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The EU Green Deal and ESG Risk: Evidence from Nordic Stock Market Reactions

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Abstract

This thesis investigates how the announcement of the Green Deal of the European Union influenced the performance of the stock market among publicly listed Nordic firms, with a particular focus on how investor reactions varied depending on the ESG risk ratings. The study evaluated the cumulative abnormal returns surrounding the announcement to determine whether the ESG risk moderated market responses.

The findings reveal that companies with low ESG risk experienced statistically significant positive abnormal returns across multiple event windows, suggesting that the market rewarded companies perceived as well aligned with sustainability goals. Surprisingly, companies with high ESG risk did not exhibit significant negative market responses; in fact, several windows indicated positive abnormal returns. Regression analysis did not show a consistent effect of ESG in the entire sample, but positive and statistically significant ESG coefficients were identified in specific contexts, particularly among high risk companies and within the Danish subsample.

These results indicate that the market response to sustainability-related policy initiatives is heterogeneous and conditional. Although strong ESG profiles appear to be consistently rewarded, firms with elevated ESG risk may also attract investor interest, particularly under favorable market sentiment or transition narratives. This study contributes to the ESG finance literature by highlighting the need for disaggregated analysis that considers firm- and country-level contexts in evaluating the pricing of sustainability risks and opportunities in capital markets.

Nomenclature

Abbreviation

AAR	Average Abnormal Return
AIC	Akaike Information Criterion
AR	Abnormal Return
BIC	Bayesian Information Criterion
$CAAR$	Cumulative Average Abnormal Return
CAR	Cumulative Abnormal Return
$D/ERatio$	Debt-to-Equity Ratio
EMH	Efficient Market Hypothesis
ESG	Environmental, Social, and Governance
$HERC$	High ESG Risk companies
$LERC$	Low ESG Risk companies
OLS	Ordinary Least Squares
R^2	R-squared
ROA	Return on Assets
$STDEV$	Standard Deviation

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1 Introduction

Climate change is one of the most critical global challenges of the twentieth century. Its vast impacts, ranging from extreme weather events and rising sea levels to economic disruptions and health risks, have underscored the urgent need for coordinated action between governments, industries and societies. As these threats become more visible, the call for long-term, sustainable solutions has intensified on a global scale. In recent years, there has been a growing realization that reducing climate change cannot be achieved through policy alone. The complexity and scale of the problem require deep structural changes in the way economies function and resources are used. A shift of this magnitude demands not only bold public policy, but also widespread engagement from the corporate sector and the financial markets that fuel it. Industries must decarbonize, innovation must be directed toward clean technologies, and production processes must align with environmental goals. All of this depends on capital and, more importantly, on where and how that capital is invested (Carney, 2019).

Europe has long positioned itself as a global leader in climate action. During the past two decades, the European Union has steadily tightened its environmental regulations and integrated climate goals into its broader economic framework. Landmark policies such as the Emissions Trading System, the Renewable Energy Directive and the Circular Economy Action Plan have set the stage for a green transition between member states. However, the most significant and ambitious initiative came in December 2019 with the announcement of the EU Green Deal. The EU Green Deal marked a pivotal moment in the continent's climate strategy. It outlined a bold and comprehensive road map for transforming the EU into the first climate-neutral continent by 2050. Its objectives extend beyond carbon reduction; the plan aims to redefine energy production, transportation systems, agriculture, industry, and finance, while promoting social inclusion and economic competitiveness. By establishing clear regulatory expectations and mobilizing at least €1 trillion in sustainable investments, the Green Deal acts as a powerful signal to markets and corporations: the future is green and those who lead in sustainability will be best positioned to thrive (European Commission, 2020).

However, transitioning to climate neutrality is not something governments can achieve on their own. Private companies, as major emitters and key drivers of innovation, play a crucial role in achieving the goals of the Green Deal. From reducing their own emissions to providing sustainable goods and services, companies are central actors in the green transformation. This has shifted the focus of investors, policymakers, and consumers toward identifying and supporting businesses that demonstrate a genuine commitment to sustainability. As a result, interest in so-called "green companies", firms that prioritize environmental performance, social responsibility, and good governance, has increased. Investors increasingly view these companies not only as ethically aligned with climate goals but also as financially sound in the long term. This has led to the rise of environmental, social and governance (ESG) metrics as key tools for evaluating corporate sustainability. ESG factors offer insight into a company's exposure to non-financial risks, such as regulatory penalties, reputational damage, and climate-related disruptions. The financial markets responded accordingly. ESG-focused funds have seen significant inflows, sustainable finance instruments such as green bonds have gained traction, and companies with strong ESG ratings are often rewarded with lower capital costs and enhanced investor interest. As ESG performance becomes more embedded in investment decision making, it is increasingly influencing stock valuations and market dynamics (Joyce, 2021).

1.1 Problem formulation and Research Question

The transition to a sustainable low carbon economy is increasingly becoming a central focus of both policy and investment. The Green Deal of the European Union represents a significant milestone in climate policy, with the aim of steering the continent toward climate neutrality by 2050. Achieving this goal requires not only legislative frameworks and public initiatives, but also significant financial investments in the private sector. Corporations play a critical role in this transformation, particularly through their ability to reduce emissions, innovate green technologies, and align business practices with long-term climate objectives. As governments introduce increasingly ambitious environmental frameworks, investors are paying more attention to how companies respond to these policy changes, particularly through their sustainability performance, often measured via ESG ratings. This growing interest in sustainable investing raises an important question: Do markets actually reward firms with strong ESG credentials when major climate-related policies are introduced?

Although ESG considerations have become a key part of investment strategies, it is still debated how effectively ESG ratings capture a firm's resilience to policy changes and whether they translate into tangible financial advantages, especially in the short term. The EU Green Deal, as a significant and highly publicized policy event, offers a unique opportunity to explore this relationship. By analyzing stock market reactions in the days surrounding the announcement, we can assess whether firms with lower ESG risk ratings were perceived more favorably by investors and thus experienced more positive abnormal returns compared to their higher-rated counterparts. So, the research question is as follows:

How did Nordic firms' ESG risk ratings influence their cumulative abnormal returns following the EU Green Deal announcement

1.2 Structure of the study

This study focuses exclusively on Nordic companies, specifically those publicly traded in Denmark, Finland, Norway, and Sweden due to the strong reputation of the region for environmental responsibility, transparent governance, and advanced sustainability practices. According to the Yale University 2024 Environmental Performance Index, Nordic countries, particularly Finland, Sweden, Denmark, and Norway, consistently rank among the top performers in reducing climate change, promoting environmental health, and restoring ecosystem vitality (EPI, 2024). These high scores reflect a long-standing commitment to environmental responsibility, clean energy, and robust regulatory standards. This reputation makes the Nordic region an ideal setting for examining how investors interpret ESG performance in response to major climate policy events. By studying companies in an environmentally progressive region, the research can better assess whether ESG ratings serve as meaningful signals to investors in a context where sustainability is not just regulatory, but cultural and strategic. By focusing on companies in a region where ESG is already highly institutionalized, this study allows for a nuanced analysis: Do investors distinguish between firms with low versus high ESG ratings in the face of a new policy initiative like the EU Green Deal? And can ESG be understood as a form of policy readiness that signals future adaptability, lower regulatory risk, or strategic alignment with sustainability goals? Furthermore, research is informed by signaling theory, which posits that firms use ESG performance as a signal to convey long-term value and readiness for regulatory changes. If markets interpret strong ESG ratings as a sign of future resilience or competitiveness in a green economy, this could result in a favorable short-term reaction to climate policy announcements.

The purpose of this research is to contribute to the growing body of literature on ESG and financial market behavior by examining whether ESG ratings influence stock price reactions during key policy announcements. Although long-term effects of ESG have been extensively explored, empirical evidence on the short-term financial impact of ESG performance - especially in response to specific environmental policy events - remains limited. Using the EU Green Deal as a case study and applying an event study methodology, this thesis seeks to provide insight into how financial markets interpret and price corporate sustainability performance in real time. The findings may help inform investors, policy makers, and corporate decision makers about the financial relevance of ESG in a rapidly evolving policy landscape and whether strong ESG performance can act as a buffer or even an advantage during times of regulatory change.

Background 2

In recent decades, sustainability has changed from a peripheral ethical concern to a defining feature of both financial markets and public policy. Climate change, biodiversity loss, pollution, and social inequality have forced both investors and governments to rethink the foundations of long-term value creation. In this evolving landscape, ESG factors have become central to understanding how companies manage non-financial risks and how investors assess corporate readiness in a rapidly changing world.

2.1 The Rise and Institutionalization of ESG

The origins of ESG can be traced back to Socially Responsible Investing (SRI), a practice that emerged in the 1960s and 1970s and was primarily values-driven screening investments in sectors such as tobacco, weapons, or fossil fuels based on ethical grounds (Sparkes and Cowton, 2004). Although SRI was significant in raising awareness, it was limited by its exclusionary approach. The modern concept of ESG took shape in the early 2000s, offering a more integrated framework that links sustainability performance with financial materiality. A major turning point was the 2004 report titled "Who Cares Wins", initiated by the United Nations Global Compact in collaboration with major financial institutions. This report introduced the term ESG and called for the incorporation of ESG factors in financial analysis and decision-making. This led to the establishment of the UN Principles for Responsible Investment in 2006, which now includes more than 5,000 signatories representing more than 120 trillion dollars in assets under management globally. These developments gave ESG formal legitimacy in the investment community (UN, 2005).

Since then, ESG has evolved into a main analytical framework. Rather than simply avoiding controversial sectors, investors now use ESG data to assess how companies manage risks related to climate change, labor practices, supply chains, diversity, corporate governance, and more (Friede et al., 2015). ESG ratings provided by agencies such as Sustainalytics, MSCI, and Refinitiv offer standardized (though methodologically varied) assessments of company performance on these issues. These ratings are increasingly used to guide capital allocation, shareholder engagement, and risk modeling (Berg et al., 2022). In this study, ESG is evaluated using Sustainalytics' ESG Risk Ratings, which assess a company's exposure to industry-specific ESG risks and how well it manages these risks. Importantly, Sustainalytics assigns lower scores to firms with lower unmanaged ESG risk, meaning a lower score represents better ESG performance.

2.2 Europe's Climate leadership and the Road to the Green Deal

While ESG has developed globally, Europe has played a unique leadership role in embedding sustainability into financial systems and public policy. The EU has long viewed environmental protection not only as a moral imperative but also as an economic opportunity and a regulatory necessity. The foundation for modern EU environmental policy was laid in the 1990s, with the introduction of the EU Emissions Trading System in 2005 (European Commission, 2005), then the world's largest carbon market. The EU also became a key player in international climate diplomacy, including its leadership role in the Kyoto Protocol and later the Paris Agreement of 2015 (United Nations, 2015). Following the Paris Agreement, the EU committed to reduce greenhouse gas emissions by at least 55 percent by 2030 (compared to 1990 levels) and achieve net zero emissions by 2050.

This policy direction was supported by an expanding regulatory ecosystem. The EU Sustainable Finance Action Plan, launched in 2018, was a key step in linking financial flows with sustainability goals. It included initiatives such as the EU Taxonomy: a classification system defining what counts as an environmentally sustainable activity. The Sustainable Finance Disclosure Regulation requires asset managers to disclose how they integrate ESG into investment decisions. The Non-Financial Reporting Directive obliging large companies to report on ESG issues in their annual statements (European Commission, 2018). These frameworks laid the groundwork for the European Green Deal, introduced in December 2019, which represents the EU's most ambitious and comprehensive climate strategy to date. The Green Deal aims to make Europe the first climate-neutral continent by 2050, with wide-ranging initiatives in clean energy, circular economy, sustainable agriculture, biodiversity protection and green finance. Importantly, it recognizes that financial markets must play a central role in achieving these goals by directing private capital to sustainable economic activities (European Commission, 2019).

