG pillar they concern, reach no consensus as to which issues generate the most significant market reactions.

Klassen and McLaughlin (1996) found significant positive abnormal returns following positive environmental events and significant negative abnormal returns following negative environmental events. They show that, on average, negative events generate abnormal returns of -1.5% in a three-day window around the event, while positive events lead to abnormal returns of 0.82%. Similarly to Shane and Spicer (1983), the authors attribute the market's response to changes in investors' beliefs of net present values of future cash flows, highlighting the link between environmental performance and future costs as particularly important.

Flammer (2013) finds that investors react positively to announcements of eco-friendly initiatives and negatively to announcements of eco-harmful behaviour. An additional insight

presented by Flammer is that the market's negative response to eco-harmful behaviour has been increasing in magnitude over time. She argues that as "becoming green" has increasingly become the norm, investors' punishment of firms' eco-harmful behaviour has become more severe (Flammer, 2013).

Glück et al. (2022) study market reactions to changes in ESG ratings. As described in Section 2.1.1, ESG news events and ratings are interrelated, and similarly to news events, rating changes could bring new information to investors. Glück et al. (2022) find significant negative abnormal returns following rating downgrades. They argue that this can be explained by two factors. First, rating downgrades lead to changes in investors' expectations about future cash flows and risk. Second, investors may divest to remain in line with their ESG investment strategies. Furthermore, in their preferred model, Glück et al. (2022) find that downgrades in the environmental score lead to the largest and most significant reactions. Downgrades in the social score are also found to generate significant market responses. However, no significant reaction is found in the wake of downgrades in governance score. Glück et al. (2022) conclude that rating changes, especially downgrades, present new value relevant information which leads investors to react and thus generate abnormal returns.

Capelle-Blancard and Petit (2019) find significant negative reactions following announcements of negative news. Their results suggest that the average impact of negative ESG news is similar whether it concerns environmental, social or governance issues. In contrast to Flammer (2013), Capelle-Blancard and Petit find that the negative stock market responses show little variation over time. A key difference between the two studies, however, is that Flammer studies the period between 1980 and 2009, while Capelle-Blancard and Petit study a shorter period from 2002 to 2010.

All the presented findings point to a positive correlation between ESG news and stock prices. This positive correlation is explained with a range of different reasons. Highlighted factors include an increased ability to manage resources, achieve lower capital costs and reduced stock risk, as well as better reputation among consumers and investors. Accordingly, positive (negative) ESG news are received favourably (unfavourably) by investors.

However, different conclusions are reached by Krueger (2015), whose results indicate that markets react negatively to both positive and negative ESG news. Moreover, Krueger finds that issues related to communities (social pillar) and the environment generate the largest

market reactions. This is true for both positive and negative news events, meaning that positive news regarding social and environmental issues are linked with significant negative abnormal returns.

Glück et al. (2022) find that downgrades in the social rating have a significant negative impact on a stock's downside risk, which they argue may indicate that worsened performance on social issues increases expected cash flows. Glück et al. explain that while being "good citizens" and providing job security will result in high S ratings, shareholders prefer firms with the option of reducing the workforce or outsourcing stages of the value chain. These options are considered value-enhancing as they provide firms with more flexibility in managing costs.

These findings can be seen in relation with literature considering ESG performance to be negatively related to financial performance. This perspective can be traced back to Milton Friedman (1970), who argued that "the social responsibility of business is to increase its profits". Friedman's main argument is that any efforts and investments to improve corporate social responsibility will increase costs and reduce profitability. Authors within this perspective generally consider the efforts and costs required to obtain and maintain good ESG performance to exceed the benefits (see e.g., Friedman, 1970; Hong et al., 2012; Di Giuli and Kostovetsky, 2013). Thereby, increased ESG performance leads to lower valuation and reduced stock prices. According to this perspective, positive news about ESG is bad news for shareholders (Krueger, 2015). Weak ESG performance, on the other hand, can signal less investment in activities that are tangential to a firm's commercial mission (Hawn et al., 2018). Thus, investors should punish firms with good ESG performance, and reward firms with poor ESG performance with higher stock prices.

A third perspective is that ESG performance has no value relevance for investors (Serafeim & Yoon, 2021). Thus, information on ESG performance is considered unable to move stock prices. Serafeim and Yoon (2021) find positive market reactions to positive ESG news but no significant reactions to negative news in general. Negative news is found to generate significant reactions only when it concerns issues that are regarded as financially material, receive much attention, and is measured in terms of industry-adjusted returns. Thus, Serafeim and Yoon's findings indicate that positive ESG news are value relevant, while negative ESG news announcements reveal no value relevant information to investors. Moreover, the value relevance of positive news is driven by information on financially material ESG issues, which is a result supported by the findings of Khan et al. (2015).

This perspective is also supported by Moss et al. (2020) who study the reactions of retail investors following ESG disclosures. The authors find that investors make as many changes to their portfolios on days with ESG press releases as on days without press releases. Therefore, they conclude that retail investors do not adjust their portfolios in response to ESG announcements, which indicates that ESG information is value irrelevant.

An aspect worth considering is that the significance of different ESG issues likely varies systematically across firms and industries, depending both on the sector the firm operates in and the strategy of the firm (Eccles & Serafeim, 2013). A related insight is offered by Capelle-Blancard and Petit (2017) who find that firms are usually evaluated on one single pillar based on their industry. For instance, financial institutions are scrutinized most closely on corporate governance issues while basic-resource firms are evaluated mainly on environmental issues (Capelle-Blancard & Petit, 2017). This could imply that studies using different data samples may arrive at divergent conclusions, which may be part of the explanation of the differences in the presented literature.

4. Methodology

The aim of this section is to describe the research methodology used in the thesis. We develop a multi-method research design in which we use both an event study method and a quasi-experimental method. This multi-method design means that we obtain results using two different approaches. We believe this can strengthen our findings as we are able to compare the results from both methods. Thereby, we can be more confident that the findings do not result from a weakness in the chosen method.

In the first part of this section, we present the first method, which is an event study method. First, the foundations of the methodology, in which the efficient market hypothesis is integral, will be presented. Thereafter, the different elements of the methodology will be described, and we will explain the choices we have made in the design of our event study.

In the second part of the section, we present the second method, which is a quasi-experimental approach. This method is based on matching firms with ESG events with comparable firms with no event through propensity score matching to "simulate" a randomized experiment.

4.1 Event Study Methodology

The event study methodology has since its introduction by Fama et al. in 1969 become a widely used approach within financial research (Fama, 1991). In accordance with the efficient market hypothesis, stock prices will be affected when new value relevant information is introduced to the stock market. The event study methodology aims to measure this effect by finding the "abnormal returns" resulting from an event. This is done by comparing actual, observed returns around the announcement of new information to the returns that would be expected in the absence of the announcement (Capelle-Blancard & Petit, 2019). As discussed in Section 2.2.2, the efficient market hypothesis implies that the announcement of ESG news should generate stock price reactions if the information is regarded as value-relevant by investors. In the following, we will describe the event study methodology thoroughly.

4.1.1 Event and Estimation Windows

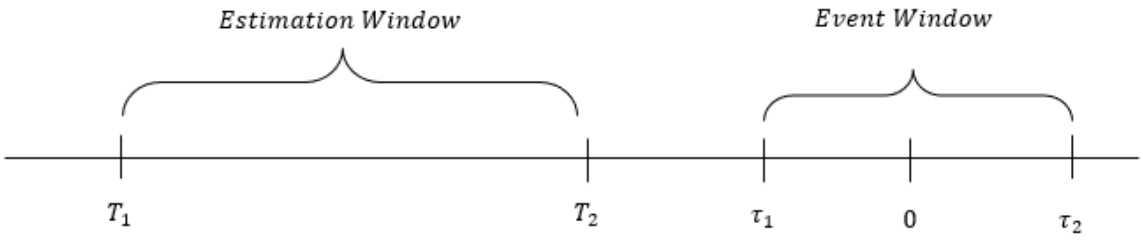
The first step to calculate abnormal returns is to define normal returns. These are the returns one would expect to see in the absence of an event. Generally, normal returns are estimated in a period before the occurrence of the event, known as the "estimation window". Thereafter, the estimated normal returns are compared to the actual returns observed around the event, in a period known as the "event window" (MacKinlay, 1997). Fama et al. (1969) underline the importance of setting the estimation and event window so that they do not overlap to avoid any event-specific variation being used in the estimation of normal returns. Moreover, it is crucial that the length of the estimation and the event windows are set befittingly.

Besides not overlapping with the event window, there are no set rules as to how the estimation window should be determined. The duration of estimation windows used in prominent literature often falls in the range of 100 to 250 days before the event (see e.g., MacKinlay, 1997; Flammer, 2013; Krueger, 2015; Glück et al., 2022). Krivin et al. (2003) highlight that an important aspect of setting the estimation window is the trade-off between longer windows which provide more observations to use for estimation and shorter windows which reduce the risk of including observations with unrelated movements.

In the event window, the effect of the event will be measured by comparing the estimated normal returns with the observed returns. McWilliams and Siegel (1997) highlight the length of the event window as possibly the most crucial research design issue in event study methodology. Different event studies vary substantially in the duration of event windows, which is logical given that event studies are used to capture both short-term and long-term effects (Fama, 1991). A general finding, however, is that shorter event windows are easier to use and better able to isolate the effect of the event (McWilliams & Siegel, 1997; Kothari & Warner, 2007). McWilliams and Siegel (1997) therefore argue that the event window should be as short as possible but long enough to capture the significant effect of the event. Furthermore, Fama (1991) underlines that event studies using daily data typically find that stock prices adjust within a day of the event. Still, the event window is generally longer than the day of the event, and usually includes at least the day before the event and the day after (MacKinlay, 1997). The days after the event can capture reactions related to the event, depending on the quickness with which the market adapts to the new information. Furthermore, events may be announced after the closing of the stock exchange, meaning that market reactions will not be reflected in stock prices before the next trading day(s)

(MacKinlay, 1997). Moreover, as we study news announcements, there may be occurrences where investors are informed prior to the news announcement. For instance, this may be the case if the media is later to report on the events than other sources, such as the companies themselves. Thereby, the information may be reflected in stock prices prior to our reported event dates. Therefore, it is important to include days prior to the event day in the event window.

Figure 4.1: Event Study Design



Based on the presented arguments, we set the estimation window to 200 days prior to the event window. In Figure 4.1, which depicts the event study design, T_1 is thus set equal to -206 days. T_2 is equal to -6 days, to avoid overlap between the estimation and the event window. The event window is set such that τ_1 is equal to -5 and τ_2 is equal to 5 days after the event. We believe that this event window is sufficiently long to capture the full market reaction from the event, including potential reactions from pre-informed investors, while being short enough to limit risks of other events influencing returns in the event window.

4.1.2 Measuring Abnormal Returns

Throughout this thesis, we use logarithmic returns as a measure of price changes. Compared to simple returns, logarithmic returns have an advantage in that they are time-additive and have normality characteristics.

Logarithmic returns are calculated as:

$$ln(\frac{P_t}{P_{t-1}}),$$

where P_t is the closing stock price at time t, and P_{t-1} is the closing stock price at time t-1, which is the previous trading day.

In the event study methodology, normal returns are estimated with parameters obtained from Ordinary Least Squares (OLS) regressions over the estimation window by using a normal performance model. However, studies differ in their choice of model. Commonly used models include the single-factor market model, the constant mean model, the Capital Asset Pricing Model (CAPM), the Arbitrage Pricing Theory (APT) model, as well as different Fama-French factor models (Brown & Warner, 1985; Kothari & Warner, 2007).