From an investor's perspective, the EU Green Deal can be seen not only as a political initiative, but also as a regulatory signal that could influence capital allocation. Potentially, it favors firms aligning with sustainability goals through access to green capital and policy incentives, while creating risks for those less aligned. This shift has important implications for listed companies, particularly in regions such as the Nordics, where ESG integration is relatively advanced. Nordic firms often perform well on sustainability metrics and are recognized for governance and transparency. This context provides a relevant case for examining whether investors adjust their valuations based on ESG performance following regulatory developments such as the EU Green Deal.

2.3 Market Context in Q4 2019

The fourth quarter of 2019 was characterized by a robust rally in global equity markets, providing a particularly favorable macroeconomic backdrop for investors. This period marked a culmination of strong year-to-date performance in most developed markets, driven by a combination of accommodative monetary policies, ease of geopolitical tensions, and relatively stable economic data.

In the United States, the S&P 500 Index recorded an impressive gain of 9.1% in the fourth quarter alone, supported by positive corporate earnings revisions and continued dovish guidance from the Federal Reserve (Standard & Poor's, 2020). For the full year, the index delivered a return of 31.5%, making 2019 the second-best performing year of the decade for US equities. These results were driven not only by earnings growth but also by an expansion in valuation multiples, indicating a significant role for investor confidence and risk appetite. Strong performance in US markets also had spillover effects on international equity indices, enhancing global investor sentiment during the last months of the year.

European markets, while more subdued compared to their US counterparts, also experienced a notable upswing. The STOXX Europe 600 index increased by 6.7% in Q4 and 23.2% for the full year, reflecting optimism over a possible resolution to the uncertainty of Brexit and improved manufacturing activity in Germany and France (ESMA, 2020). Against this continental backdrop, Nordic equity markets outperformed broader European peers, benefiting from their structural orientation toward globally competitive sectors such as industrials, clean technology, and healthcare.

Specifically, the Nordic 40 Index of OMX, a benchmark comprising the 40 most traded stocks in Denmark, Sweden, Finland, and Norway, showed an annual return of approximately 24% in 2019 (Nasdaq, 2020). This performance was bolstered by strong returns in sectors such as pharmaceuticals, consumer goods, and financial services, as well as notable contributions from ESG-leading firms that attracted inflows from sustainability-oriented investors. Notably, the fourth quarter rally in Nordic equities aligned with a broader rotation into risk assets globally, as fears of an imminent recession were largely dispelled by accommodative central bank actions and a de-escalation of trade-related tensions (OECD, 2020).

The strong market performance in Q4 2019 provides a critical contextual basis for this thesis. It reinforces the importance of controlling for market-wide effects when estimating abnormal returns and warns against over-attribution of firm-specific outcomes to ESG factors alone. Recognizing the broader economic and financial environment helps ensure that conclusions drawn from regression models and event windows are appropriately situated within the realities of investor behavior during the time period studied.

Literature Review 3

3.1 ESG and Financial Performance

Over the past two decades, ESG performance has emerged as a key component in the evaluation of corporate financial resilience. ESG ratings offer a framework to assess a firm's sustainability practices and exposure to non-financial risks, which is increasingly relevant as investors incorporate environmental and social risks into portfolio decisions. A large body of research suggests a generally positive or neutral relationship between ESG performance and firm value. Friede, Busch, and Bassen (2005), in a widely cited meta-analysis that covered more than 2,000 empirical studies, concluded that the vast majority found a non-negative link between ESG and financial performance, with a strong trend toward positive outcomes. This reinforces the growing belief that sustainability is not a cost to be minimized, but a value driver—enhancing reputation, reducing risk exposure, and improving long-term profitability. Early evidence of this connection comes from Klassen and McLaughlin (1996), one of the first event studies to examine market reactions to environmental performance. Their study found that firms receiving positive environmental news, such as awards or recognition of eco-friendly practices, experienced significantly positive abnormal returns, while firms involved in negative environmental incidents saw their stock prices decline. This demonstrated that investors respond to environmental signals and that these signals carry financial weight.

More recent studies have confirmed and expanded this view. Fatemi, Fooladi, & Tehranian (2018) emphasizes that ESG performance must be paired with transparency; firms that not only perform well, but also disclose their sustainability efforts tend to be more trusted by investors. Flammer (2013) also found that shareholders reward companies for voluntarily adopting environmental standards, especially when such actions go beyond regulatory compliance, suggesting that ESG can act as a forward-looking indicator of strategic thinking.

3.2 Market Reactions to ESG Events

A growing body of literature uses event study methodology to analyze how financial markets respond to events related to ESG, such as sustainability disclosures, controversies, or regulatory announcements. This approach isolates short-term stock price effects, offering insight into investor perceptions and the materiality of ESG information. Krüger observed that investors react asymmetrically to ESG news: firms involved in ESG controversies, such as environmental violations, often experience significant stock price declines, while positive ESG actions do not consistently lead to stock price increases. This suggests that investors may perceive ESG primarily as a risk factor, where negative news is more important than positive developments (Krüger, 2015). Based on this, Aouadi and Marsat (2018) found that ESG controversies significantly reduce firm value, particularly when they attract public or media attention. Their study highlights that the severity and visibility of a controversy play crucial roles in shaping investor reactions, underscoring the importance of reputational risk in the valuation process.

Serafeim and Yoon (2022) further contribute to this discourse by examining how ESG ratings and the degree of agreement among rating agencies influence stock price reactions to ESG news. They discovered that consensus ESG ratings predict future ESG news; however, this predictive ability diminishes when there is significant disagreement among rating agencies. In addition, the study found that stock price reactions to ESG news are moderated by these ratings: firms with high consensus ESG ratings exhibit smaller stock price reactions to positive news, suggesting that such information is already anticipated and priced in by the market. In contrast, high disagreement among raters weakens the relationship between ESG news and market reactions, indicating that rating divergence can impede the efficient incorporation of ESG information into stock prices. Together, these studies demonstrate that ESG events, whether positive or negative, influence stock prices. However, the direction and magnitude of these reactions depend on factors such as the nature of the ESG event, the firm's existing reputation, the consensus among ESG ratings, and the broader regulatory and cultural context. Although much research has focused on firm-specific events, fewer studies have explored how preexisting ESG ratings shape investor reactions to major external events, such as policy announcements. This study aims to address this gap by investigating how ESG ratings influenced Nordic firms' stock price reactions to the EU Green Deal announcement, a pivotal policy initiative in the EU's climate strategy.

Although this study explores how ESG ratings influenced stock price reactions to the EU Green Deal, it is important to recognize their limitations. ESG ratings are shaped by selective disclosures and methodological differences between providers, which can lead to significant inconsistencies (Berg et al., 2022). These divergences reflect differences in the aspects of ESG measured and how, rather than disagreements over the same data (Christensen et al., 2022). As such, ESG scores can offer only a partial and sometimes conflicting view of a firm's sustainability profile, complicating their use in empirical studies (Dimson et al., 2022).

Recent contributions by Capelle-Blancard, Hsouna, and Petit (2022) emphasize that the impact of ESG factors on financial markets is not only event-specific but also context-dependent. Their findings suggest that the degree of ESG integration across markets significantly influences how investors respond to sustainability-related information. Specifically, they argue that national institutions, investor sophistication, and ESG disclosure standards shape the extent to which ESG is priced into stock valuations. This insight is particularly relevant for cross-country, as it highlights that the interpretation of ESG signals may differ markedly depending on local governance frameworks and market maturity. The variation observed in market reactions across Nordic countries in this study may, therefore, be partially attributable to these institutional differences, further strengthening the importance of regional dynamics in the valuation of ESG. Although most studies focus on firm-specific ESG events, relatively little attention has been paid to how ESG profiles mediate market responses to broad regulatory announcements; this thesis addresses this intersection.

3.3 Climate Policy and Financial Markets

As climate change becomes an increasingly urgent policy priority, governments around the world are implementing far-reaching measures to mitigate environmental risks and transition to low-carbon economies. These climate policies, ranging from carbon pricing mechanisms to green finance regulations, have significant implications not only for the real economy, but also for financial markets. Investors are now more aware that regulatory changes can shape corporate risks, alter sectoral profitability, and reallocate capital to more sustainable business models. Research increasingly shows that markets respond to climate-related policy signals. For instance, Bolton and Kacperczyk (2021) found that firms with higher carbon emissions face higher costs of capital, as investors anticipate the financial risks posed by future climate regulations. Similarly, Andersson, Bolton, and Samama (2016) introduced the concept of 'decarbonized' investment portfolios and demonstrated that reducing exposure to carbon-intensive assets can be done without sacrificing financial returns, suggesting that climate-aware investing is not only ethical, but also financially viable.

More specifically, empirical studies have examined how stock prices react to climate policy events. Ramelli found that green firms, those aligned with climate goals, outperformed brown firms in reaction to pivotal events such as the 2015 Paris Agreement. Their work supports the view that climate-related policy changes can influence investor preferences and firm valuations, especially when the policy is perceived as credible and likely to affect future cash flows (Ramelli et al., 2021)

In the European context, the EU Green Deal, announced in December 2019, is a landmark policy framework aimed at making Europe the first climate-neutral continent by 2050.

It includes a comprehensive strategy to mobilize at least €1 trillion in green investments, strengthen the ETS, and align finance with sustainable objectives through regulatory tools such as the EU Taxonomy and Sustainable Finance Disclosure Regulation. As such, the Green Deal is not only a policy declaration, but also a market-moving event that reshapes expectations for firms operating within the EU (European Commission, 2019). Initial studies suggest that the Green Deal has already influenced investor behavior. Bua and Dunz (2022) analyzed market reactions surrounding EU climate policy announcements and found that equity prices, especially in high-emission sectors, responded significantly, reflecting investor reassessments of regulatory and transition risks. This supports the idea that climate policy is increasingly priced in financial markets.

Despite these findings, there remains a gap in understanding how firm-level characteristics, such as ESG ratings, interact with market responses to climate policy. Although macro-level changes are observable, it is still unclear whether investors reward companies that are perceived to be more 'policy aligned' based on their ESG performance. This study contributes by examining how firm-level ESG ratings influenced investor reactions to the EU Green Deal, thus addressing a gap in the ESG-policy interface literature.

3.4 Theoretical Framework

This study is supported by several theoretical frameworks that help explain how and why ESG ratings can influence investor behavior, particularly in the context of major policy announcements such as the EU Green Deal. One such framework is Signaling Theory, which suggests that firms convey important information to the market through observable attributes and voluntary disclosures. In this context, a firm's ESG risk rating acts as a signal to investors about the company's exposure to environmental, social and governance-related risks, as well as its ability to manage these risks effectively. Importantly, a lower ESG risk rating indicates stronger ESG performance, which means that the firm is better positioned in terms of sustainability management and risk mitigation (Spence, 1973). Therefore, a low ESG risk rating can signal to investors that the company is characterized by high-quality leadership, strong governance structures, and proactive environmental and social strategies. These traits can be especially valuable during periods of regulatory change, such as the announcement of the EU Green Deal, which raises the bar for sustainability compliance across industries. This perception may lead to more favorable investor reactions, such as reduced risk premiums or positive abnormal returns, when significant sustainability policies are introduced. Thus, ESG ratings serve not just as ethical benchmarks, but as credible indicators of future-oriented, risk-aware management, especially in increasingly climate-conscious capital markets.