Similarly to Glück et al. (2022), we estimate normal returns using two different models, both using excess returns. In the discussion of our results, therefore, the results from both models will be presented. The first model is a one-factor market model defined as:

$$E[er_{i,T}] = \alpha_i + \beta_{i,RM} E[RMRF_T] + \varepsilon_i$$

Thereby, the abnormal returns are calculated:

$$AR_{i,\tau} = er_{i,\tau} - (\alpha_i + \beta_{i,RM} RMRF_\tau)$$

where $er_{i,\tau}$ is actual excess returns for each firm, α and β_{RM} are the estimated OLS parameters, and $RMRF_\tau$ is the excess market returns, measured by subtracting the risk-free rate from daily returns of the OSEBX index. Risk-free rates are calculated using rates of Norwegian 10-year bonds, in accordance with Goedhart et al. (2020, p. 314).

The second model is a Fama-French five-factor model which estimates the coefficients based not only on market returns but also on other common risk factors. The factors describe the difference between returns of portfolios consisting of different types of stocks. The Fama-French five-factor model is defined as:

$$E[er_{i,T}] = \alpha_i + \beta_{i,RM} RMRF_T + \beta_{i,SMB} SMB_T + \beta_{i,HML} HML_T + \beta_{i,RMW} RMW_T + \beta_{i,CMA} CMA_T + \varepsilon_i$$

Thereby, the abnormal returns are calculated by:

$$AR_{i,\tau} = E(er_{i,\tau}) - (\alpha_i + \beta_{i,RM} RMRF_\tau + \beta_{i,SMB} SMB + \beta_{i,HML} HML + \beta_{i,RMW} RMW + \beta_{i,CMA} CMA)$$

where the additional terms not used in the one-factor model are Fama-French factors. SMB_τ is the difference between the returns of a portfolio of small stocks and of large stocks, HML_τ

is between high book-to-market stocks and low book-to-market stocks, RMW_τ is between robust profitability stocks and weak profitability stocks, and CMA_τ is between conservative investment stocks and aggressive investment stocks.

Thereby, the Fama-French factor model controls for factors that are typical determinants of stock performance. This is useful to isolate the performance associated with the event, which is the aim of any event study on stock price performance (Kothari & Warner, 2007). Furthermore, the Fama-French factor model can reduce cross-sectional correlation which is important for calculating robust significance tests (Glück et al., 2022). Kothari and Warner (2007) even argue that including Fama-French factors is essential when measuring abnormal performance.

4.1.3 Cumulative Abnormal Returns

To draw overall inferences for the events of interests, the abnormal returns have to be aggregated across time and securities (MacKinlay, 1983). First, the abnormal returns are aggregated across time for each security by;

$$\mathrm{CAR_i}(\tau_1, \tau_2) = \sum_{\tau=\tau_1}^{\tau_2} \mathrm{AR_{i,\tau}}$$

where τ_1, τ_2 denotes the start and the end of the event window.

Then the cumulative abnormal returns are aggregated across each security by;

$$\overline{\mathrm{CAR}}(\tau_1 \tau_2) = \frac{1}{\mathrm{N}} \sum_{\mathrm{i}=1}^{\mathrm{N}} \mathrm{CAR_i}(\tau_1, \tau_2)$$

The cumulative average abnormal returns, hereafter CAR, are normally distributed if there is no event-date clustering, meaning that tests of the null hypothesis can be done directly (MacKinlay, 1983). However, our data sample includes several event dates that have an overlap in their event window across securities. Such event date clustering renders the independence assumption for the abnormal returns in the cross-section incorrect (Kothari & Warner, 2007). Therefore, we utilize robust standard errors as proposed by Boehmer et al.

(1991) and later modified by Kolari and Pynnönnen (2010). The robust standard errors take both event-induced volatility and cross-sectional correlation into account.

The direct implementation of the robust standard errors is expanded upon in Appendix A1.

4.1.4 Event Study Assumptions

For an event study to provide a true measure of the impact of an event, certain assumptions must be valid. The three most essential assumptions are that: (1) markets are efficient, (2) the event is unanticipated, and (3) there are no confounding effects during the event window (McWilliams & Siegel, 1997).

The first assumption relates to the efficient market hypothesis. If stock prices do not incorporate all available value relevant information, an event study will not yield significant results. A general understanding is that stock markets are roughly semi-strong (Fama, 1991). Therefore, we assume that this assumption holds in the case of the Norwegian stock market. The second assumption underlines that an event must indeed provide new information to investors. If this assumption is fulfilled, abnormal returns can be assumed to result from the market's reaction to the new information provided by the event (McWilliams & Siegel, 1997). Our expectation is that the announcements of ESG news provide investors with new information, and we include pre-event days in the event window to ensure that the reactions of potentially pre-informed investors are included. The third assumption states that the event window should not contain any other events than the one being studied (McWilliams & Siegel, 1997). The presence of confounding events makes it difficult to isolate the impact of the event being studied. Unfortunately, it is almost impossible to completely exclude effects from confounding events as there is a range of different events with the potential to affect stock prices. For instance, the company may be subject to non-ESG news, or it may disclose financial information. However, as the news events in our sample are random in the sense that they do not occur at certain dates every year, we expect that the events are unlikely to consistently coincide with other company events.

Furthermore, it is important to ensure that the stock price observations in the estimation window are not affected by other events being studied. In cases where news events concerning a specific company are announced within 206 days of each other, the first news announcement

would be included in the estimation window for the second event. Therefore, we have chosen to only use events for which there are no other events for the relevant company in the estimation window. As a result, the number of events in our data sample decreases, but we ensure that the estimation of normal returns is not affected by other ESG events.

4.1.5 Cross-Sectional Regression

As a final step in the event study method, we conduct a cross-sectional regression to determine whether an abnormal stock market reaction is indeed attributable to the ESG news events and not related to event-specific firm characteristics (Glück et al., 2022). According to MacKinlay (1997), abnormal returns in the event window will in many situations be related to firm characteristics, not only through the valuation effect of the event but also through a relation between the firm characteristics and the extent to which the event is anticipated. In this case, observed valuation effects may be different from their true value (Mckinlay, 1997).

To examine this, we employ the following model:

$$CAR[\tau_0, \tau_1]_i = \alpha + \beta_1 X_i + \gamma FirmControls'_i + Industry\ FE + Year\ FE + \varepsilon_i$$

As the dependent variable, we use CAR for each security from the full-sample Fama-French five-factor model. To determine if the stock market reactions are truly due to the event, we include several event-specific firm controls that serve as independent variables.

In our cross-sectional analysis we employ three different variations of the model above. One that has X=0, meaning that we only study how firm characteristics effect CAR. In the second model X is substituted for severity, and we thereby examine how severe ESG news affect the dependent variable. The last model studies how cumulative abnormal return has changed over time, and therefore substitutes X with a time-dummy D.

To address the issue of unobserved heterogeneity (Wooldridge, 2018), we use industry fixed effects and year fixed effects. Industry fixed effects represent all factors affecting cumulative abnormal returns that are varying across industry, but not across time. Industry characteristics such as firm composition and geographical location is assumed to remain constant in our observation period.

Meanwhile, year fixed effects control for unobserved variables that are constant across entities but change over time. For instance, this can be yearly loan rates or other aspects of the Norwegian economic situation, that stay constant across all firms within that year, but change throughout our sample period.

4.2 Quasi-Experimental Method

The second part of our multi-method design is a quasi-experimental method based on propensity score matching. A weakness with the event study method is that the model may face external factors that influence the outcome. To mitigate this, the event window needs to be sufficiently small to decrease the likelihood of such influencing factors. However, as we cannot guarantee that no exogenous factors are present, we utilize the quasi-experimental method to create a "copy" of the firms involved in news events. Thereby the external factors should affect the two firms similarly, and solve this potential problem.

In the event study method, there are also potential concerns regarding anticipation and self-selection that can be solved with matching (Kothari & Warner, 2007). Abnormal returns can vary cross-sectionally due to anticipation effects, an example of this is firms with more analysts following them, making events more predictable. Meanwhile, self-selection entails that outcomes can have endogeneity problems due to firms self-selecting themselves to an event. This is not as prevalent in our study, as in studies on stock splits and similar events. However, a firm would not have an ESG event if it did not engage in activities subject to ESG evaluation, and this could therefore pose a problem in our event study design.

The quasi-experimental method should overcome these concerns and provide results that can be causally interpreted. In the following, we will describe the elements of our quasi-experimental method.

4.2.1 Propensity Score Matching

Generally, inference about the effects of a treatment involves speculation about the effect the treatment would have had on a unit which did not receive the treatment. As treatment

assignment in our study is given to firms that experience negative ESG news, it is difficult to observe the counterfactual, this being the effect of negative ESG news on firms that have not experienced a negative ESG news in the time period. To establish a causal effect, we must conduct a randomized experiment, which is impossible as treatment assignment is already given. However, the use of propensity score matching (PSM) enables a "simulation" of a randomized experiment. This is done by matching treatment firms with non-treatment firms based on a chosen set of firm characteristics.

Propensity scores were first introduced by Rosenbauer and Rubin (1983) and describe the conditional probability of assignment to a particular treatment given a vector of observed characteristics.

Thereby, the propensity score gives each observation in the sample a probability of being assigned to treatment, given their observed characteristics. In this way, the firms with ESG news events are matched with firms without any ESG news events, based on these probabilities.

To estimate the propensity score of each event, we apply a probit model with the binary treatment assignment D as the dependent variable, and a set of three independent variables. D takes the value of one for firms that experience a negative ESG news on that date, and zero otherwise. The independent variables are chosen to identify firms that are similar to the treatment firms for each of their event dates.

$$D_i[0,1] = \alpha + \gamma FirmControls'_i + Year\ FE + \varepsilon_i$$

Due to our research spanning several years, we also have to take time effects into account when applying propensity score matching. Therefore, we only allow firms and their characteristics to be matched within the same time period as the one where the event occurs. This ensures that each match is created based on characteristics that are specific for that time period.

Several studies use propensity score matching when analysing the effect of a treatment on stock prices. However, the independent variables chosen for matching vary widely and will be different for each sample that should be matched. For our sample, we have chosen book-to-market, market capitalization and volume traded as independent variables.

Book-to-market is an indicator of whether a firm's stock is a growth stock (low BM) or a value stock (high BM). Book-to-market is therefore considered to enable matches that are in the same stage of growth as the firms facing an ESG event. Market capitalization can be linked to both stock liquidity and the size of the firm. Large firms might be subject to more attention on their ESG performance than smaller firms, and this can in turn increase the probability that the firms face an ESG event. Volume traded is used to describe the liquidity of the stock. Liquidity can describe how many investors are following the firm, and this can increase the probability that an ESG event will be reported in the media.

Finally, to match companies based on propensity scores, we must decide which matching algorithm is appropriate. As we wish to create a single match for each treated firm, we employ Nearest-Neighbor (NN)-matching. This pairs the treated firm with the control firm that is closest in terms of propensity score (Caliendo & Kopeinig, 2005). When employing NN-matching, there are two further choices that must be considered. First, one must decide whether to allow control firms to be matched to more than one treated firm, which is matching with replacement. If replacement is allowed, the average quality of matching will increase and the bias will decrease (Caliendo & Kopeinig, 2005). However, as we will also use the event study method in which abnormal returns are calculated over a period of 205 days prior to the event, we have opted for a no-replacement option within each period. This ensures that no control firm is matched to different treatment firms in a period of at least 205 days within each other, while they can be matched with multiple firms throughout the whole sample and thereby receiving the benefits of replacement, such as improved quality and reduced bias, throughout the whole sample.

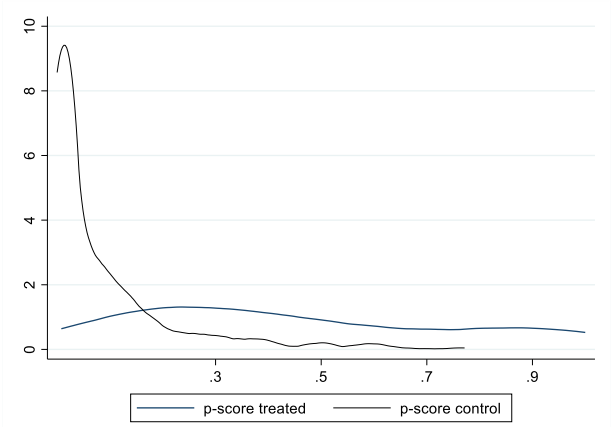
4.2.2 Propensity Score Matching Assumptions

There are three underlying assumptions in the propensity score matching method. The first is the conditional independence assumption (Caliendo & Kopeinig, 2005), which states that given a set of observable covariates **X** which are not affected by the treatment, potential outcomes are independent of treatment assignment. This implies that differences in outcomes between treated and control individuals with the same values in their covariates are entirely attributable to the treatment. In our research, we conduct matching on an event day, given observable covariates prior to the event. Therefore, any difference in post-event outcomes is attributed to the treatment, and we assume this condition to be met.