The Efficient Market Hypothesis asserts that financial markets are informational efficient, meaning that all publicly available information is rapidly and fully reflected in asset prices. In its semi-strong form, EMH posits that any new publicly disclosed information, such as earnings reports, macroeconomic data, or policy announcements, is immediately incorporated into stock prices, leaving no opportunity for investors to consistently earn excess returns through public information analysis (Fama, 1965). Applied to the context of this study, if ESG performance is considered relevant and material information by market participants, firms with lower ESG risk ratings should be perceived as better equipped to navigate regulatory changes, social expectations and long-term sustainability challenges. This becomes particularly important during policy shifts like the EU Green Deal, which signal a structural transformation of the economic environment toward low-carbon and sustainable practices. Under the EMH framework, this policy announcement represents new, market-relevant information. Therefore, the market should react immediately, adjusting stock prices based on how well firms are perceived to align with the policy's goals. Companies with strong ESG ratings can be viewed as more adaptable or less exposed to transition risks and, therefore, can experience positive abnormal returns in the short term. In contrast, firms with weaker ESG credentials could face anticipated costs or regulatory burdens, potentially triggering negative market reactions.

To empirically assess this adjustment, the event study methodology offers a well-established approach. It enables researchers to measure the market's immediate response to new information by analyzing abnormal stock returns around a specific event window. This methodology is particularly suited to test EMH in the context of ESG and climate policy, as it captures how quickly and to what extent investors react to firm-specific characteristics, such as ESG ratings, when faced with external shocks or regulatory developments. Finally, Stakeholder Theory emphasizes that modern corporations must consider a broad set of stakeholders beyond shareholders, including regulators, customers, communities, and the environment. Firms with strong ESG performance may be better aligned with stakeholder expectations, potentially reducing reputational risk and enhancing investor confidence in the face of policy-driven scrutiny (Mahajan et al., 2023). Together, these theories provide a foundation for understanding the mechanisms by which ESG ratings can influence market behavior during significant sustainability-focused policy events and support the use of event study methodology to assess how such dynamics are reflected in stock prices.

4 Data and Methodology

4.1 Data Collection and Sources

This study uses firm-level and market-level data obtained from FactSet to assess how the announcement of the EU Green Deal influenced the stock prices of Nordic companies, with a particular focus on the moderating role of ESG performance. The analysis is based on companies listed in Denmark, Finland, Sweden, and Norway, countries recognized for their strong environmental performance, transparent corporate governance, and high levels of ESG integration.

Stock Return Data

Daily stock prices were obtained from FactSet, a widely used financial data platform. Returns were calculated using the natural logarithm of the ratio of daily closing prices:

$$R_{i,t} = \ln\left(\frac{P_{i,t}}{P_{i,t-1}}\right)$$

Where:

- $R_{i,t}$ is the return of firm i on day t
- $P_{i,t}$ is the closing price on day t

Stock price data span the full estimation window and the event window, including 120 trading days prior to the event and up to 30 days after. This allows for the construction of multiple event windows $[-5, +5]$, $[-10, +10]$, $[-20, +20]$ and $[-30, +30]$ and for the calculation of expected returns.

Market Index

To control for market-wide movements, this study uses the OMX Nordic 40 index as a benchmark to estimate expected returns. The OMX Nordic 40 is a market capitalization-weighted index that includes 40 of the largest and most liquid companies listed on the main stock exchanges of Denmark, Finland, Sweden and Norway. The index spans a range of industries and sectors, making it broadly representative of the overall performance of publicly traded Nordic firms. Its cross-border and diversified nature makes it particularly well suited for this study, which focuses on ESG performance across the Nordic region. By capturing region-wide investor sentiment, macroeconomic trends, and policy expectations, the index serves as a robust proxy for systematic market risk that affects all companies in the sample. This benchmark choice also improves the consistency of the analysis by aligning the market index with the geographic and economic context of the selected companies, ensuring that the results reflect regional dynamics rather than global fluctuations.

ESG Ratings

Firm-level ESG performance is assessed using *Sustainalytics'* ESG Risk Ratings, which assess a company's exposure to material environmental, social, and governance risks and the degree to which the company manages those risks. Ratings focus not only on how exposed a company is to ESG issues but also on its preparedness, policies, and programs to mitigate that risk. Importantly, Sustainalytics uses an industry-specific and forward-looking framework, recognizing that ESG risks vary between sectors and business models.

The ESG Risk Rating is composed of two key components:

1. **Exposure**: an assessment of how much a company is exposed to material ESG risks, based on its sub-industry, business model and operations.
2. **Management**: a score that reflects how well the company manages its risks of ESG through policies, programs, and performance.

The final ESG Risk Rating represents the portion of ESG risk that is not managed, which means risks that are material to the company but not adequately addressed. Scores are absolute (not relative) and range on a scale from 0 to 100, where:

- 0–10 = **Negligible risk**
- 10–20 = **Low risk**
- 20–30 = **Medium risk**
- 30–40 = **High risk**
- 40+ = **Severe risk**

Thus, lower scores indicate better ESG performance, with less unmanaged risk and greater resilience to ESG. Due to the limited availability of historical ESG data, this study uses the most recent ESG risk rating of each firm (as of 2024) as a proxy of its ESG position at the time of the event (December 11, 2019). The ESG data was retrieved through Sustainalytics own website, which currently only provides access to Sustainalytics scores from 2024 onward.

In the course of this research, efforts were made to obtain historical ESG scores from other major data providers such as Bloomberg and Refinitiv. However, these platforms also appear to only provide access to current ESG scores or lack publicly available historical data from 2019. As such, this constraint reflects a larger challenge in academic ESG research, namely the lack of accessible, time-stamped ESG data for earlier years. Using current ESG ratings as a proxy introduces the assumption that firm ESG performance has remained relatively stable over time, especially in the Nordic region, where sustainability practices are deeply embedded and often evolve incrementally. Although this is a methodological limitation and is explicitly acknowledged in the limitations section of this thesis.

Sample Selection Criteria

Companies were included in the sample based on a set of clearly defined criteria to ensure consistency, relevance, and analytical robustness. The selection process began with an initial pool of approximately 200 publicly listed firms from the main Nordic stock exchanges: Nasdaq Copenhagen, Nasdaq Helsinki, Nasdaq Stockholm, and Oslo Børs. These exchanges were chosen to ensure geographical consistency and alignment with the regional focus of the EU Green Deal.

To refine the sample, three primary selection criteria were applied. First, each firm was required to have an ESG Risk Rating issued by Sustainalytics, which serves as the primary measure of sustainability risk in the study. However, because Sustainalytics ratings are generally limited to larger and more prominent firms by market capitalization, this criterion substantially reduced the eligible sample. Second, companies had to have available and reliable daily stock return data from FactSet surrounding the event window around December 11, 2019 the date the EU Green Deal was announced. This was necessary to construct both the estimation and the event windows used in the event study analysis. Third, the final sample excluded firms with incomplete financial data or missing values for key control variables such as ROA, Market Capitalization, or leverage.

Companies were classified into two groups according to their ESG risk ratings: those with a rating below 20 were classified as low ESG risk companies (LERC), while those above 20 were considered high ESG risk companies (HERC). After applying these criteria, the final sample consisted of 125 firms. This structured filtering process helps ensure that all companies included in the analysis had both the sustainability metrics and the return data necessary to robustly test the research hypotheses.

4.1.1 Descriptive statistics

Sample Description

The data set used in this study consists of 125 publicly listed Nordic companies from four countries. Denmark, Sweden, Norway, and Finland. These companies represent a diverse range of industries, reflecting the economic structure of the Nordic region. The inclusion of companies from multiple countries ensures that the analysis captures any potential variations in market reactions based on national contexts or economic environments. The distribution of companies based on their ESG rating is as follows:

The sample, as seen in 4.1, is approximately balanced between companies with high ESG risk ratings (63 companies) and low ESG risk ratings (62 companies), allowing for a comparative analysis of the reactions of the stock price between these two groups. This

Nation	LERC	HERC	Full Sample
Denmark	10	12	22
Sweden	21	21	42
Norway	14	20	34
Finland	17	10	27
Total	62	63	125

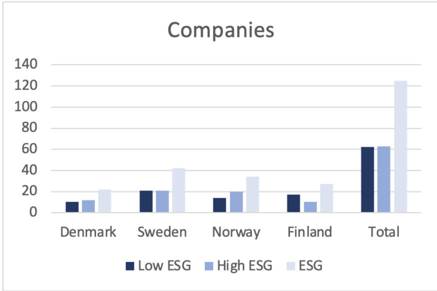

Figure 4.1. Countries / Companies

balanced distribution is essential for minimizing biases and ensuring that the observed effects can be attributed to differences in ESG performance rather than sample size disparities. The companies selected for this study are publicly traded on the primary stock exchanges of their respective countries:

- Denmark: *Nasdaq Copenhagen*
- Sweden: *Nasdaq Stockholm*
- Norway: *Oslo Børs*
- Finland: *Nasdaq Helsinki*

The study focuses on these exchanges, as they represent the major platforms where the stocks of large and mid-sized Nordic companies are actively traded. The inclusion of companies from all four countries provides a comprehensive view of the Nordic market's reaction to the EU Green Deal announcement.

The criteria for selecting companies included the availability of:

1. Reliable ESG ratings from Sustainalytics.
2. Historical stock price data around the event window.
3. Continuous trading data on the respective stock exchanges during the period analyzed.

By encompassing companies from a variety of industries and countries within the Nordic region, the study aims to provide robust insights into how variations in ESG ratings influence stock price reactions following the EU Green Deal announcement.

ESG Rating Distribution

The ESG ratings used in this study were obtained from Sustainalytics, a leading global provider of research and ratings on ESG and corporate governance. Sustainalytics assesses companies based on their environmental, social, and governance practices, providing a comprehensive evaluation of their sustainability performance. The dataset consists of 125 Nordic companies categorized into two groups based on their ESG ratings: low ESG and high ESG. The rating distribution across these groups, as well as the overall ESG ratings, are summarized below:

Statistics	LERC	HERC	Full Sample
Mean	14,6	27,0	20,8
STDEV	3,2	6,5	8,0
Min	7,1	20,2	7,1
Max	19,9	56,1	56,1
Skewness	-0,25	2,4	1,2
Kurtosis	-0,48	7,7	3,1

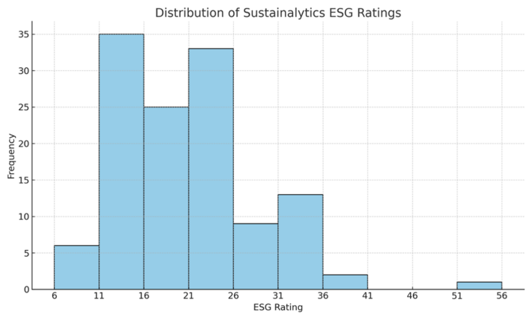

Figure 4.2. ESG Distribution

The mean ESG rating, as seen in 4.2 for LERC, is 14.66, while it is significantly higher at 27.03 for HERC. The overall mean ESG score for all companies is 20.86. The standard deviation is higher for the HERC (6.53) compared to the LERC (3.16), indicating greater variability between companies with higher ESG ratings. The minimum ESG score observed in the LERC is 7.1, while the HERC has a much higher minimum score of 20.2. The maximum ESG score in the high ESG group reaches 56.1, compared to 19.9 in the low ESG group.

The distribution of ESG scores shows notable differences between LERC and HERC. The LERC demonstrates a slight negative skewness (-0.25), indicating that the distribution has a tail to the left. This means that most companies within this group have relatively higher ESG scores and only a few companies show significantly lower values. In contrast, HERC shows a positive skewness (2.36), indicating a distribution skewed to the right with a tail to the right. This suggests that, although these companies are classified as high ESG, a majority of them actually have scores clustered toward the lower end within the high rating range, while a few companies exhibit significantly higher scores. In general, the combined ESG score distribution has a positive skewness (1.21), indicating a general tendency for scores to cluster at the lower end within the high ESG rating range. This pattern reflects the fact that while some companies have exceptionally high ESG ratings, the majority tend to have scores that are closer to the minimum threshold for high ESG classification. Regarding kurtosis, the High ESG group shows a high positive value (7.71), indicating a leptokurtic distribution (sharp peak and heavy tails), while the LERC has a negative kurtosis (-0.48), indicating a platykurtic distribution (flat and light tails). The overall ESG distribution exhibits moderate positive kurtosis (3.09).

The bar graph visualizes the mean, standard deviation, minimum, maximum, skewness, and kurtosis of the ESG ratings for the entire data set. It clearly shows the differences between the groups, highlighting the greater variability and positive skew in the HERC. By analyzing these statistical measures, it becomes evident that companies classified as having high ESG ratings demonstrate a wider spread and a more skewed distribution compared to LERC. This variation could be indicative of differing market perceptions and the diverse range of sustainability practices adopted by companies with higher ESG scores.

Sectors

This study includes a diverse set of Nordic companies classified according to their ESG risk ratings as companies with low ESG risk and high ESG risk. A low ESG Risk rating indicates strong sustainability practices and lower exposure to environmental, social, and governance risks, while a high ESG Risk rating suggests that firms are more susceptible to sustainability-related risks. Analyzing the sectoral distribution of both groups allows for a nuanced understanding of how different industries may have reacted to the EU Green Deal announcement. By examining sector-specific responses, we aim to capture whether firms with stronger sustainability profiles showed distinct market reactions compared to those with higher ESG risk. The intention behind constructing this dataset was to ensure a diverse representation of industries rather than solely focusing on sectors traditionally associated with low and high ESG risk. By including companies from a wide range of industries, we aim to provide a comprehensive and balanced perspective on how the EU Green Deal announcement affected Nordic companies, regardless of their typical risk profile. This approach allows us to understand the broader implications of ESG practices in different economic sectors rather than just isolating high-risk industries.

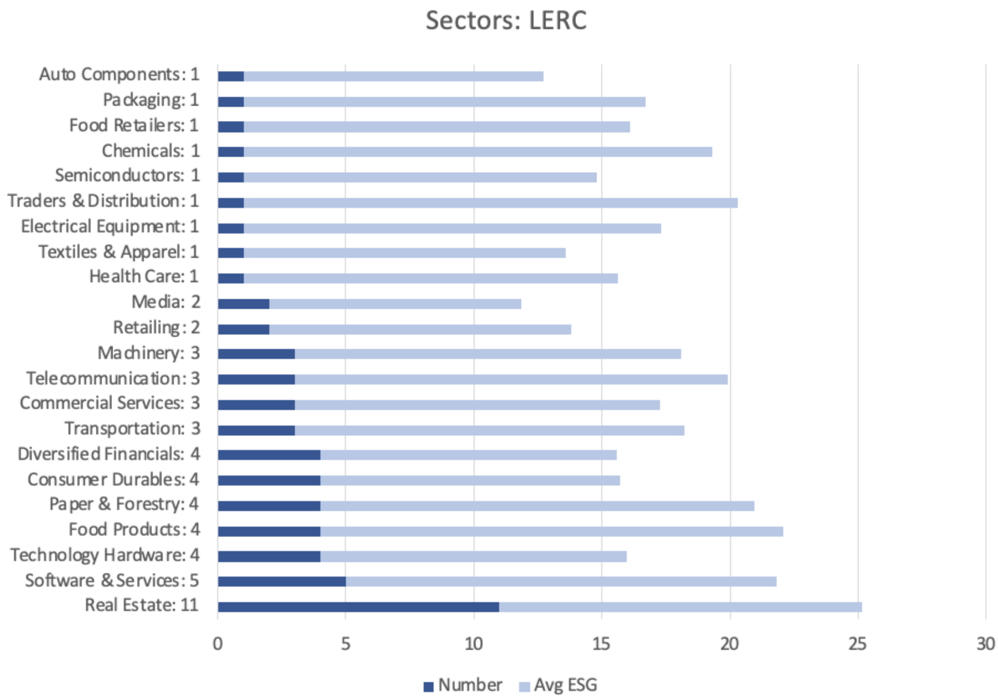

Figure 4.3. Sectors of LERC

Among LERC, as seen in 4.3, the sector most represented is real estate, comprising 11 companies with an average ESG risk score of 14.15. The prominence of this sector highlights the growing focus on sustainable building practices, energy efficiency, and responsible land use within the real estate industry, aligning well with the goals of the EU Green Deal. Following Real Estate, the Software & Services sector includes 5 companies with an average ESG risk score of 16.8, indicating that technology companies also actively manage sustainability risks.

Other important sectors among LERC include technology hardware (4 companies, average ESG score of 11.95), Food Products (4 companies, average ESG score of 18.08), and Paper & Forestry (4 companies, average ESG score of 16.95). These sectors reflect industries where companies are increasingly focusing on reducing environmental impacts through sustainable sourcing, innovation, and responsible production practices. Several additional sectors, such as consumer durables, diversified financials, transportation and commercial services, each contain 3 to 4 companies within the low-ESG risk category. The representation of these diverse sectors indicates that firms with strong sustainability practices are not confined to a specific industry but are instead distributed across a wide range of business areas. This diversity enables a comprehensive analysis of how different sectors with low ESG risk ratings might respond to the EU Green Deal announcement. The remaining sectors, including Telecommunications, Machinery, Retailing, Media, Healthcare, and Textiles & Apparel, are less represented, typically containing only one or two companies. These sectors show varying average ESG risk scores, illustrating that strong ESG performance can be achieved between industries despite the distinct challenges inherent to each sector. For example, chemicals, food retailers, and packaging are represented by just one company each, with average ESG scores ranging from 15.1 to 18.3. This highlights that even industries traditionally associated with higher environmental impacts can demonstrate lower ESG risk through focused sustainability initiatives.

In contrast, the HERC data set as seen in 4.4 predominantly features the Machinery sector,

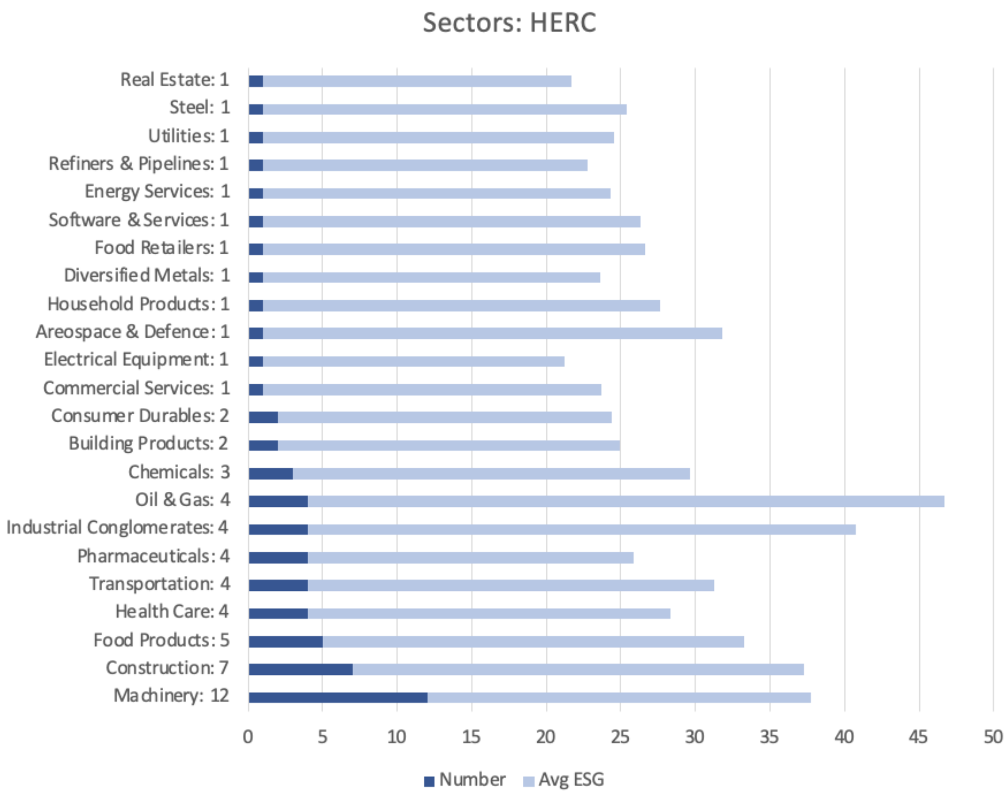

Figure 4.4. Sectors of HERC

with 12 companies and an average ESG risk score of 25.73. This representation suggests that machinery and manufacturing companies may face significant challenges related to emissions, energy efficiency, and sustainable production practices. The construction sector follows, with 7 companies and an average ESG risk score of 30.31, indicating typical challenges associated with environmental impact and resource management. Other key sectors among HERC include food products (5 companies, average ESG score of 28.26), healthcare (4 companies, average ESG score of 24.35), transportation (4 companies, average ESG score of 27.28) and pharmaceuticals (4 companies, average ESG score of 21.85). These sectors show varying levels of ESG risk, with some, like Oil & Gas (4 companies, average ESG score of 42.67), showing a particularly high risk due to the environmental challenges inherent in fossil fuel extraction and production.

Smaller sectoral groups within the HERC category include Industrial Conglomerates, Chemicals, Building Products, and Consumer Durables, each comprising between 2 and 4 companies. These industries generally face challenges related to carbon emissions, resource use, and environmental compliance, aligning with the higher risk profiles indicated by their ESG scores. Some sectors are represented by one single company, including Commercial Services, Electrical Equipment, Aerospace & Defense, Household Products, Diversified Metals, and Food Retailers. These industries often exhibit high average ESG risk scores, reflecting the specific sustainability issues relevant to each. Notably, the Oil & Gas sector stands out with the highest average ESG risk score among HERC, indicating that companies within this sector are particularly exposed to regulatory changes introduced by the EU Green Deal.

The sectoral breakdown clearly highlights the contrasting distribution patterns between LERC and HERC. Real estate dominates among LERC, reflecting proactive environmental management, while machinery is the most represented sector among HERC, indicating challenges related to emissions and sustainable practices. Additionally, the Oil & Gas sector's high risk highlights the significant sustainability challenges faced by fossil fuel companies.The graphical representations of sector distributions show the dominance of Real Estate among LERC and machinery among HERC. The comparative bar graphs illustrate the variation in both the number of companies and the average ESG risk scores between sectors, highlighting the distinct risk profiles associated with specific industries.

4.1.2 Firm and Market return

Statistics	Mean	SD	Skewness	Kurtosis
LERC	0,0008	0,0062	-1,8776	6,311300
HERC	0,0003	0,0069	-0,9072	1,80880
Full Sample	0,0006	0,0063	-1,4961	4,091900
STOXX	0.0006	0.0089	-1,0508	3,131700

Figure 4.5. Return statistics

The statistical distribution of daily returns for the full sample of Nordic ESG rated companies and the STOXX index reveal important differences in their risk and return profiles. Despite both exhibiting the same average daily return of 0.0006, the nature of these returns and their associated risks diverge in meaningful ways.

The full sample of Nordic companies shows, as seen in 4.5, a standard deviation of 0.0063, which is noticeably lower than the 0.0089 observed for the STOXX index. This suggests that Nordic ESG stocks, on average, experienced less day-to-day price volatility than the broader European market. From a risk perspective, this lower dispersion could reflect regional stability or possibly the effect of ESG screening, which could act as a filter against highly volatile or poorly governed firms.