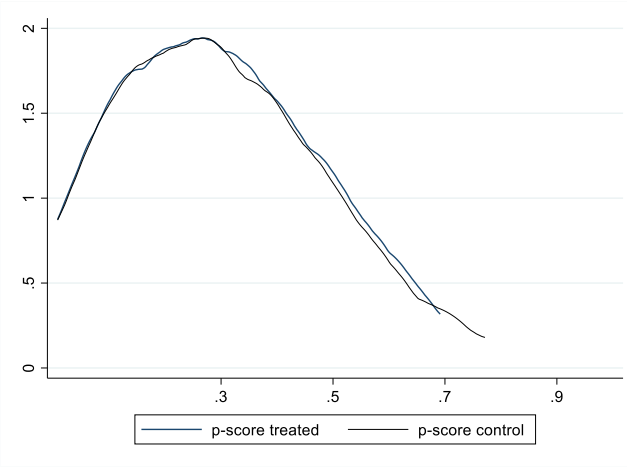
The second assumption is common support, which states that there are both treated and untreated observations for every value of X. Therefore, there must be a substantial overlap in the distribution of the propensity scores of the treated group and the control group. Figure 4.2 displays density plots of the distribution of propensity scores of the treated group and the control group before and after matching.

Figure 4.2: Density Plots[1]

Panel A: Before matching



Panel B: After Matching



In Panel A of Figure 4.2 we observe that the propensity score distribution between the treated and control groups before matching lacks some overlap, especially towards the right tail of the graph. After treatments and control firms have been matched, the data is trimmed so that common support is met. Thereby, the distribution of propensity scores of the two groups are much more similar, which is depicted in Panel B, and we assume the assumption to be met.

The final assumption is the "balancing condition" (Huntington-Klein, 2021), which states that one should observe the same X-characteristics, given the same propensity score. We evaluate the balancing condition in Table 4.1, where we compare the firm-characteristics of the treated and control before and after matching. We notice that prior to matching, the mean difference between the treated and control group is significantly different for the natural logarithm of market capitalization and volume. Meanwhile, the mean difference is not significant for book-

[1] Propensity score matching results for each pillar are shown in Appendix A5.

to-market. After matching, however, all the covariates are more similar and none of the mean differences are significant. This shows that the propensity score matching was successful in creating matches that have similar firm characteristics.

Table 4.1: Descriptive Statistics PSM

	Unmatched/ Matched	Treated Mean	Control Mean	% Bias	% Red. Bias	t	p>|t|	V(T) / V(C)
ln(Mcap)	U	22.938	20.373	158.1		14.4	.000	0.57*
	M	22.475	22.459	0.9	99.4	0.08	.939	0.82
Vol (M)	U	1.4	0.27	56.4		6.82	.000	2.52*
	M	0.71	0.97	-13.6	75.9	-0.67	.503	0.21*
BM	U	0.93092	37.514	-15.8		-1.2	.232	0.00*
	M	1.0184	0.92625	0.0	99.7	0.37	.714	0.19*

The table presents descriptive statistics of firm characteristics used to match firms with an ESG event to control firms without events in the period. Ln(Mcap) is the natural logarithm of market capitalization, Vol (M) is volume in millions of NOK, BM is book-to-market. The *-sign is denoted if variance ratio is outside [0.69,1.45] for unmatched and [0.65,1.55] for matched.

4.2.3 Quasi-Experimental Method and Difference-in-Difference

Through propensity score matching we create a set of matched control firms that act as the counterfactual for each treated firm for each event in our sample. Next, we want to examine how large the effect of a negative ESG news announcement is on the cumulative abnormal returns on the firms, by comparing the treated and control firms.

We wish to draw a ceteris paribus comparison between the treatment and control group between the period prior to the event and during the event. To draw this causal inference, we employ a Difference-in-Difference (DiD) regression.

The DiD regression is given by:

$$CAR_{i,t} = \alpha + \beta_1 Treatment * Post + \beta_2 Treatment + \beta_3 Post + \gamma\ FirmControls + Industry\ FE + Year\ FE + \varepsilon_{i,t}$$

We study the cumulative abnormal returns obtained from the Fama-French five-factor model on each event in our sample. “Treatment” is a binary variable which takes the value of 1 for the firms that have a negative ESG event, and zero for the matched control firms. “Post” defines the treatment time and takes the value of 1 in the event window [-5,5], and is zero prior to the event window. Lastly, we control for firm fundamentals, and add industry and time fixed effects.

The coefficient of interest is β_1, which, if significant, shows that the cumulative abnormal returns of the treated group was different from the control group in the post-treatment period. Meanwhile, β_2 captures the permanent difference between treatment and control group, and β_3 reflects the time trend common to both groups (Glück et al., 2022).

Normally in a DiD regression, the “Post” variable is set such that it is zero in the event window prior to the event, and one from the event day to the end of the event window. However, in our study we have established that there is a substantial possibility that information can be leaked prior to the media reported event. Therefore, we use the whole event window as Post=1 to be able to study the causal effect, while accounting for the information leakage.

To be able to draw a causal inference from the DiD regression, there is one key assumption that has to be met. This assumption is the parallel trends, which says that “… if no treatment had occurred, the difference between the treated group and untreated group would have stayed the same in the post-treatment period as it was in the pre-treatment period” (Huntington-Klein, 2021). This assumption is therefore inherently unobservable. However, we can study the pre-treatment trend to see if the assumption is likely to be met.

Figure 4.3: Parallel Trends[2]

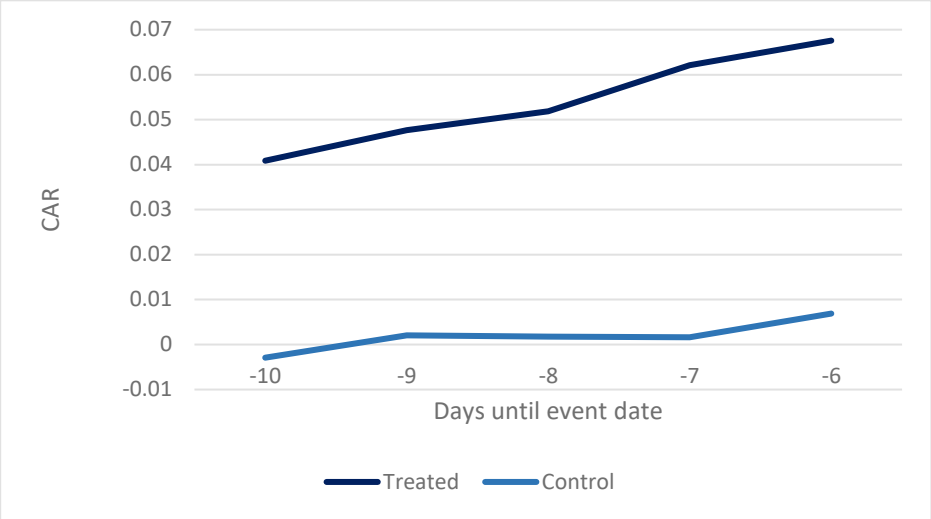


Figure 4.3 shows the pre-treatment trend for the treated group and the control group five days prior to the event window. The difference in CAR between the two groups throughout this period remains relatively constant, and we therefore consider the assumption to be satisfyingly met.

Subsequently, we will compare the event study results to the results from the quasi-experimental method. As the DiD regression analyses how the treated firms are affected by negative ESG news compared to the control firms in the whole event window, we also wish to examine the effect inside the event window. We believe that this will give valuable insight on how abnormal returns behave around the event day, and how the two methods differ. Throughout these results we will calculate the abnormal returns and cumulative abnormal returns of the control firms in the same manner as the event study method with Fama-French factors.

[2] Parallel trends for each ESG pillar is shown in Appendix A6.

5. Data

In this section, the data sample used in our thesis will be presented. First, Section 5.1 presents the data sources and describes the collection process. Second, Section 5.2 will illustrate key aspects of the data sample through descriptive summary statistics.

5.1 Data Sources and Collection

5.1.1 ESG News Data

ESG news events were obtained from the RepRisk databases. RepRisk differs from most other rating agencies by not considering ESG information offered by the companies they evaluate. Instead, they consider only information from external public sources. Daily, RepRisk screens more than 100 000 public news sources in 23 languages, including all Scandinavian languages. The aim of the screening is to uncover announcements of negative news related to the ESG performance of firms. As all uncovered events are stored in RepRisk's databases, the source is highly suitable for research on the impact of negative ESG news on firms. Moreover, each news announcement is specifically linked to at least one of the three ESG pillars. Another significant aspect of RepRisk's database is that each event is assigned a level of "severity". The three levels of severity, low, medium and high, are determined as a function of three dimensions. The first dimension relates to the consequences of the incident. Secondly, the extent of the impact of the incident is considered. The third dimension evaluates whether the incident was caused by accident, negligence, intent or in a systematic manner (RepRisk, 2022).

We collect data on ESG events for the period 2008-2020 for 89 companies listed on the Oslo Stock Exchange. After removing all events with confounding events in the estimation window, as explained in Section 4.1.4, our final sample consists of 136 events. Some of the news events are related to more than one ESG pillar. In the analyses where we separate the events based on the three ESG pillars, we choose to include only the events relating to a single ESG pillar, so that we isolate the effect for each. Thus, the sample size in these analyses drops from 136 to 107 events, which are distributed across the three pillars.

5.1.2 Financial Data

Two different sources have been used in the collection of stock price data. The first source is Børsprosjektet NHH, from which we have obtained daily stock prices for most firms in our data sample. However, stock price data for certain firms in our sample was not available from Børsprosjektet NHH. In these instances, the second source, Refinitiv Eikon, has been used. Furthermore, Refinitiv Eikon has been used to download all data on firm characteristics. This includes data on daily volumes traded, monthly market capitalizations, assets, P/E ratios and leverage.

Moreover, we have retrieved data on daily returns for the Oslo Stock Exchange Benchmark Index OSEBX from the Euronext platform. For the Fama-French factor model, we have obtained the factors for European markets from the Kenneth R. French Data Library (Tuck School of Business, 2022). The factors have been converted with the methods proposed by Glück et al. (2020). Finally, as a measure of the risk-free rate, we have obtained data on the rates of Norwegian 10-year bonds from Norges Bank, which in accordance with Goedhart et al. (2020, p. 314) is the preferred measure of the risk-free rate.

5.2 Descriptive Summary Statistics

Figure 5.1: Events per Year

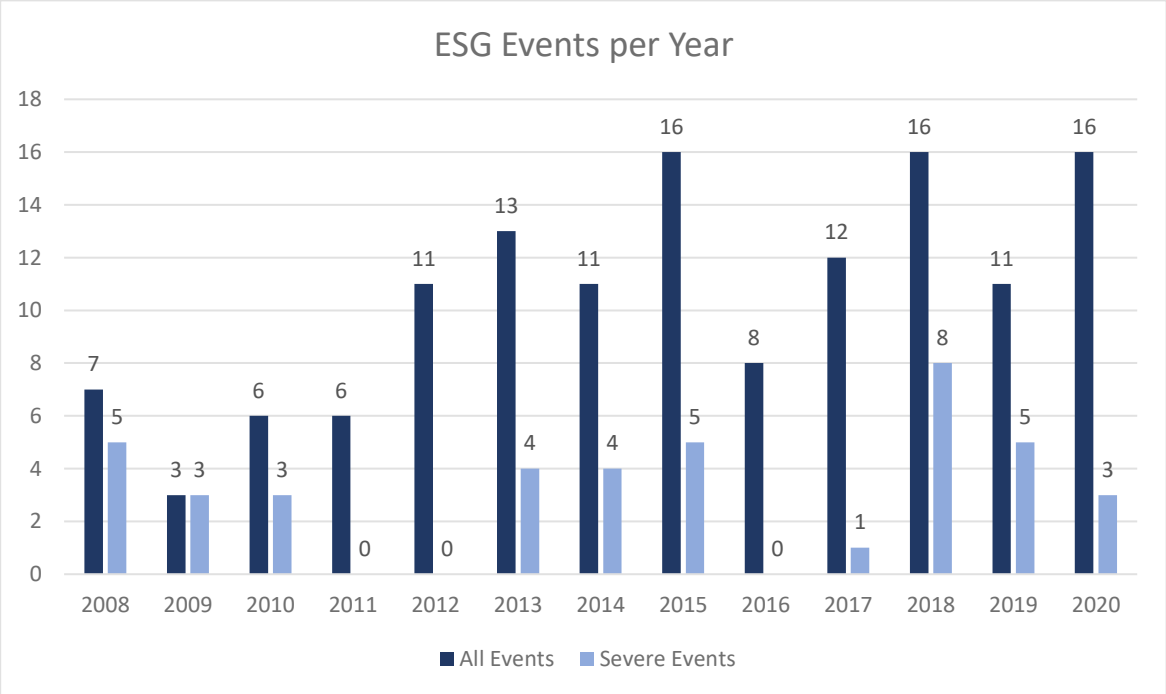
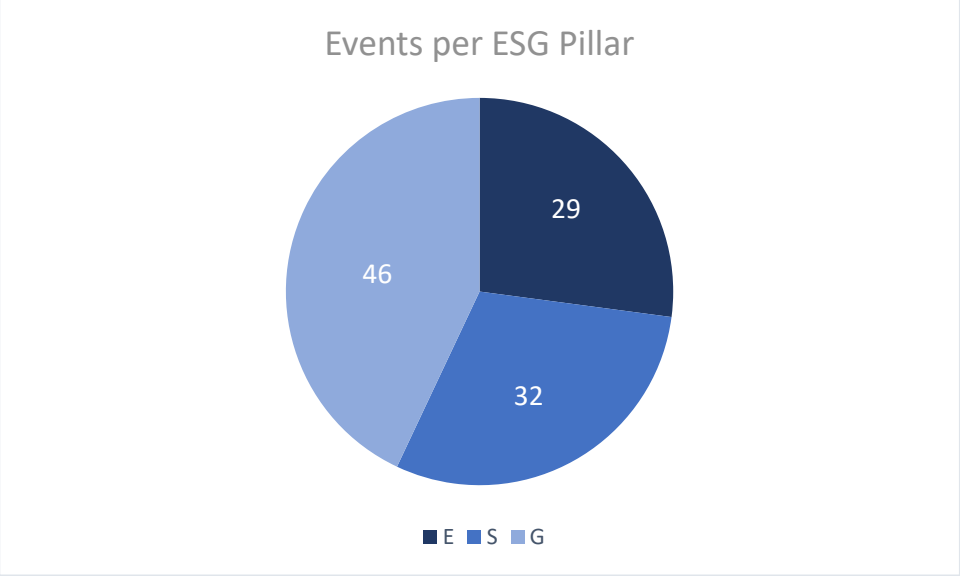


Figure 5.1 shows the distribution of the news events in our sample over time. There is variation in the number of events in different years and some indication of an increasing trend over time.

Figure 5.2: Events per ESG Pillar



As described in Section 5.1.2, the analyses on different ESG issues disregard the news events relating to more than one ESG pillar. Thereby, the sample is reduced to 107 events. Figure 5.2 illustrates how these events are distributed between different ESG issues. We observe a relatively even distribution between the three ESG pillars, with 29 events concerning environmental issues, 32 events concerning social issues, and 46 events relating to governance issues.

When examining the effect of ESG events on stock returns, it is important to evaluate whether events in the pillars carry additional information valued by market participants. It is therefore desirable if the correlations among the pillars are small, so that each pillar tends to cover materially different issues and thus information overlap between pillars are likely to be insignificant (Glück et al., 2022). In Appendix A3 the correlation of ESG events and control variables is depicted. The three pillars are weakly and negatively correlated, which allows us to evaluate each pillar separately.

6. Test Results

In this section we present the results from the tests on our hypotheses. The three hypotheses are investigated in turn, using our multi-method design described in Section 4. In the final part of the section, we present a cross-sectional regression on the event study results.

In the tables where results are presented, the different event windows are shown as [start of event window, end of event window]. We have chosen to view three windows that span from entirely prior to reported news [-5,-1], into the event day [-5,0] and one day after the reported event [-5,1]. This is to ensure that we capture the effect of the event, even if the effect materializes prior to the reported event date, as mentioned in Section 4.1.1. Moreover, we choose two event windows that study the direct effect of the reported event date. The first being the event day [0], which captures the abnormal return on the reported event day. Finally, we view the effect for the event day and the five following days [0,5].

6.1 Market Reactions to Negative ESG News

H1: Negative news do not generate abnormal stock returns in the Norwegian stock market.

6.1.1 Results from Difference-in-Difference Regression

To investigate the first hypothesis, we first test the effect of the treatment through the Difference-in-Difference regression. We include two models, one with firm controls included and another without. This is done because the inclusion of time-varying firm fundamentals could pose statistical problems if these impact the treated and control group differently (Huntington-Klein, 2021).

Table 6.1: Difference-in-Difference Results

Panel A: Excluding Firm Controls

	CAR			
	ESG	E	S	G
T *x* Post	-0.202%	0.801%	0.970%	2.656%**
	(-0.089)	(0.218)	(0.094)	(2.343)
Treated	2.324%**	-0.872%	-6.335%*	5.514%
	(2.480)	(-0.519)	(-1.924)	(1.432)
Post	-1.103%	-1.896%	-0.694%	-4.093%**
	(-0.975)	(-1.609)	(-0.974)	(-2.558)
R^2	0.074	0.239	0.084	0.202
N	3486	714	798	1302
Matched Sample	*Yes*	*Yes*	*Yes*	*Yes*
Firm Controls	*No*	*No*	*No*	*No*
Industry FE	*Yes*	*Yes*	*Yes*	*Yes*
Year FE	*Yes*	*Yes*	*Yes*	*Yes*

Panel B: Including Firm Controls

	CAR			
	ESG	E	S	G
T *x* Post	-0.530%	1.467%	0.690%	2.286%*
	(-0.233)	(0.294)	(0.047)	(2.209)
Treatment	3.720%***	-1.121%	-0.177%	5.269%
	(3.997)	(-0.890)	(-0.026)	(1.669)
Post	-0.886%	-2.810%	-0.962%	-3.422%*
	(-0.804)	(-1.199)	(-0.884)	(-2.070)
R^2	0.090	0.288	0.130	0.235
N	3333	667	762	1232
Matched Sample	*Yes*	*Yes*	*Yes*	*Yes*
Firm Controls	*Yes*	*Yes*	*Yes*	*Yes*
Industry FE	*Yes*	*Yes*	*Yes*	*Yes*
Year FE	*Yes*	*Yes*	*Yes*	*Yes*

The results from Table 6.7 show that the difference between treatment and control groups in the post-window is only significant for G-events. Panel A gives a positive interaction term for G-events of 2.656%, while Panel B gives 2.286%.

Through the matching process, we are isolating the difference between being treated and not treated, for the group that actually is treated. In other words, we have created a counterfactual for the treated firms that is reflecting how their stock prices would move during the post-event period if they had not been involved in an ESG news event. Therefore, the interaction coefficient describes the average treatment effect on the treated firms.

Results from Panel B indicate that the CAR for the treated group was roughly 2.3% higher than that of the control group in the post-event window. Therefore, through ceteris paribus comparison of the two groups, we can conclude that the Norwegian market reacts positively to negative G news.

Further, we wish to examine how the abnormal returns behave in the days surrounding the event. Therefore, we conduct two tests on the full sample of ESG news. First, we present the results obtained using the event study method. When presenting these results, the table consists of two panels. Panel A shows the results obtained using the One-factor model and Panel B shows the results of the Fama-French five-factor model. Second, we present the results obtained using the quasi-experimental method.

6.1.2 Results from Event Study Method

Table 6.2: CAR Results for All Events, Event Study Method

	CAR			
	ESG	E	S	G
Panel A One-Factor model				
[0]	0.491%	1.073%	0.014%	-0.034%
	(0.358)	(1.332)	(0.966)	(-1.368)
[0,5]	1.294%	1.630%	-2.782%	3.640%
	(0.375)	(1.461)	(-0.084)	(0.000)
[-5,-1]	1.977%	0.916%	-0.971%	2.329%
	(0.041)	(0.019)	(-0.347)	(1.347)
[-5,0]	2.468%	1.989%	-0.957%	2.295%*
	(0.144)	(0.555)	(-0.702)	(1.854)
[-5,1]	2.849%	2.041%	-0.782%	2.965%
	(0.053)	(0.542)	(-0.212)	(1.460)
Panel B Fama-French factor model				
[0]	0.496%	1.047%	0.199%	-0.020%
	(0.418)	(1.530)	(1.103)	(-1.286)
[0,5]	1.276%	2.013%*	-2.639%	3.593%
	(0.426)	(1.754)	(-0.052)	(0.037)
[-5,-1]	2.166%	1.582%	-0.950%	2.370%
	(0.198)	(0.006)	(-0.187)	(1.405)
[-5,0]	2.662%	2.629%	-0.751%	2.350%*
	(0.032)	(0.614)	(-0.582)	(1.858)
[-5,1]	3.021%	2.787%	-0.718%	3.016%
	(0.057)	(0.585)	(-0.238)	(1.554)
N	138	30	32	52

Note: T-values are depicted in parentheses. Two-tailed t-test: *** p<0.01, ** p<0.05, * p<0.1

Table 6.2 shows the results from the first test. By comparing the outputs of Panel A and Panel B, it is evident that there are only slight differences in the results obtained from the One-factor model and the Fama-French factor model.

We notice three datapoints that are statistically significant, one in the One-factor model and

two in the Fama-French factor model. In the One-factor model, the G pillar shows a positive average cumulative abnormal return of 2.295% in the [-5,0] event window. This result is also evident in the Fama-French factor model, where the effect is further increased to 2.35%. The fact that no significance is found for the abnormal returns on the event day [0], could indicate that information regarding G issues is often known to investors prior to the news announcement. Thereby, market reactions materialize in the days prior to the announcement, such that the average cumulative abnormal returns are on an upward trend prior to the event day. On the event day, when the news is announced, the effect increases in magnitude, which gives a statistically significant reaction in the [-5,0] event window.

Furthermore, the E pillar gives positive statistical significance in the Fama-French model in the [0,5] event window with a magnitude of 2.013%. The sign and the magnitude of the effect are comparable to the results on G issues. However, the reaction is found in the event window including the event day and the five following days. As no significance is found on the event day alone, this indicates that market reactions to negative news events concerning the E pillar materialize in the days following the announcement.

Most of the CAR values for the dependent variables in the different event windows provide no evidence of statistically significant returns. Neither model finds significant results for the ESG variable, thus indicating that significant reactions are only found for certain types of issues.

6.1.3 Results from Quasi-Experimental Method

Propensity score matching (PSM) allows us to draw causal inference on the market reaction to an ESG event. We find the market reactions from the quasi-experimental method by providing cross-sectional regressions on the cumulative abnormal returns for different windows, where the binary variable “Treated” is present. The binary variable is equal to 1 if the firm has had an ESG event, and zero if not, and therefore describes how the cumulative abnormal returns differ between treatment and control firms. Note that the “Treated” variable is equal to the interaction term Treated *x* Post, where Post is equal to 1. As described in Section 4.2.3, the pre-treatment trend is parallel between the treated and control group, and now we wish to examine how the two groups differ within the post-treatment period.