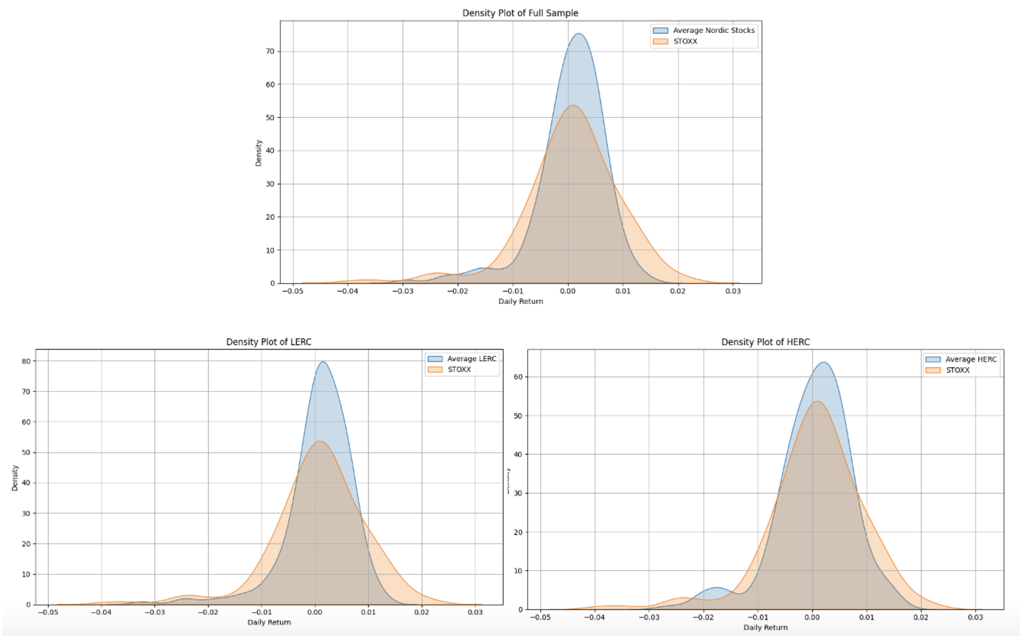

Figure 4.6. Density Plots

However, when examining the distributional shape of returns, a more nuanced picture emerges. The complete sample shows a more pronounced negative skewness (-1.4961) and a higher kurtosis (4.0919) than the STOXX index, which has a skewness of -1.0508 and a kurtosis of 3.1317. This indicates that while the dataset have lower overall volatility, their return distributions are more asymmetric and fatter-tailed, as seen in 4.6, meaning that extreme negative returns are more likely to occur than in the broader market index.

The full sample exhibits a steeper and narrower peak, implying that most daily returns cluster near the mean, but the extended left tail reveals a vulnerability to sudden negative shocks. In contrast, the STOXX distribution is wider and more bell-shaped, reflecting greater general variability but fewer severe outliers. In essence, while the full sample offers slightly more stable returns under normal market conditions, they appear to be more prone to rare but significant downturns than the market index. This trade-off between typical stability and occasional downside risk is critical to understanding how ESG integration affects the risk-return dynamics of a portfolio.

HERC vs. LERC

The return characteristics of Nordic stocks categorized by ESG risk reveal important distinctions when evaluated against the broader STOXX index. Starting with LERC, as seen in 4.5, these companies exhibit the highest average daily return (0.0008), outperforming both the HERC (0.0003) and the STOXX index (0.0006). This suggests that on average, firms with lower ESG risk may offer superior returns, a finding that challenges the often assumed trade-off between sustainability and performance.

Moreover, LERC display the lowest standard deviation (0.0062), indicating reduced volatility relative to both High ESG firms (0.0069) and the STOXX benchmark (0.0089). This combination of higher return and lower volatility implies an attractive risk-return profile for the low ESG cohort. However, further inspection reveals that this group also exhibits the most negative skewness (–1.88) and the highest kurtosis (6.31), highlighting the presence of fat tails and left-skewed distributions, as seen in 4.6. These distributional properties suggest that, while average returns may be attractive, there is an increased likelihood of extreme negative outcomes, underscoring latent tail risk. In contrast, HERC exhibits a more moderate profile. It has the lowest mean return (0.0003) and a slightly elevated standard deviation (0.0069), suggesting somewhat higher volatility for relatively weaker performance. However, it shows a more balanced return distribution: the skewness is closer to zero (–0.91), and the kurtosis (1.81) is below that of both the LERC and the STOXX index. These statistics point toward a more symmetric and normal-like return distribution, implying fewer extreme events, either positive or negative.

The STOXX index, which serves as the market benchmark, occupies a middle ground in this comparison. With a mean return of 0.0006 and a standard deviation of 0.0089, it reflects higher volatility than either ESG-based subgroup. Its skewness (–1.05) and kurtosis (3.13) indicate a distribution with moderate asymmetry and fat tails, typical of diversified market indices. Return distribution analysis reveals that LERC exhibits lower volatility than the STOXX index, but it comes with greater negative skewness and kurtosis, indicating a higher downside risk. LERC outperforms on average and shows more consistent returns, yet with a more pronounced tail risk. HERC offer weaker average performance but a more balanced return distribution. The STOXX index falls between, serving as a benchmark.

4.2 Hypothesis

The motivation behind these hypotheses comes from the increasing importance of green finance and the growing interest of investors in sustainability. The EU Green Deal, announced on December 11, 2019, marked a pivotal moment in European climate policy, with the aim of making the EU climate neutral by 2050. This ambitious policy shift emphasizes sustainability, innovation, and the reduction of environmental risks, which are closely related to the companies' ESG ratings. Given the prominence of Nordic countries in sustainability practices and their high rankings on the Environmental Performance Index, this study aims to investigate the impact of the announcement of the EU Green Deal on the stock performance of Nordic companies based on their ESG risk ratings.

Hypothesis 1:

The announcement of the EU Green Deal had a positive impact on the stock price of Nordic companies with a low ESG risk rating

In regions such as the Nordics, where there is a high awareness of environmental responsibility and sustainability, companies with low ESG risk ratings are often perceived as more resilient to regulatory changes. The EU Green Deal, which emphasizes green transformation, could be seen as an endorsement of sustainable practices, leading investors to view these companies more favorably. Consequently, a positive market response may arise from investor confidence in firms that already align with the environmental vision of the EU. This hypothesis is grounded in signaling theory, suggesting that firms demonstrating strong sustainability practices signal lower risk to investors, enhancing their attractiveness **?**.

Hypothesis 2:

The announcement of the EU Green Deal had a negative impact on the stock price of Nordic companies with a high ESG risk rating

Companies with high ESG risk ratings may be perceived as more vulnerable to policy changes that target environmental and sustainability improvements. Investors may anticipate increased compliance costs, regulatory challenges, or reputational risks for these companies. As a result, the EU Green Deal announcement could trigger negative market reactions for high ESG risk companies, as the policy directly challenges their existing practices. This hypothesis is grounded in Stakeholder Theory, which posits that companies are expected to consider and balance the interests of various stakeholders, including investors, regulators, and the community. When a firm is perceived as failing to meet societal and regulatory expectations, stakeholders can respond negatively, leading to a decrease in investor confidence and lower stock performance. In the context of the EU

Green Deal, companies with high ESG risk ratings could be seen to be short of societal sustainability goals, prompting adverse reactions from environmentally conscious investors.

Hypothesis 3:

ESG risk ratings have a statistically significant effect on CAR among Nordic companies after the announcement of the EU Green Deal.

This hypothesis investigates whether a firm's ESG rating can explain the variation in stock price reactions to the announcement of the EU Green Deal. Using cross-sectional OLS regression models, the analysis seeks to determine whether ESG ratings act as a significant predictor of CARs, controlling for firm-specific financial characteristics and macroeconomic variables. A statistically significant ESG coefficient would suggest that investors incorporate ESG risk into their pricing of firms' expected performance in response to environmental policy changes such as the Green Deal.

4.3 Event Study Methodology

This thesis aims to examine whether a firm's ESG performance influenced its stock price reaction to the announcement of the EU Green Deal. To analyze this relationship, an event study methodology is used, which is commonly used in financial research to measure how capital markets respond to new publicly available information.

According to the semi-strong form of the Efficient Market Hypothesis (Fama, 1965), stock prices should immediately reflect all publicly available information. Based on this principle, one can infer the impact of a significant policy announcement such as the EU Green Deal by observing deviations in stock returns from their expected levels in the period surrounding the event. The event study method is designed specifically for this purpose, as it evaluates abnormal returns, which are the differences between actual and expected returns around the time of a known event.

In the context of this research, the event date is defined as December 11, 2019, the day the European Commission officially announced the Green Deal. The expected returns are calculated using the Market Model based on a prior estimation window. Any significant deviation from the expected returns after the announcement can be interpreted as the market reaction to the policy, possibly modulated by how aligned the firm is with the sustainability objectives, as reflected in its ESG rating.

Because policy announcements like the EU Green Deal may have been anticipated or partially priced in prior to the official date, this study incorporates multiple event windows that extend up to 30 trading days after the event to capture immediate and delayed market responses. The analysis aggregates firm-level abnormal returns across a sample of Nordic companies, which are widely recognized for their high ESG standards. This aggregation allows for broader insight into how ESG performance can function as a signal of policy alignment and resilience in sustainability-focused markets.

In event studies, changes in stock prices are expressed in terms of returns rather than price levels to standardize comparisons between firms. The core of the method lies in comparing the observed returns of stocks with a firm-specific expected return model, where the difference constitutes the abnormal return (MacKinlay, 1997).

Event Window

In event study methodology, the analysis is structured around two key timeframes: the estimation window and the event window. The estimation window refers to the period prior to the event during which the normal returns of a firm are estimated, using a market model in this incident. These returns represent the hypothetical performance of the stock in the absence of the event and serve as a baseline for comparison. The event window captures the days immediately surrounding the event itself and is used to identify any abnormal returns, that is, deviations from expected performance, that may be attributed to the event under investigation. In many studies, this includes a few days before and after the event to account for information leakage or delayed market reactions.

According to MacKinlay, the estimation window and the event window should be non overlapping to avoid contamination of the baseline return model with any effects from the event. A typical timeline can be described using four points:

- T_0 *to* T_1: The estimation window,
- T_1 *to* T_2: The event window,
- T_2 *to* T_3: The post-event window, if further analysis of lingering effects is desired.

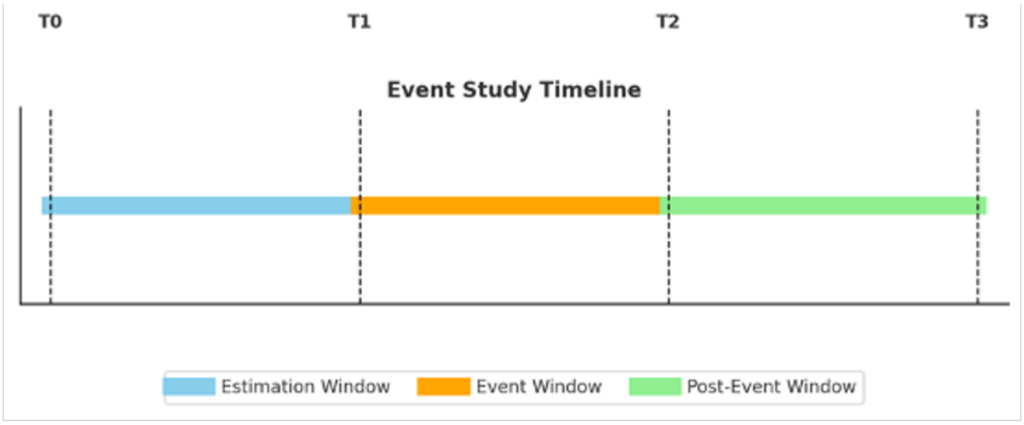

Figure 4.7. Event Windows

As you can see in 4.7, this structure enables researchers to isolate the market impact of the event and to test whether the observed stock price movements differ significantly from what would be expected under normal conditions (MacKinlay, 1997).