Table 6.3 depicts the results from regressing the CAR for each event window on the binary variable. The regression is done on the matched sample, and previously mentioned firm controls are included. Industry and year fixed effects are also included.

Table 6.3: CAR Results for All Events, Quasi-Experimental Method

	CAR			
	ESG	E	S	G
[0]	1.157%	3.010%*	0.699%	0.923%
	(1.098)	(2.104)	(0.559)	(1.010)
[0,5]	-0.512%	3.254%*	-9.571%	8.758%**
	(-0.136)	(2.353)	(-1.099)	(2.773)
[-5,-1]	5.182%	-4.242%	6.516%	5.006%*
	(1.252)	(-0.780)	(1.218)	(2.192)
[-5,0]	7.028%*	-1.079%	6.436%	7.020%**
	(1.999)	(-0.135)	(1.055)	(2.491)
[-5,1]	5.022%	-4.871%	6.424%	9.912%*
	(1.677)	(-0.800)	(0.770)	(2.438)
N	159	29	34	59
Matched Sample	*Yes*	*Yes*	*Yes*	*Yes*
Firm Controls	*Yes*	*Yes*	*Yes*	*Yes*
Industry FE	*Yes*	*Yes*	*Yes*	*Yes*
Year FE	*Yes*	*Yes*	*Yes*	*Yes*

Note: Numbers in the bracket represent days relative to the event, the results depict the cumulative abnormal return for the binary explanatory variable treatment. T-values are presented in the parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 6.3 shows that similarly to the results from the event study method, statistically significant market reactions are found for the E and the G pillar. All statistically significant results are positive, which was also the case with the event study method.

However, several differences from the event study method are also evident. First, Table 6.3 shows a significant positive reaction in the [-5,0] event window for the combined ESG variable. The result is large in magnitude, indicating that ESG news events in general lead to firms experiencing, on average, 7.02% higher CAR than matched firms with no event.

Second, results for the environmental pillar are statistically significant on the event day, showing a positive abnormal return of 3.01% compared to the control firms. In the extended event window which includes the event day and the five following days, the cumulative abnormal return increases to 3.254%. Similarly to the results from the event study method, no statistically significant results are found for the S pillar. The results for the G pillar are statistically significant in all event windows, except for the single event day. The significant results are all positive and relatively large in magnitude. Event windows [-5, -1] and [0, 5]

show CAR of 5.006% and 8.758% respectively. These event windows do not overlap and cover a range of 11 days combined, which indicates that the effect is large and relatively long-lasting. As was discussed for the event study results, the significant pre-event results may indicate that investors are informed prior to the news announcement.

6.1.4 Summary

Our multi-method approach has allowed us to obtain results using two different methods. To a large degree, the main findings are similar with both approaches. Firstly, we find significant causal evidence that the Norwegian market has a positive reaction to negative G news in the whole event window. When we examine reactions within the event window, we find that market reactions are different for different ESG news and find positive and significant reactions to both negative E and G issues. We believe this strengthens our overall test results as it shows they are not the result of a weakness in the event study method. However, certain differences in the results are evident. For instance, a significant and positive reaction is found to ESG news in general when using the quasi-experimental method, which is a result not found statistically significant when using the event study method. Furthermore, the magnitude of the significant effects differs between the methods, as the PSM results are generally larger than those obtained with the event study method.

6.2 Market Reactions to Severe Negative ESG News

H2: The Norwegian stock market does not react differently to severe negative ESG news than to negative ESG news in general.

When examining the second hypothesis, we choose not to split the sample into the three ESG pillars. The reason is that the sample size decreases substantially when including only severe news events. Separating the severe sample into the ESG pillars would mean that the three subsamples would be worryingly small. Therefore, the tests are run only on the combined ESG sample.

Table 6.4 shows the CARs for the full sample of ESG events and the sample of only severe events. Results in the columns “ESG (All)” and ESG (Severe)” are obtained from the event study method using the Fama-French five-factor model. Thus, the results in the “ESG (All)”

column are the same as the ones presented in Panel B of table 6.2. They are included again as a basis of comparison for the results from the sample with only severe events, which are presented in the "ESG (Severe)" column. The column "Difference" shows the difference in the CARs for the full sample and the sample with only severe events. We have conducted a two-tailed Student's t-test to examine if the differences between the CARs are significantly different from each other. The last column "ESG Quasi" shows the results obtained from the quasi-experimental method.

Table 6.4: Results from Test on Severe Events

	CAR			
	ESG (All)	ESG (Severe)	Difference (All)-(Severe)	ESG Quasi
[0]	0.496%	0.888%	-0.392%	-0.946%
	(0.418)	(0.137)	(-0.562)	(-0.678)
[0,5]	1.276%	-2.969%	4.245%	-13.685%
	(0.426)	(-0.693)	(0.942)	(-1.588)
[-5,-1]	2.166%	1.219%	0.923%	1.445%
	(0.198)	(0.307)	(0.308)	(0.173)
[-5,0]	2.662%	2.107%	0.555%	1.644%
	(0.032)	(0.350)	(0.173)	(0.188)
[-5,1]	3.021%	2.356%	0.675%	-1.750%
	(0.057)	(0.516)	(0.194)	(-0.230)
N	138	37	175	166

Note: Numbers in the bracket represent days relative to the event. The column ESG (All events) shows results from the full sample model. The column ESG (Severe events) shows results from the sample of severe events. The Quasi-model is implemented on the right-hand side and includes sector and year fixed effects. T-values are presented in the parentheses, *** p<0.01, ** p<0.05, * p<0.1

From the two columns on the left in Table 6.4 we observe that no statistically significant results are found for the full sample or the sample with only severe ESG events. Thus, the results do not indicate that market reactions are more significant when the news events are more severe.

Although the results do not indicate that severe news generate more significant market reactions, it is evident that the CARs differ. The "Difference" column shows that the differences in reactions are not statistically significant. However, we note that reactions to severe ESG news are less positive than reactions to ESG news in general in all event windows except for the event day.

The results in the last column, "ESG Quasi", show that statistically significant differences between reactions to severe news and news in general are not found with the quasi-

experimental method either. Thus, the two methods paint a similar picture; the Norwegian stock market does not react more significantly, nor significantly differently, to severe ESG news than to ESG news in general.

6.3 Market Reactions Over Time

H3: Market reactions to negative ESG news have not changed over time

To examine whether market reactions have changed over time, we split the sample into two subsamples and compute CARs for each subsample separately. According to Kell (2018), ESG investing was greatly accelerated around 2013 and 2014. Therefore, we use the year 2015 to split the sample, so that we have one subsample with events announced before 2015 and another with events from 2015 and onwards. Hereafter, this first group of events will be referred to as "early events" and the latter will be called "recent events"

Again, we use both the event study method and the quasi-experimental method to obtain the results. The two columns on the left of Table 6.5 show CAR results from the event study method, one for recent events and the other for early events. The third column, "Difference", shows the difference in CARs between the recent and the early events. A Student's t-test has been conducted to examine if the differences are statistically significant. The "ESG Quasi" column shows results from the quasi-experimental method.

Table 6.5: Results from Test of Differences Over Time

	CAR			
	ESG (Recent)	ESG (Early)	Difference (Recent)-(Early)	ESG Quasi
[0]	0.926%	-0.097%	1.023%	2.576%*
	(0.214)	(-0.417)	(1.593)	(2.190)
[0,5]	2.624%	-0.583%	3.207%	1.400%
	(1.346)	(-0.651)	(0.865)	(0.223)
[-5,-1]	3.140%	0.823%	2.320%	3.353%
	(0.390)	(0.669)	(0.907)	(0.784)
[-5,0]	4.066%	0.726%	3.340%	7.095%
	(0.463)	(0.312)	(1.191)	(1.789)
[-5,1]	4.731%	0.662%	4.070%	3.888%
	(0.526)	(0.348)	(1.302)	(1.271)
N	80	58	138	166

Note: Numbers in the bracket represent days relative to the event. Column ESG(Recent) is post (including)2015, ESG (Early) is prior to 2015. The Quasi-model is implemented on the right-hand side and includes sector fixed effects. T-values are presented in the parentheses, *** p<0.01, ** p<0.05, * p<0.1

As we seek to examine if market reactions have changed over time, the two columns of interest are “Difference” and “ESG Quasi”. Most results from the quasi-experimental method and all results from the event study method indicate that market reactions to negative ESG news have not changed significantly over time. A statistically significant result is found only on the event day when using the quasi-experimental method, which means that there is a significant difference between the event day reaction to recent events and early events. Moreover, the result is positive, which shows that event day reactions to recent events are significantly more positive than event day reactions to early events.

The results from the event study method indicate that market reactions have not changed significantly over time. We do note, however, that all results are positive. This indicates that, even though the difference is statistically significant, market reactions to recent events are, on average, more positive than reactions to early events.

6.4 Cross-Sectional Regression Analysis of Event Study Results

We will now investigate whether the CAR results from the event study are truly attributable to the ESG events and not to other firm characteristics. In this section we will also provide an analysis of how the cumulative abnormal returns are affected by the severity of an event and which time period the event occurs in. To examine this, we utilize a cross-sectional analysis, with CAR as the dependent variable.

Panel A of Table 6.6 examines the effect of firm controls CAR. The chosen firm controls are market capitalization, volume and book-to-market. We choose to examine E and G in the windows [0,5] and [-5,0] respectively, due to these periods having significant results with the event study method. Further, we include G in the post-event window and ESG in the pre-event window, as these are significant in the quasi-experimental results.

Market capitalization is chosen as we believe that the size of a firm can impact the stock reaction of ESG news. This is due to larger firms facing more media coverage than smaller firms, and therefore investors can be more sensitive to ESG news. However, the higher media coverage can also generate anticipation effects for investors. Due to the higher coverage,

investors are more informed about the day-to-day dealings of the firms, and thereby better able to anticipate ESG news. This can decrease the stock reaction around the event. Glück et al. (2022) find that higher market capitalization firms experience, on average, lower abnormal returns surrounding an ESG rating event.

The second firm control, volume, is used to analyse if reallocation possibilities affect the stock reactions. Investors in firms with lower volume of traded stocks will face difficulties in quickly selling their stocks, as there is a low volume of traders. Therefore, stock reactions can take longer time before they are implemented into stock prices. Meanwhile, more liquid stocks are expected to have a more immediate impact on their returns when an event occurs.

The last firm control is book-to-market ratio. This ratio compares a company's book value to its market value and can tell an investor if a stock is overvalued or undervalued. Book-to-market ratio is included to indicate whether a stock is a growth-stock (low BM) or value-stock (high BM). Glück et al. (2022) find that growth stocks earn a higher abnormal return on average compared to value stocks.

All firm controls are used in natural logarithms to avoid skewness, thereby normalising the distributions.

Panel B of Table 6.6 shows how the severity of an event, the time period in which the event occurs, and firm controls affect the CAR in each event window. The event windows chosen are [0], [0,5] and [-5,-1] to capture how the independent variables affect the cumulative abnormal returns before the event, at the time of the reported event, and after.

To ensure that the relationship between the CARs and each explanatory variable is isolated, we show the correlation between the explanatory variables in Appendix A3. The correlations are low to moderate, meaning that we expect no multicollinearity issue to be prevalent.

Lastly, we use clustered standard errors across industry and year in the regression results. Standard errors clustered by industry capture the unspecified correlation between events in the same industry across years, while clustering by year captures unspecified correlation between different industries in the same year[3].

[3] Discussion of standard error clustering can be found in section 8.1.

Table 6.6: Cross-Sectional Regression on Event Study Results

Panel A studies event window [0,5] and [-5,0] due to there being similarities in statistical significance in the event study method and quasi-experimental method. Panel B studies how severity, the time periods and firm controls affect ESG in the different event windows. Panel B includes industry fixed effects and year fixed effects in the model with severity, but as the time dummy acts as the year fixed effect, we exclude it in the time models.

Panel A	CAR			
	E [0,5]	G [0,5]	ESG [-5,0]	G [-5,0]
ln(Mcap)	0.028**	-0.004	-0.031	0.009
	(3.764)	(-0.377)	(-1.752)	(0.387)
ln(Vol)	-0.007	-0.002	0.006	0.003
	(-0.976)	(-0.558)	(0.842)	(0.576)
ln(BM)	-0.060	0.027**	-0.051**	0.002
	(-2.047)	(3.658)	(-2.658)	(0.112)
(Intercept)	-0.569***	0.171	0.657	-0.236
	(-7.825)	(0.609)	(1.861)	(-0.419)
R^2	0.802	0.487	0.185	0.355
N	25	46	135	47
Industry FE	*Yes*	*Yes*	*Yes*	*Yes*
Year FE	*Yes*	*Yes*	*Yes*	*Yes*

Panel B	CAR					
	ESG [0]	ESG [0,5]	ESG [-5,-1]	ESG [0]	ESG [0,5]	ESG [-5,-1]
Severity	0.011*	-0.092	-0.037			
	(2.268)	(-1.056)	(-0.633)			
D				0.010	0.011	0.013
				(1.795)	(0.343)	(0.792)
ln(Mcap)	-0.005	-0.016	-0.029	-0.005*	-0.015	-0.031*
	(-1.723)	(-1.028)	(-1.644)	(-2.185)	(-1.197)	(-2.188)
ln(Vol)	-0.002	0.000	0.007	-0.001	0.002	0.009
	(-0.956)	(0.073)	(1.137)	(-0.628)	(0.211)	(1.687)
ln(BM)	-0.007	-0.009	-0.046**	-0.006	0.001	-0.038**
	(-1.117)	(-1.046)	(-2.571)	(-0.797)	(0.278)	(-2.895)
(Intercept)	0.125**	0.403	0.596	0.125**	0.334	0.606*
	(2.573)	(1.108)	(1.665)	(2.732)	(1.152)	(2.077)
R^2	0.206	0.182	0.211	0.113	0.132	0.175
N	135	132	133	135	132	133
Industry FE	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Year FE	*Yes*	*Yes*	*Yes*	*No*	*No*	*No*

Note: T-values are presented in the parentheses, *** p<0.01, ** p<0.05, * p<0.1

Panel A shows that market capitalization has a significant positive effect of 2.8% on the cumulative abnormal returns for E events in the window [0,5]. This means that larger firms, in terms of market capitalization, experience an average CAR that is 2.8% higher than smaller firms in the five days past the reported event date. Meanwhile, book-to-market significantly

affects the average CAR of ESG and G news differently in each respective event window. For G news in the window [0,5], the coefficient is positive at 2.7%, which indicates that value stocks, on average, earn a higher abnormal return in the post-event window. Conversely, value stocks earn lower abnormal returns on average in the five days prior to an ESG event.

Panel B shows that the severity of the events has no significant impact on the average abnormal returns prior to the event and after the event. However, severe events have a significant positive effect on the abnormal return on the reported event date. This effect is 1.1% and indicates that the severity of an event has an impact on investors decision, but that the impact quickly diminishes. Meanwhile, book-to-market is significant in the pre-event window, similarly to what was found in Panel A.

Further, Panel B shows that the time period has no significant effect on the abnormal returns for each window. This indicates that investors' reactions to negative ESG news have not changed over time and is identical to what was found in Section 6.3.

7. Discussion

In this section, the presented results will be more closely examined and discussed. We will discuss the results from the tests on the three hypotheses in turn. In the last part of the section, we will summarize.

When suitable, the results will be compared to the findings of the literature presented in Section 3. This will be done both when our results are in line with the presented literature, and when our findings may be contradicting previous findings. We believe these comparisons are valuable for two reasons. First, they are helpful in explaining the findings we have made. Second, they underline how our findings may contribute to the understanding of market reactions to ESG news, as formed by existing research.

7.1 Discussion of Results from Tests on Full Sample

H1: Negative ESG news do not generate abnormal stock returns in the Norwegian stock market.

We find evidence in favour of rejecting the null hypothesis that negative ESG news do not generate abnormal stock returns. Our findings indicate that the Norwegian stock market reacts significantly to certain ESG issues.

Through the results from the Difference-in-Difference regression, we find that news events concerning the governance pillar have a causal positive effect on stock prices. This positive effect is also evident when examining different event windows through the event study method and the quasi-experimental method. Furthermore, significant positive reactions are found in certain event windows of the two methods for both the environmental pillar and the ESG pillar.

The perhaps most interesting insight from these results is that the Norwegian stock market reacts differently to negative news concerning the different ESG pillars. This is evident in the results obtained from both the event study and the quasi-experimental method. We believe this is a new contribution to the field of research as it has, to our knowledge, not previously been studied in the Norwegian stock market. However, several studies using data on U.S. or large European firms have separated the three ESG pillars when studying market reactions to ESG news (see e.g., Krueger, 2015; Capelle-Blancard & Petit, 2019; Serafeim & Yoon, 2021; Glück et al., 2022). Interestingly, these studies reach divergent conclusions as to whether market

reactions are different for different issues. Thus, our finding that market reactions are different for different ESG issues is in line with the findings of Krueger, Serafeim and Yoon and Glück et al., but in contrast to those of Capelle-Blancard and Petit. Although their results are in line with our finding that market reaction differ for different ESG issues, both Serafeim and Yoon and Glück et al. find that negative events concerning the governance pillar do not lead to significant reactions. This is a contrast to our results, in which negative news related to the G pillar give significant results for both methods. Thus, it indicates that the Norwegian stock market is more sensitive to governance issues than other markets.

Another interesting finding is that all statistically significant results are positive. Thus, we find that certain negative ESG news are received positively by investors who reward the involved firms with higher stock prices. Generally, studies arguing that good ESG performance should be punished by investors while weak ESG performance should be rewarded, find the costs of ESG performance to outweigh the benefits (see e.g., Friedman, 1970; Hong et al., 2012; Di Giuli and Kostovetsky, 2013). Our results on negative news concerning environmental and governance issues indicate that this might be a prominent opinion in the Norwegian stock market. Although this view is presented in several contributions on the connection between ESG and financial performance, it is seldomly found in studies on market reactions to ESG news. As such, our findings on environmental and governance issues are contrary to most prominent literature on the field. Especially, they are in contrast with research finding poor ESG performance to be punished in the stock market (see e.g., Flammer, 2013; Capelle-Blancard & Petit, 2019). According to Flammer, stock price reactions to ESG controversies are more severe when good ESG performance is considered the norm and is expected by investors. In Norway, which as exemplified by Dhaliwal et al. (2012) is a stakeholder-oriented country, reactions to negative news should therefore be significant and negative. Interestingly, our results contradict this line of argumentation, and thus offer an alternative understanding of market reactions to negative ESG news.

However, it should be noted that the positive market reactions are only found in certain event windows. The further results from the first test, such as most of those for the combined ESG variable, indicate that the Norwegian stock market regards information from negative ESG news to be value irrelevant. Value irrelevant information has been defined as information unable to move stock market prices. From the literature examining market reactions to new ESG-related information, both Serafeim and Yoon (2021) and Moss et.al. (2020) make findings in support of this perspective. The findings of Serafeim and Yoon especially, are in

line with those from our first test, as their results in general find no evidence of significant market reactions around announcements of negative ESG news. One of the explanations provided by Serafeim and Yoon is that ESG news will not lead to price changes if "investors do not update their beliefs post ESG news because much is already known through already existing channels". ESG ratings may be one such channel. The prevalence of ESG ratings means that information on a firm's ESG performance is easily available to investors. Rather than changing beliefs based on single news events, investors may instead rely on ESG ratings to provide information about a firm's ESG performance. Subsequently, announcements of negative news will not provide stock markets with value relevant new information.

Another possible explanation behind the results where no significance is found is that the reactions of different investors will counterbalance the overall effect. As is evident from the discussion in Section 3, there are different perceptions on how investors should value ESG performance. Thus, different market participants will react differently to negative ESG news. The overall effect on stock prices, therefore, could be small and insignificant.

In the presentation of the results, we briefly commented that the significant results for G issues may indicate that the information in the news event is known to investors prior to the announcement. There are several reasons why information can reach investors before the news announcement. First, as discussed in Section 4.1.1, there may be occurrences where the media is later to report on the events than other sources. As the RepRisk database consists solely of news from external sources, announcements from the companies themselves are not included. If a company reports on its own ESG incidents, there may be a lag before the incident is reported in the media. Thereby, investors who integrate ESG information in their investment decisions can react before our reported event days. Moreover, the sources included in the RepRisk database may report on incidents later than alternative sources not included in the database. For instance, some local Norwegian newspapers may not be included in RepRisk's screening. If these alternative sources report ESG events prior to the RepRisk sources, the market reaction will materialize in our pre-event window. Furthermore, information may be leaked prior to news announcements. Leakage of information may come from insiders within the company, the media sources or from other sources such as interest groups with access to the information.

7.2 Discussion of Results from Tests on Severe News

H2: The Norwegian stock market does not react differently to severe negative ESG news than to negative ESG news in general.

We have discussed how ESG news may not be value relevant if much is already known through existing channels, such as ESG ratings. When ESG incidents covered in news events increase in severity, they could be expected to be more successful in bringing investors new value relevant information. However, we do not find this to be the case. Therefore, we do not find evidence to reject the null hypothesis stating that the Norwegian stock market does not react differently to severe negative ESG news than to negative ESG news in general

The results from the tests on differences in reactions to severe ESG news are interesting for two reasons. First, the results indicate that investors do not attach more value relevance to severe ESG news than to ESG news in general. Thus, one can argue that investors are not sensitive to the severity of negative ESG news.

Second, a further insight is that the event study method gives less positive results for the severe events in almost all event windows. Although the results are not statistically significant, this indicates that severe ESG news are received less positively by investors. The arguments presented as explanations behind the positive reactions of the first test relate to investors regarding ESG performance to be negatively related to profitability. When events increase in severity, however, it seems that investors no longer regard the poor ESG performance to be significantly value-enhancing for shareholders.

The results remain largely consistent through the cross-sectional regression. However, severity has a significant positive reaction on the event day. As there are no significance in the period prior to or after the event, we can conclude that the effect is highly transitory.

Among the prominent literature on market reactions to ESG news, no study has, to our knowledge, separated between news based on their severity. We therefore believe that our finding can be a valuable contribution to the research on market reactions to ESG news.

7.3 Discussion of Results from Tests on Reactions Over Time

H3: Market reactions to negative ESG news have not changed over time.

We find a statistically significant difference in results between early and recent events on the event day when using the quasi-experimental method. The result indicates that market reactions to ESG news have become more positive over time. However, no further statistically significant results are found. Thereby, we have very limited evidence to reject the null hypothesis stating that market reactions to negative ESG have not changed over time. This result is further enhanced through the cross-sectional regression, where no significant effect was found.

Thus, our findings challenge the conventional idea of an increasing significance of ESG issues in investment decisions. In the literature on market reactions to ESG news, however, there is no clear consensus as to whether reactions have increased in significance over time.

Flammer (2013) finds that the negative reaction has become more negative over time in a study ranging from 1980 to 2009. On the other hand, Capelle-Blancard and Petit find that stock market penalties do not vary significantly over time when studying companies between 2002 and 2010. Our results contribute to the understanding by using a more recent data sample. By finding no significant difference over time, our results are in line with those of Capelle-Blancard and Petit, while contrasting the findings of Flammer.

Although the differences are not statistically significant, it is interesting to note that the average effects are more positive for more recent events. This indicates that there has been some development in the market reactions over time, but they are generally not sufficiently large to be considered statistically significant.