Market Model

To assess the stock market reaction to the EU Green Deal announcement, this study employs the Market Model, which is a widely used approach in event studies to estimate normal returns, the returns that would be expected in the absence of the event. By comparing actual returns with these expected returns, it becomes possible to isolate ARs that can be attributed to the event itself.

The Market Model is a linear regression model that estimates a firm's expected return based on its historical relationship with the general market. It is expressed as:

$$R_{it} = \alpha_i + \beta_i R_{m,t} + \epsilon_{i,t}$$

Where:

$$\begin{aligned} R_{i,t} &= \textit{actual return of firm } i \textit{ on day } t \\ R_{m,t} &= \textit{return of the market index on day } t \textit{ (OMX Nordic 40)} \\ \alpha_i, \beta_i &= \textit{regression coefficients estimated over the estimation window} \\ \epsilon_{i,t} &= \textit{the error term or residual} \end{aligned}$$

This model is estimated using ordinary least squares (OLS) regression over the 120-day estimation window prior to the event window. The parameters α_i and β_i are then used to predict the expected return on each day within the event window.

Abnormal Return

The Abnormal Return is calculated as the difference between the actual return and the expected return.

$$AR_{i,t} = R_{i,t} - (\hat{\alpha}_i + \hat{\beta}_i R_{m,t})$$

A positive AR suggests that the firm performed better than expected given market conditions, potentially due to a favorable reaction to the EU Green Deal. A negative AR implies the opposite.

Cumulative Abnormal Return

To measure the total effect over the event window, Cumulative Abnormal Returns (CARs) are computed by summing ARs over a specified number of days:

$$CAR_i = \sum_{t=T_1}^{T_2} AR_{i,t}$$

Where:

- T_1 and T_2 represent the start and end of the event window (e.g., -1 to $+1$)
- The CAR aggregates the abnormal returns to capture the overall market reaction to the event

This study examines multiple event windows:

- $[-5, +5]$, $[-10, +10]$: to capture the immediate effect
- $[-20, +20]$, and $[-30, +30]$: for robustness checks on early leakage or delayed reaction

Average Abnormal Return (AAR)

In addition to individual firm-level Cumulative Abnormal Returns (CAR), this study also calculates the average abnormal return (AAR) and the cumulative average abnormal return (CAAR) for all firms in the sample to evaluate the aggregate market reaction.

$$AAR_t = \left(\frac{1}{N}\right) \sum_{i=1}^{N} AR_{i,t}$$

Where:

- $N = \textit{the number of firms in the sample}$
- $AR_{i,t} = \textit{the abnormal return for firm } i \textit{ on day } t$

Cumulative Average Abnormal Return (CAAR)

$$CAAR_t = \left(\frac{1}{N}\right) \sum_{T_1}^{T_2} AAR_{i,t}$$

These measures allow for the analysis of the average investor reaction to the EU Green Deal across the entire sample of Nordic firms, providing a more robust test of market behavior.

OLS Regression

To examine the relationship between ESG risk and stock market reactions, this study applies a standard event study framework using CAR as a dependent variable. Expected returns are estimated using the market model, where individual stock returns are regressed on a market index, which in this case is the STOXX index, to obtain firm-specific alpha and beta coefficients over a 120-day estimation window prior to the event date. Abnormal returns are calculated as the difference between actual and expected returns, and then aggregated across the event window to compute the CAR.

To explain cross-sectional differences in CAR, an ordinary least squares (OLS) regression model is used. The main explanatory variable is the ESG risk rating, which captures a firm's exposure to environmental, social, and governance-related risks. A higher ESG score indicates a greater perceived risk of sustainability. Several control variables are included to account for firm-specific characteristics that may influence CAR independently of ESG considerations.

$$CAR_i = \gamma_0 + \gamma_1 ESG_i + \gamma_2 ROA_i + \gamma_3 \log(Size_i) + \gamma_4 \frac{D}{E}_i + \gamma_5 STDEV_i + \gamma_6 Inflation_i + \varepsilon_i$$

Return on assets (ROA) proxies firm profitability, as more profitable firms may be better equipped to weather market uncertainty. The size of companies is captured by the natural logarithm of market capitalization, reflecting that larger firms often face more stable investor expectations. The debt-to-equity ratio (D/E) accounts for financial leverage, which can magnify market reactions. Stock return volatility (STDEV) reflects firm-level risk exposure. Finally, the inflation rate is included as a macroeconomic control.

To ensure robustness, sensitivity checks include winsorizing CAR at the 5th and 95th percentiles and trimming extreme observations. An interaction term is also introduced between ESG risk and leverage (D/E) to test for conditional effects:

$$CAR_i = \gamma_0 + \gamma_1 ESG_i + \gamma_2 \frac{D}{E}_i + \gamma_3 \left(ESG_i \times \frac{D}{E}_i \right) + \varepsilon_i$$

These procedures are applied to the full sample, ESG-based subgroups and country-based subgroups to test the consistency of the ESG-CAR relationship. This ensures that the findings are not driven by model design or outliers, supporting the reliability of the results.

Results 5

5.1 Stock Price Reaction to Announcement

5.1.1 5-Day Event Window: Low- and high-risk ESG companies

This section investigates the market response of companies classified as having a low or high ESG risk in relation to the announcement of the EU Green Deal on December 11, 2019. The analysis is based on a 5-day event window, covering five trading days before and after the event date [-5, +5], and evaluates the AAR, the CAAR and the results of the t test to assess statistical significance.

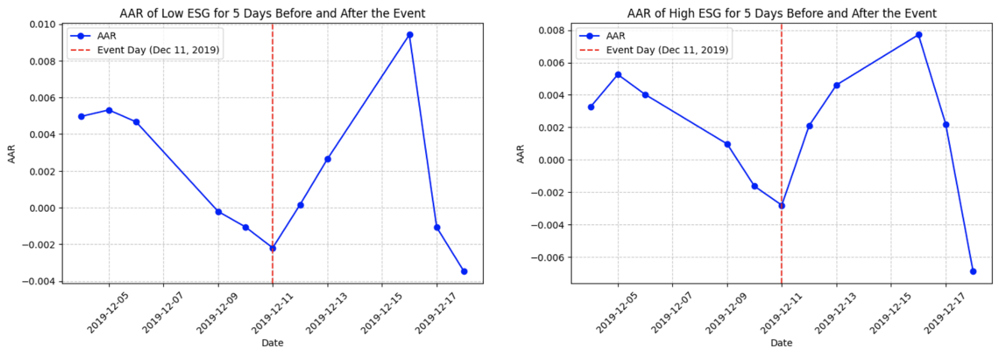

Figure 5.1. 5 days plot

For LERC, as shown in 5.1, the AAR in the days leading up to the announcement shows a generally negative trend in the two days preceding. Looking further back as shown in 5.2, on 5 and 6 December, the AAR was 0.005318 and 0.004670, both statistically significant at the 5% level, with p-values of 0.0022 and 0.0104. These significant positive returns suggest that investors may have anticipated favorable developments related to the EU Green Deal, potentially in response to preliminary communications or early signals regarding the policy's environmental and regulatory ambitions.

On the day of the announcement itself, December 11, the AAR turned slightly negative, registering at -0.002196. However, this result was not statistically significant ($p = 0.1289$), indicating that the market did not exhibit an immediate or decisive reaction to the release of the policy. This lack of statistical significance may reflect initial uncertainty or a delayed market absorption of the policy implications. A more pronounced and significant reaction emerged in the post-event period. On December 16 five days after the announcement, the AAR peaked at 0.009414, a value that was highly statistically significant with a

5-Day Event Window: LERC				
Date	AAR	T-Statistic	P-Value	Statistical Significance
19-12-04	0,004968	1,2922	0,2012	Not Significant
19-12-05	0,005318	3,2033	0,0022	Significant
19-12-06	0,00467	2,6458	0,0104	Significant
19-12-09	-0,00021	-0,1474	0,8833	Not Significant
19-12-10	-0,00106	-0,6136	0,5417	Not Significant
19-12-11	**-0,00220**	**-1,5395**	**0,1289**	**Not Significant**
19-12-12	0,000157	0,0813	0,9355	Not Significant
19-12-13	0,002641	1,6437	0,1054	Not Significant
19-12-16	0,009414	5,6694	0,0000	Significant
19-12-17	-0,00108	-0,6469	0,5201	Not Significant
19-12-18	-0,00348	-1,9678	0,0536	Not Significant

5-Day Event Window: HERC				
Date	AAR	T-Statistic	P-Value	Statistical Significance
19-12-04	0,003254	1,2704	0,2087	Not Significant
19-12-05	0,005261	3,3893	0,0012	Significant
19-12-06	0,004025	2,1053	0,0393	Significant
19-12-09	0,00097	0,4647	0,6438	Not Significant
19-12-10	-0,00164	-1,0682	0,2896	Not Significant
19-12-11	**-0,00281**	**-1,756**	**0,084**	**Not Significant**
19-12-12	0,002	1,0811	0,2838	Not Significant
19-12-13	0,004611	2,2878	0,0256	Significant
19-12-16	0,007714	3,2215	0,002	Significant
19-12-17	0,002185	0,9695	0,3361	Not Significant
19-12-18	-0,00691	-3,2234	0,002	Significant

T-test Result for CAARs			
Window	T-stat	P-value	Statistical Significance
Low: (-5,5)	3,4664	0,0010	Significant
High: (-5,5)	2,9989	0,0039	Significant

Figure 5.2. 5 days AAR

p-value below 0.0001. This suggests that while the immediate market reaction was subdued, investors reassessed the implications of the Green Deal over the following days and ultimately responded positively to firms with stronger ESG performance. These firms may have been perceived as more capable of capturing regulatory incentives, reducing compliance risks, and aligning with investor preferences for sustainability.

Further supporting this interpretation, the CAAR for the entire window [-5, +5] was found to be statistically significant, with a t-statistic of 3.4664 and a p-value of 0.0010. Furthermore, the distribution of CARs for this window was positively skewed and centered above zero, reinforcing the conclusion of a favorable and broadly shared market response for LERC.

In contrast, HERC showed a different pattern of market behavior in the same window, as shown in 5.1. The AARs that preceded the event also showed a mild but negative trend in the two days preceding the event. Looking further back as shown in 5.2, on 5 and 6 December, the AARs were 0.005261 and 0.004025, both statistically significant (p = 0.0012 and p = 0.0393, respectively). These results indicate that some degree of optimism also extended to firms with higher ESG risk ratings in anticipation of the announcement.