7.4 Summary of Discussion

In summary, we find that the announcements of certain types of negative ESG news lead to significant abnormal returns in the Norwegian stock market. Therefore, we have evidence in support of rejecting the first hypothesis stating that negative ESG news do not generate abnormal stock returns. The most significant reactions are found for negative news concerning governance issues. Moreover, some evidence is also found for significant reactions to

environmental news and to ESG news in general. In contrast to most prominent literature on the field, we find that investors respond positively to these news announcements. Thus, we find two interesting insights from the first set of tests. First, we find that the Norwegian stock market reacts differently to different types of negative ESG news, and second that the significant reactions are positive.

Moreover, our results indicate that the market does not react differently to ESG news considered to be more severe than to ESG news in general. This means that we do not find evidence to reject the null hypothesis stating that the Norwegian stock market does not react differently to severe negative ESG news than to negative ESG news in general.

Our fourth finding is that the market reactions have been relatively stable over time. Thereby, we have very limited evidence to reject the null hypothesis stating that market reactions to negative ESG news have not changed over time. This finding challenges the conventional view that ESG issues have become increasingly important in investment decisions in recent years.

Overall, our results indicate that the Norwegian stock market reacts only to certain types of negative ESG news, that the reactions are positive, that reactions are not more significant for more severe news, and finally that reactions have been relatively constant over time.

8. Conclusion

The objective of this thesis has been to contribute to the understanding of how stock markets react to announcements of ESG news. Several studies have examined such market reactions, but they do not find a consensus as to how stock prices are affected by ESG news. Furthermore, those studies that separate news events based on the three ESG pillars, reach divergent conclusions as to whether reactions are different for different news. To our knowledge, no study on the Norwegian stock market has separated between reactions on news based on ESG pillar, and no study has studied differences in reactions to ESG news considered to be more severe. Therefore, we believe our thesis offers valuable contributions to the field.

To thoroughly investigate the reactions of the Norwegian stock market to negative ESG news, we developed three hypotheses.

H1: Negative ESG news do not generate abnormal stock returns in the Norwegian stock market.

H2: The Norwegian stock market does not react differently to severe negative ESG news than to negative ESG news in general.

H3: Market reactions to negative ESG news have not changed over time.

Our data sample consists of negative ESG news events between 2008 and 2020 regarding firms listed on the Oslo Stock Exchange. The hypotheses have been tested using a multi-method research design in which we combine an event study methodology with a quasi-experimental method to calculate and compare cumulative average abnormal returns around the announcements of negative ESG news.

We find that the announcements of certain types of negative ESG news lead to significant abnormal returns in the Norwegian stock market. The most significant reactions are found for negative news concerning governance issues. In contrast to most prominent literature on the field, we find that investors respond positively to these news announcements. This result is found when using both the event study method and the quasi-experimental method, and through Difference-in-Difference regression we are able to interpret the effect causally. Moreover, some evidence is also found for significant positive reactions to environmental news and to ESG news in general.

Thus, we make two interesting insights from the first set of tests. First, we find that the Norwegian stock market reacts differently to different types of negative ESG news, and second that the significant reactions are positive. The finding of positive reaction to negative ESG news contrasts most existing literature on the field. However, the finding is supported by several studies arguing that ESG performance is negatively related to financial performance. Generally, these studies argue that the costs of ESG performance outweigh the benefits (see e.g., Friedman, 1970; Hong et al., 2012; Di Giuli and Kostovetsky, 2013). Our findings suggest these views might be prominent in the Norwegian stock market.

Moreover, our results indicate that the market does not react more significantly differently to ESG news considered to be more severe than to ESG news in general. This finding is especially interesting as no study has, to our knowledge, studied differences in reactions based on level of severity. Finally, we find that the market reactions have been relatively stable over time, which challenges the view that ESG issues have been increasingly important in investment decisions in recent years.

8.1 Limitations

In this section we critically assess the limitations of our thesis. Our main concerns regard the data sample and the event study methodology, which could lead to biased outcomes.

The data sampling of the ESG news events were done through the RepRisk database, which entails that the events are reported by public sources. This restriction might induce significant lag between the event dates and the market reactions. To adjust for this, we emphasise the importance of the "pre-event" window. However, there is some uncertainty regarding the size of the lags that could affect the outcomes.

In regard to the event study methodology, some of the assumptions are disputed, such as the market efficiency hypotheses and the rationality of market participants. The methodology also suffers from the risk of exogenous factors influencing stock prices during certain event windows. Although we try to adjust for this by introducing a quasi-experimental method, there could still be factors influencing the event dates that are not adjusted for, as each event window's cumulative abnormal return is equally weighted.

Our research design could also alter the outcomes presented. The event study research design entails choosing the length of the estimation window and event window. We chose an estimation window of 200 days to minimize the variance of daily returns. However, one could choose a shorter window to better reflect the recent stock movement. The length of our estimation window also reduced the number of usable events significantly, as we did not allow for estimation windows and previous event windows to overlap. Regarding the event window we opted for a 10-day window surrounding the event. However, when accounting for the information lag, it could be prudent to choose a longer pre-event window when using public reported news. Another option would be to include a holdout window, to ensure that the estimation window does not overlap with potential market reactions.

Therefore, we consider the most distinct limitation of our study to be the limited sample size of our events. When conducting the propensity score matching, we further trim the sample size to fulfil the common support assumption and due to some limitation in available firm controls. Hence, this can also limit the analysis of causal inference.

Lastly, the outcomes from the quasi-experimental method and cross-sectional regression use clustered standard errors to estimate the standard errors and thereby the significance of the results. We have chosen to cluster by industry and year[4], but there are possibilities to cluster differently, such as by firms and week. However, we have opted for year due to observing treatment effects across time and we expect treatment assignment to be more "sticky" than at the weekly level, and therefore a wider standard error is required. Secondly, we use industry fixed effects instead of firm due to the RepRisk data at hand. From our analysis, the materiality of the news is often wider than firm level, meaning that our treatment assignment is also industry dependent.

8.2 Further Research

A suggestion for future research would be to study the effect of severe news events on each ESG pillar on a larger market than solely the Norwegian stock market, such as the

[4] This is based on the paper from Abadie, A., Athey, S., Imbens, G.W. & Woolridge, J.M. (2022). *When Should You Adjust Standard Errors for Clustering?*

Scandinavian stock market. As we did not separate the sample of severe news events into the three ESG pillars due the sample size diminishing, we were not able to study differences in reactions to more severe events for different ESG issues. We believe the severity of an ESG event is an interesting aspect of stock market reactions that deserves further research.

As the news events are likely to suffer from leakage effects, another suggestion would be to experiment with increasing the length of the pre-event window to better isolate the market reactions to negative media-reported ESG news events.

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Appendix A1: Robust Test Statistics

When testing whether the CAAR's are significantly different from zero, we use robust test statistics. This is to account for cross-sectional correlation of residuals and event-induced volatility.

The implementation requires several steps, with the first being a standardization of abnormal returns.

$$SAR_{i,\tau} = \frac{AR_{i,\tau}}{S_{AR_i}\sqrt{1 + c_\tau}}$$

With,

$$S_{AR_i} = Residual\ standard\ error\ of\ the\ regression$$

$$c_\tau = x'_\tau (X'X)^{-1} x_\tau$$

$$x_\tau = Vector\ of\ explanatory\ variables\ on\ event\ day\ \tau$$

$$X = Matrix\ of\ explanatory\ variables\ in\ estimation\ period$$

The aim of standardization is to give relatively less weight to more volatile observations, than to more stable ones (Glück et al., 2022).

Next, we convert the standardized abnormal returns into standardized cumulative abnormal returns.

$$\overline{SCAR} = \frac{1}{N}\sum_{i=1}^{N} SCAR_i$$

With,

$$SCAR_i = \frac{1}{\sqrt{L}}\sum_{\tau_0}^{\tau_1} SAR_{i,\tau}$$

Where L is the length of the event window.

We then calculate the cross-sectional standard errors, which accounts for potential event-induced volatility (Boehmer et al., 1991).

$$S_{\overline{SCAR}} = \sqrt{\frac{1}{N-1}\sum_{i=1}^{N}(SCAR_i - \overline{SCAR})^2}$$

Secondly, we adjust for potential cross-correlation of abnormal returns, due to event-date clustering of our sample.

$$\bar{r}_k = \frac{1}{N_k(N_k-1)}\sum_{i=1}^{N_k}\sum_{\substack{j=1 \\ i\neq i}}^{N_k} r_{ij,k}$$

Then we estimate the average sample correlation over all-event date clusters.

$$\tilde{r}_k = \frac{1}{N_k(N_k-1)}\sum_{k=1}^{q} N_k(N_k-1)\bar{r}_k$$

Where,

$$N_k = Number\ of\ events\ in\ kluster\ k$$

$$N_q = Number\ of\ clusters$$

Lastly, we obtain our robust test statistics following Kolari and Pynnönen (2010), which is approximately normally distributed.

$$z_{kp} = \sqrt{N}\frac{\overline{SCAR}}{S_{\overline{SCAR}}}\sqrt{\frac{1-\tilde{r}_k}{1+(N_k-1)\tilde{r}_k}}$$

Appendix A2: Summary Statistics

	Min	1st Qu.	Mean	Median	3rd Qu.	Max	SD	Obs
Panel A: Events								
ESG	1	1	1	1	1	1	0	136
E	1	1	1	1	1	1	0	29
S	1	1	1	1	1	1	0	46
G	1	1	1	1	1	1	0	32
Severity	0	0	.301	0	1	1	.461	136
	Min	1st Qu.	Mean	Median	3rd Qu.	Max	SD	Obs
Panel B: Controls								
ESG								
Asset (M)	250.7	9238.6	85710.2	20324.7	43679	2653201	328590.4	134
BM	.081	.419	.953	.676	1.230	6.021	.852	134
Lev	0	.081	.243	.232	.357	.843	.180	134
Mcap (M)	81.31	5130.7	22046.8	10320.55	21650.22	261512.3	34367.73	134
PE	-251.61	-.895	9.051	9.269	19.864	198.034	40.357	133
Vol (M)	.000	.054	1.363	.353	1.483	13.153	2.297	135
Price	1.41	22.9	13413.38	65.75	110	1776312	152871.7	135
E								
Asset (M)	250.7	10935.3	48885.2	20376.3	37955	568943	105145.9	29
BM	.192	.348	.913	.541	1.280	2.790	.785	29
Lev	0	.062	.269	.265	.399	.843	.209	29
Mcap (M)	81.3	5064.5	22377.1	15528.5	30171.5	78214.9	24140.5	29
PE	-251.6	-1.5	6.7	9.9	20.5	198	66.2	28
Vol (M)	.001	0.112	1.722	.555	2.300	9.425	2.611	29
Price	1.722	29.92	104.7	77	115.9	561	123.9	29
S								
Asset (M)	2293.4	9081.4	59387.2	29882.4	49295	463367	105469.1	32
BM	.125	.582	1.303	.809	1.544	6.021	1.315	32
Lev	0	.095	.280	.257	.409	.783	.200	32
Mcap (M)	242.86	3618.4	17973.2	9699.4	23370.3	81354.6	21975.8	32
PE	-23.64	-1.550	15.13	6.581	16.47	118.12	30.246	31
Vol (M)	.005	.187	1.955	.759	2.343	13.153	3.051	32
Price	3.596	14.48	71.450	55.25	94.355	432.3	89.721	32
G								
Asset (M)	663.74	8868.1	91573.2	13207.6	52115	2653201	392824.7	45
BM	.177	.423	.852	.638	1.230	2.246	.577	45
Lev	0	.081	.195	.200	.290	.557	.141	45
Mcap (M)	245.92	5649	20823.3	7818.3	18010.5	170046.7	34983.2	45
PE	-186.67	-1.625	1.820	8.574	17.619	51.429	36.143	45
Vol (M)	.000	.039	1.092	.304	1.001	7.274	1.864	45
Price	1.41	22.2	40068.4	50.95	104.4	1776312	264729.2	45

Appendix A3: Correlation Matrix of Independent Variables

	ESG	E	S	G	Severity	Asset	BM	Lev	Mcap	PE	Vol	Price
ESG	1											
E	-.4150	1										
S	-.4390	-.1434	1									
G	-.5448	-.1779	-.1882	1								
Severity	.0334	-.0380	.1016	-.0986	1							
Asset	.0256	-.0368	-.0253	.0203	-.0984	1						
BM	-.0295	-.0263	.1457	.0674	.1789	.0260	1					
Lev	.0066	.0544	.0814	-.1247	.1515	-.0403	.2259	1				
Mcap	.0259	.0124	-.0412	-.0074	-.0437	.6707	-.2288	-.1404	1			
PE	.0231	-.0133	.0638	-.0731	-.1014	.0182	-.1720	-.1148	.2028	1		
Vol	-.0339	.0449	.0860	-.0692	-.1993	.1291	.0725	-.1553	.1128	-.0146	1	
Price	-.0113	-.0342	-.0363	.0745	-.0593	-.0220	-.0761	.1610	-.0322	-.0074	-.0562	1

Appendix A4: Discounted Free Cash Flow Model

We believe it is useful to include some theory on asset pricing to better understand how stock prices can be moved by changes in expectations of a firm's future financial performance. Therefore, we present the Discounted Free Cash Flow Model.

Berk and DeMarzo (2020, p.311-332) present different stock valuation techniques that are commonly used by investors to determine the value of a firm's shares. Although the authors argue that no single technique provides a final answer about a stock's true value, they underline the usefulness of Discounted Cash Flow models. One such model is the Discounted Free Cash Flow (DCF) Model. The model offers valuable insights into how investors' valuation of companies, and beliefs about fair stock prices, can be formed.

With the DCF Model, the value of a stock is calculated as:

$$P_0 = \frac{V_0 + Cash_0 - Debt_0}{Shares\ Outstanding} \quad (Equation\ 1)$$

, where P_0 is the estimated value of one share today, and V_0 is the enterprise value today.

Information about a firm's cash, debt and share outstanding is publicly available. Therefore, the key is to determine the enterprise value of the firm.

The enterprise value can be estimated by computing the present value of the firm's free cash flow (FCF). Free cash flow is a measure of the cash generated by the firm before considering any payments to debt or equity holders (Berk & DeMarzo, 2020, p. 325). Formally, it is expressed as:

$$FCF = EBIT * (1 - \tau) + Net\ investment - Increases\ in\ net\ working\ capital$$

, where EBIT is earnings before interest and taxes, τ is the corporate tax rate, net investment is calculated by subtracting depreciation from the firm's capital expenditures, and net working capital is the difference between current assets and its current liabilities.

When computing the present value of the firm's free cash flow, the DCF Model uses weighted average cost of capital (WACC) as the discount factor. The WACC discount factor, r_{wacc}, is determined by three main components (Goedhart et al., 2020, p. 305). These components are the firm's cost of equity, its cost of debt, and its target capital structure.

Thus, WACC can be considered a representation of the returns that investors – both equity and debt holders – expect to earn for investing in a particular company instead of others with similar risk (Goedhart et al., 2020, p. 305). Having calculated the firm's WACC, the firm's free cash flow can be estimated up to a chosen horizon, together with a terminal value, V_N, of the enterprise (Berk & DeMarzo, 2020, p. 325). The terminal value represents the market value, at the last forecast period, of the free cash flow of all future periods.

Thereby, we have explained all elements of enterprise value, which finally can be estimated as:

$$V_0 = \frac{FCF_1}{1 + r_{wacc}} + \frac{FCF_2}{(1 + r_{wacc})^2} + \cdots + \frac{FCF_N + V_N}{(1 + r_{wacc})^N}$$

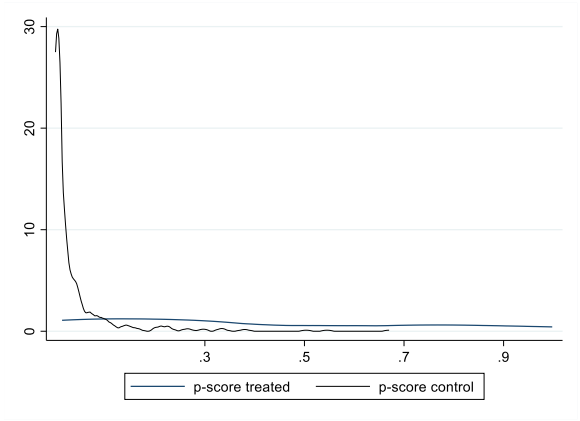
By plugging the estimated enterprise value into Equation 1, we find the price of one share today.

The DCF model shows that the price which investors perceive as the fair value of a share today, depends on a range of factors. Investors will value a firm higher if their expectations of the firm's future free cash flows increase. As future free cash flow is driven by the firm's earnings, changes in expectations about a firm's future expenses and revenues should therefore lead to stock price changes. Furthermore, the valuation is negatively related to the firm's cost of capital, as measured by the WACC. As WACC will increase through escalation of the firm's cost of equity and/or cost of debt, any such increase should lead to reductions in the firm's stock price.

Appendix A5: Propensity Score Matching for Each ESG pillar

Figure A5.1: Density Plots Environmental Pillar

Panel A: Before Matching



Panel B: After Matching

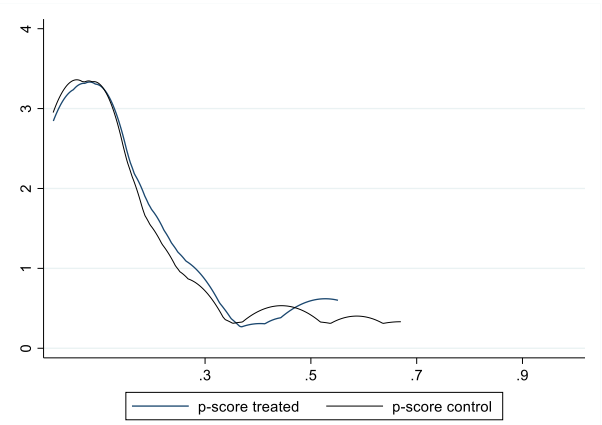
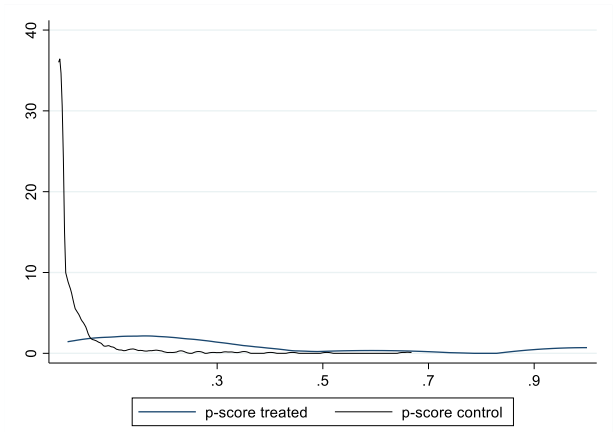


Figure A5.2: Density Plots Social Pillar

Panel A: Before Matching



Panel B: After Matching

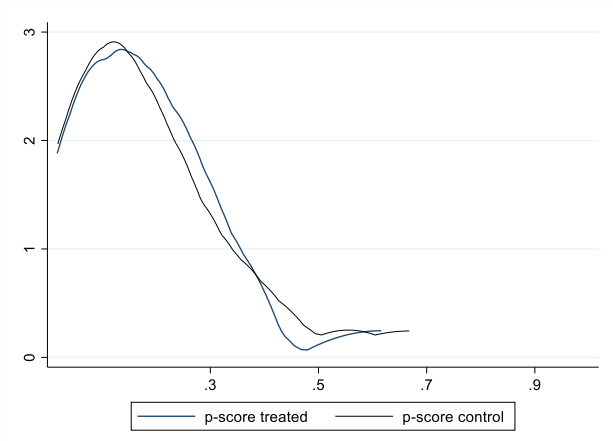
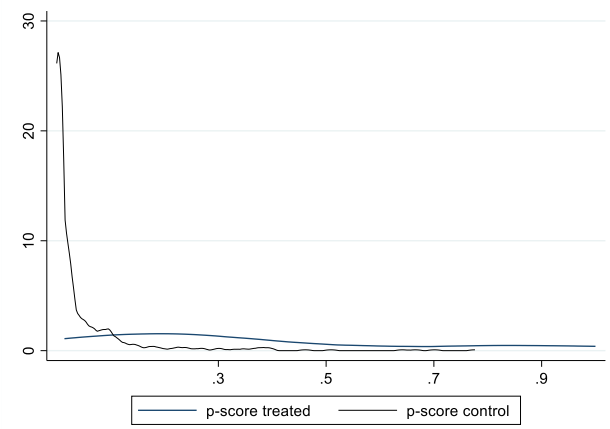
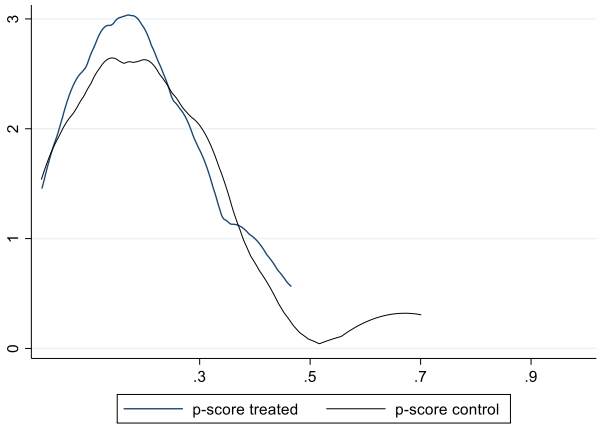


Figure A5.3: Density Plots Governance Pillar

Panel A: Before Matching



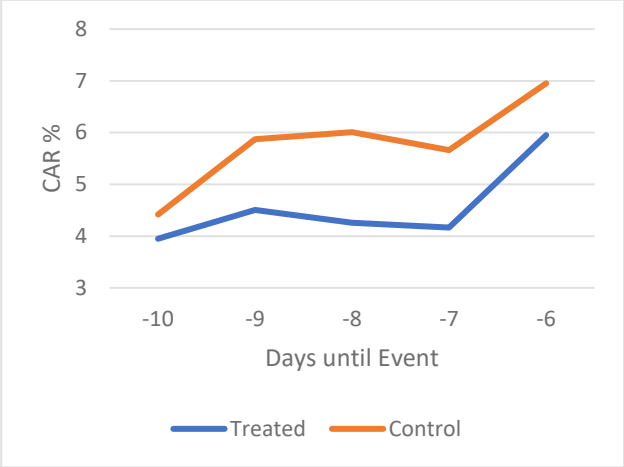
Panel B: After Matching



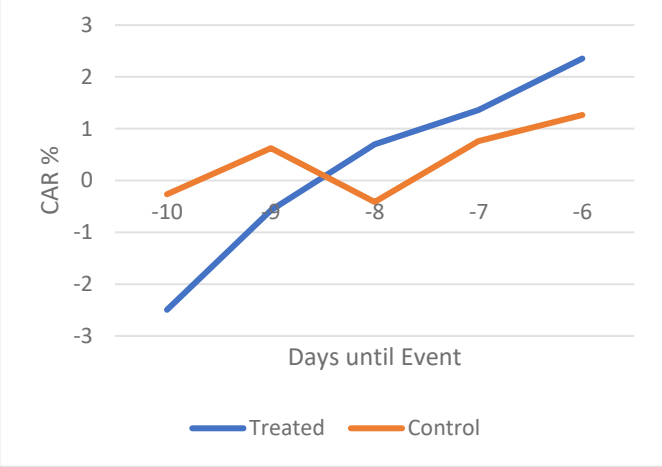
Appendix A6: Parallel Trends for Each ESG pillar

Figure A6.1: Parallel Trends ESG Pillars

Panel A: Environmental Pillar



Panel B: Social Pillar



Panel C: Governance Pillar