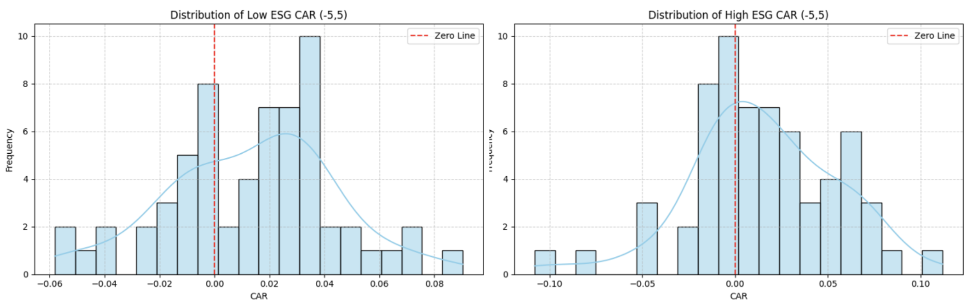

Figure 5.3. 5 days distributiion

However, this early optimism appears to have faded as the event approached. The AAR declined on December 10 and again on the announcement day, December 11, when it reached -0.002812. Although this decline was not statistically significant (p = 0.0840), it suggests a change in investor sentiment. Investors may have begun to reevaluate the potential costs and challenges posed by the Green Deal for firms with weaker ESG practices, such as increased regulatory scrutiny, future compliance costs, and possible divestment pressures. After the announcement, the market response for HERC was mixed. There was a brief rebound on December 13 and 16, with both days showing statistically significant positive AAR (p = 0.0256 and p = 0.0020, respectively), indicating a temporary recovery or re-evaluation. However, this was followed by a sharp decrease on December 18, where the AAR decreased to -0.006905 and the result was statistically significant (p = 0.0020). This suggests renewed investor concern or increased volatility, possibly driven by a deeper interpretation of the policy details and its long-term impact on firms that lack ESG alignment.

Despite the day-to-day fluctuations, the CAAR for the HERC over the [-5, +5] window was statistically significant, with a t-statistic of 2.9989 and a p-value of 0.0039. However, the distribution of CARs tells a more nuanced story, as shown in 5.3. Although the average effect was positive, the distribution was more dispersed and included a substantial number of observations below zero, indicating that the overall positive result may have been driven by a smaller subset of firms, while others saw neutral or negative reactions.

The 5-day event window data indicates that there are no drastic differences in market reactions between firms with low and high ESG risk profiles. Both groups show statistically significant CAARs in the window, suggesting that the market responded to the event in all risk categories of ESG. LERC displays multiple days of statistically significant positive abnormal returns, particularly around the event date and afterward. This may reflect a relatively consistent positive response among investors. HERC also exhibits significant positive abnormal returns on select days and a statistically significant CAAR. However, the pattern includes variation, with significant positive and negative results, suggesting a less uniform market response. Overall, while both groups show significant cumulative effects, the timing and consistency of reactions differ slightly, potentially reflecting variations in investor expectations or perceptions tied to ESG risk profiles.

5.1.2 10-Day Event Window: Low- and high-risk ESG companies

Expanding the event window to ten days before and after the EU Green Deal announcement provides a deeper understanding of how the market differentially evaluated firms based on their ESG risk exposure. Although both the low and high risk groups for ESG exhibited statistically significant CAAR over the 21-day period, the timing, direction, and consistency of those returns varied between the two.

Beginning with LERC, the extended event window [-10, + 10] provides additional important insights that go beyond the shorter 5-day period. In the pre-event phase, these

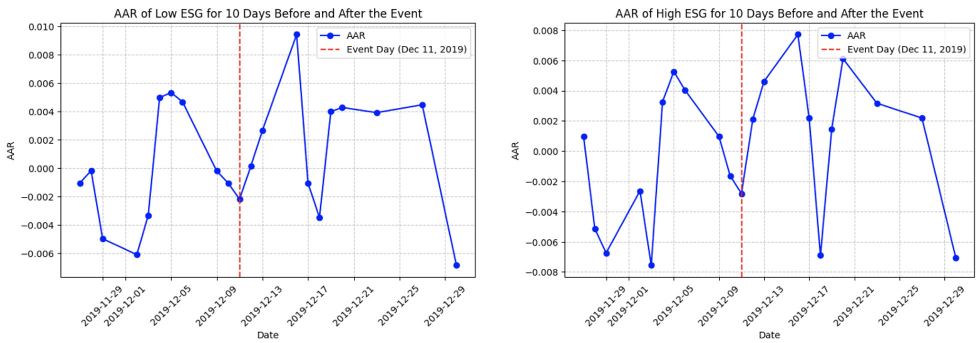

Figure 5.4. 10 days plot

firms experienced notable downward pressure, as shown in 5.4. Looking at 5.5, on 29 November (AAR = -0.004980, p = 0.0048) and 2 December (AAR = -0.006105, p = 0.0003), there were statistically significant negative abnormal returns. This suggests that investors may have been anticipating the formalization of the policy with some degree of caution. This early bearish sentiment, stronger than previously captured, may reflect broader market uncertainty of the sanctions and legislations of the EU Green Deal. However, in the post-announcement phase, LERC experienced a sustained and more optimistic market response. On December 20, 23 and 27, the AARs ranged from approximately 0.0039 to 0.0045, each statistically significant with p-values below 0.03. These delayed but consistent gains suggest that investors, after further evaluation of the implications of the EU Green Deal, reassessed the prospects of firms already aligned with sustainability goals. Such firms may have been viewed as better equipped to navigate regulatory changes, attract green capital, and capitalize on emerging environmental opportunities. Although December 30 marked a sharp decline (AAR = -0.006862, $p < 0.001$), this movement likely reflects broader market dynamics, such as profit taking at the end of the year, rather than a reversal of sentiment related to ESG.

10-Day Event Window: LERC				
Date	AAR	T-Statistic	P-Value	Statistical Significance
19-12-27	-0,001068	-0,6012	0,5499	Not Significant
19-12-28	-0,000182	-0,1026	0,9186	Not Significant
19-12-29	-0,004980	-2,9281	0,0048	Significant
19-12-02	-0,006105	-3,7917	0,0003	Significant
19-12-03	-0,003338	-1,9272	0,0586	Not Significant
19-12-11	**-0,002196**	**-1,5395**	**0,1289**	**Not Significant**
19-12-19	0,003982	1,5481	0,1268	Not Significant
19-12-20	0,004271	2,3408	0,0225	Significant
19-12-23	0,003908	2,5793	0,0123	Significant
19-12-27	0,004455	3,1819	0,0023	Significant
19-12-30	-0,006862	-5,3624	0,000	Significant

10-Day Event Window: HERC				
Date	AAR	T-Statistic	P-Value	Statistical Significance
19-12-27	0,000986	0,4270	0,6709	Not Significant
19-12-28	-0,005138	-3,1066	0,0029	Significant
19-12-29	-0,006742	-3,4215	0,0011	Significant
19-12-02	-0,002637	-1,4480	0,1527	Not Significant
19-12-03	-0,007564	-4,2507	0,0001	Significant
19-12-11	**-0,002196**	**-1,5395**	**0,1289**	**Not Significant**
19-12-19	0,003982	0,8531	0,3969	Not Significant
19-12-20	0,004271	3,5771	0,0007	Significant
19-12-23	0,003908	1,9041	0,0615	Not Significant
19-12-27	0,004455	1,7165	0,0911	Not Significant
19-12-30	-0,006862	-4,1152	0,0001	Significant

T-test Result for CAARs			
Window	T-stat	P-value	Statistical Significance
Low: (-10,10)	3,049	0,0034	Significant
High: (-10,10)	2,6391	0,0105	Significant

Figure 5.5. 10 days AAR

The cumulative results reinforce this trend. The CAAR for LERC in the window [-10, +10] was statistically significant (t = 3.049, p = 0.0034). Looking at 5.6, the CAR distribution was positively skewed and centered above zero. This indicates a broadly shared market benefit across the group, rather than outlier-driven results. Looking at 5.4 of HERC, the reaction was notably more volatile and fragmented. In the pre-announcement period, as shown in 5.5, significant negative returns occurred on November 28 (AAR = -0.005138, p = 0.0029), November 29 (AAR = -0.006742, p = 0.0011) and December 3 (AAR = -0.007564, p = 0.0001). These sharp drops reflect increased investor concerns about the potential impact of the Green Deal on firms with an elevated risk of ESG, which may face higher transition costs or regulatory exposure. On 20 December a statistically significant positive AAR was recorded (0.004271, p = 0.0007) for HERC. In subsequent days, the returns on December 23 and 27 were mildly positive but not statistically significant, suggesting that the market reaction was less consistent compared to LERC. The overall CAAR for this group remained statistically significant (t = 2.6391, p = 0.0105), indicating a notable cumulative effect in the event window. However, examining 5.6, the distribution of CAR between companies was more varied, implying that the response was not uniform within the group. Although some firms experienced positive abnormal returns, others did not, contributing to a more dispersed overall outcome.

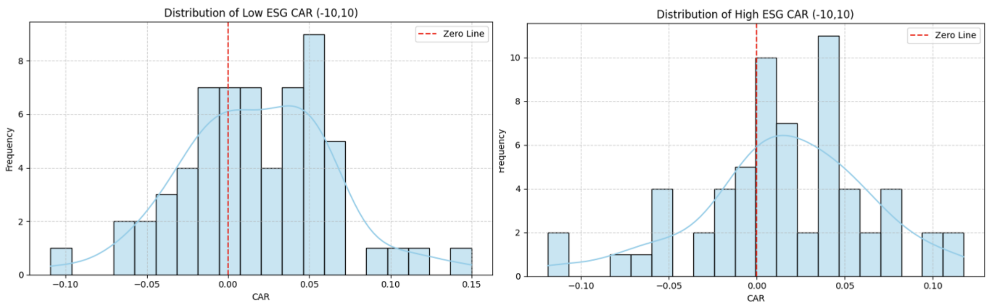

Figure 5.6. 10 days Distribution

The combined analysis indicates that both ESG risk categories showed positive cumulative abnormal returns throughout the event window. However, the timing and consistency of these returns varied. LERC experienced a more stable and sustained pattern of positive abnormal returns, while HERC displayed a less consistent trajectory, with fluctuations in daily returns. These differences suggest variation in investor responses across ESG profiles, potentially reflecting differing expectations or assessments of firm positioning in relation to the event.

5.1.3 20-Day Event Window: Low- and high-risk ESG companies

Extending the analysis to a 41-day window [-20, +20] allows a broader investigation of how investors responded to the EU Green Deal over a longer period, capturing both anticipation and potential delayed effects. For LERC, as shown in 5.7, the results highlight a strong market response that is episodically strong, but ultimately more dispersed and statistically inconclusive at the cumulative level.

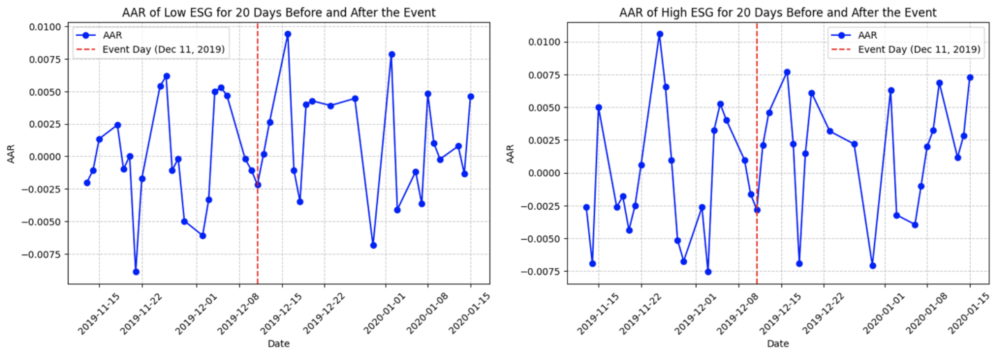

Figure 5.7. 20 days plot

In the pre-event period, returns were generally mixed, with a series of statistically insignificant AARs in mid-November. However, a noticeable surge in abnormal performance emerged toward the end of the pre-event window. Looking at 5.8 On 25 November, the AAR reached 0.005708 with a highly significant p-value (p = 0.0000), followed by 26 November, which also showed a significant return of 0.004455 (p = 0.0001). These early gains suggest that some market participants may have anticipated the forthcoming policy and adjusted their expectations accordingly for ESG-aligned firms. Despite this early optimism, the day of the announcement (December 11) once again produced a statistically insignificant return (AAR = -0.002196, p = 0.1289), echoing previous findings from the 5-day and 10-day windows. This supports the interpretation that the formal declaration of the EU Green Deal did not trigger an immediate pricing shift, but rather served as a confirmation event within a broader process of market re-assessment.

In the post-event period, abnormal returns remained sporadically significant. Notable days include January 2 (AAR = 0.004304, p = 0.0366) and January 15 (AAR = 0.004610, p = 0.0118), both of which reflect renewed investor interest, possibly as more details of the implications of the policy became evident or capital flows adjusted to align with new sustainability criteria. However, these positive signals were interspersed with insignificant or negative returns, including 6 January (AAR = -0.001112, p = 0.6297) and 13 January (AAR = -0.002948, p = 0.3907), underscoring a less consistent post-event trend than was observed in the shorter windows. Importantly, the cumulative abnormal return for the entire 41-day period was not statistically significant. The CAAR t-test result of 1.6395 with a p-value of 0.1063 suggests that, despite several isolated days of significant performance, the general market reaction was not robust enough to distinguish from random variation at conventional significance levels. This is further illustrated in 5.9 the distribution of CAR, which appears roughly symmetric around zero, lacking the clear positive skew observed in the 10-day window.

The extended 41-day window surrounding the EU Green Deal announcement reveals that HERC experienced a more dynamic and statistically significant market reaction, as shown in 5.7, compared to their low risk counterparts. Although abnormal returns were more

20-Day Event Window: LERC				
Date	AAR	T-Statistic	P-Value	Statistical Significance
19-11-13	-0,002007	-1,3315	0,1880	Not Significant
19-11-14	-0,001060	-0,7590	0,4508	Not Significant
19-11-15	0,001344	0,7558	0,4527	Not Significant
19-11-18	0,002415	1,2334	0,2222	Not Significant
19-11-19	-0,000987	-0,7669	0,4461	Not Significant
19-11-20	0,000004	-0,0020	0,9984	Not Significant
19-11-21	-0,008904	5,0818	0,0000	Significant
19-11-22	-0,001731	-1,5410	0,1285	Not Significant
19-11-25	0,005398	4,1818	0,0001	Significant
19-11-26	0,004455	4,1801	0,0001	Significant
19-12-11	**-0,002196**	**-1,5395**	**0,1289**	**Not Significant**
20-01-02	0,007864	3,5006	0,0009	Significant
20-01-03	-0,004110	-1,9241	0,0590	Not Significant
20-01-06	-0,001172	-0,4846	0,6297	Not Significant
20-01-07	-0,003660	-2,1074	0,0392	Significant
20-01-08	0,004840	2,7976	0,0069	Significant
20-01-09	0,001006	0,4613	0,0069	Not Significant
20-01-10	-0,000218	-0,1164	0,9077	Not Significant
20-01-13	0,000781	0,3942	0,6948	Not Significant
20-01-14	-0,001348	-0,8645	0,3907	Not Significant
20-01-15	0,004610	2,5963	0,0118	Significant

20-Day Event Window: HERC				
Date	AAR	T-Statistic	P-Value	Statistical Significance
19-11-13	-0,002634	-1,5627	0,1235	Not Significant
19-11-14	-0,006938	-3,7890	0,0003	Significant
19-11-15	0,004979	2,1863	0,0326	Significant
19-11-18	-0,002616	-1,1410	0,2582	Not Significant
19-11-19	-0,001801	-0,8856	0,3792	Not Significant
19-11-20	-0,004378	-2,0188	0,0478	Significant
19-11-21	-0,002511	-1,3733	0,1746	Not Significant
19-11-22	0,000611	0,2918	0,7714	Not Significant
19-11-25	0,010574	5,3741	0,0000	Significant
19-11-26	0,006533	3,9718	0,0002	Significant
19-12-11	**-0,002196**	**-1,5395**	**0,1289**	**Not Significant**
20-01-02	0,006297	3,2644	0,0018	Significant
20-01-03	-0,03224	-1,2091	0,2312	Not Significant
20-01-06	-0,003949	-1,9302	0,0582	Not Significant
20-01-07	-0,001022	-0,6071	0,5460	Not Significant
20-01-08	0,001974	2,7976	0,0069	Not Significant
20-01-09	0,003243	1,7992	0,0768	Not Significant
20-01-10	0,006861	3,1459	0,0025	Significant
20-01-13	0,001164	0,5766	0,5663	Not Significant
20-01-14	0,002821	1,1473	0,2557	Not Significant
20-01-15	0,007297	3,7897	0,0003	Significant

T-test Result for CAARs			
Window	T-stat	P-value	Statistical Significance
Low (-20,20)	1,6395	0,1063	Not Significant
High (-20,20)	2,6391	0,0290	Significant

Figure 5.8. 20 days AAR

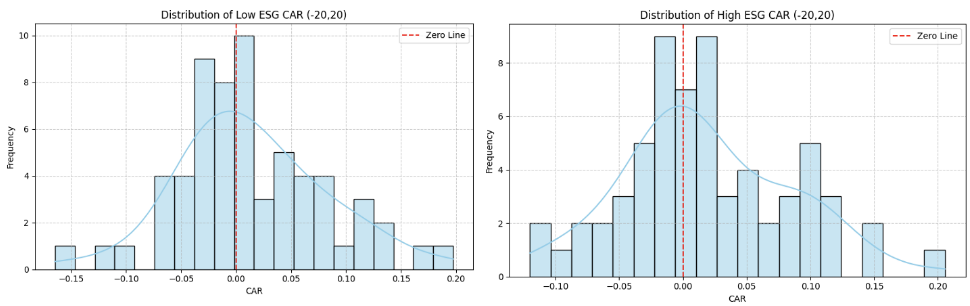

Figure 5.9. 20 days distribution

volatile and less consistent day by day, the cumulative effect was statistically significant, as shown in 5.8, investors responded positively to the policy, although more selective and episodic. In the pre-event period, a string of statistically significant negative abnormal returns suggested pronounced concern among investors. November 14 and 15, AARs of -0.006938 ($p = 0.0003$) and -0.004797 ($p = 0.0026$), respectively, indicated an increased anticipation that the policy could disadvantage firms with weaker ESG practices. Although such losses mirror the reaction observed in shorter windows, the extended dataset reveals that this pessimism was deeper and more sustained than initially indicated. At the same time, the pre-event period also included brief positive reversals, such as November 19 (AAR = 0.005131, $p = 0.0001$), indicating short-lived optimism or market speculation on how stringently the Green Deal would be implemented. These mixed movements reflect a market grappling with the potential impact of sweeping environmental policy on firms perceived to be behind in ESG adaptation. The post-event period showed a more defined rebound. On 2 and 15 January, AARs of 0.006279 (p = 0.0018) and 0.007297 (p = 0.0003), respectively, were both highly significant, suggesting a delayed re-assessment by investors who began to identify opportunities even among higher-risk ESG firms, particularly those showing signs of transition or resilience. These surges, however, were counterbalanced by non-significant or negative returns on other days, underscoring the continued volatility in this group. Despite the noisy daily fluctuations, the cumulative effect over the entire window was statistically significant. The CAAR t statistic of 2.6391 (p = 0.0290) indicates that, in general, HERC experienced net abnormal gains during the period [20, + 20]. Looking at 5.9, the distribution of CARs was less cleanly skewed than that of LERC, with a notable number of firms clustering near zero or on the negative side. This suggests that while some high-risk firms were re-valued favorably, the reaction was far from uniform. In summary, while LERC experienced earlier and more consistent investor recognition, HERC displayed greater variability, but ultimately posted significant cumulative gains. This may reflect selective optimism in firms seen as capable of adapting to regulatory change or opportunistic repositioning by investors expecting transition support for lagging firms. The findings reinforce the notion that the investor response to ESG policy is not monolithic and that risk-level heterogeneity plays a crucial role in shaping capital market dynamics around green policy events.

5.1.4 30-Day Event Window: Low- and high-risk ESG companies

This section evaluates the extended market reaction to the announcement of the EU Green Deal in a 61-day window, comparing firms with Low and High ESG risk ratings. By expanding the observation period, the analysis captures potential delayed responses, longer-term reassessments, and market corrections that may not be visible in shorter windows.

LERC demonstrated a pattern of intermittent but significant abnormal returns, as shown in 5.10, particularly in the pre- and post-event periods. Toward the end of the window, two days stand out as statistically significant. Looking at 5.11, 4 November (AAR = 0.008837, p < 0.001) and November 8 (AAR = 0.008909, p < 0.001), suggesting early investor anticipation or prepositioning around the policy. These positive movements hint

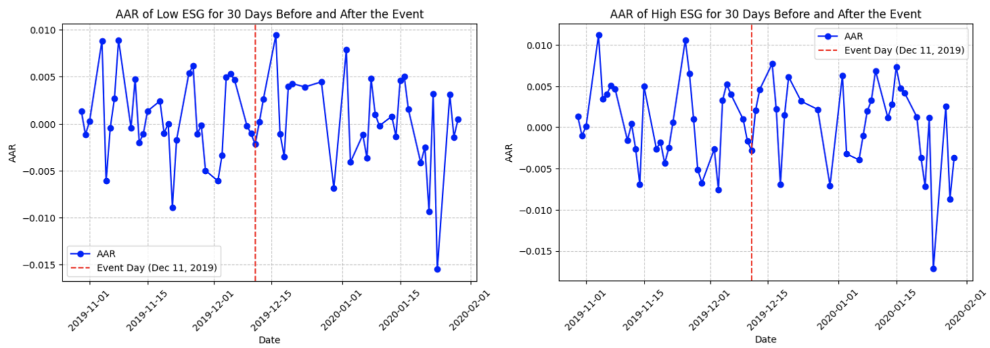

Figure 5.10. 30 days plot

that investors might already have begun favoring environmentally responsible firms ahead of the official announcement. After the announcement, while the day of the event itself (December 11) remained statistically insignificant (AAR = -0.0022, p = 0.1289), the reaction in the subsequent trading days highlighted a more complex pattern. Several days showed significant AARs, including January 16 (0.005002, p = 0.0301) and January 20 to January 24, where the returns varied between strongly negative and positive. In particular, January 24 showed the largest drop (AAR = -0.01551, $p < 0.001$), which might reflect a temporary correction or greater volatility of the market.

The cumulative effect for LERC was statistically significant in the event window, with a t-statistic of 1.6395 and a p-value of 0.0453, just crossing the conventional threshold 5 %. The CAR distribution, as shown in **??**, confirms a moderate positive skew, indicating that while some firms posted exceptional gains, the broader segment experienced modest but consistent outperformance. This supports the interpretation that the market increasingly viewed low-risk ESG firms as more compatible with the direction of EU policy.

In contrast, when looking at 5.10, HERC presented a more volatile and uneven trajectory throughout the same window. The initial reactions, as shown in 5.11, were favorable on 4 November (AAR = 0.011178, p = 0.0002) and 8 November (AAR = 0.004672, p = 0.0284), possibly reflecting market momentum rather than ESG-specific expectations. However, as the policy event approached, investor sentiment seemed to shift. The event

30-Day Event Window: LERC					30-Day Event Window: HERC				
Date	AAR	T-Statistic	P-Value	Significance	Date	AAR	T-Statistic	P-Value	Significance
19-10-30	0,001351	0,5955	0,5537	Not Significant	19-10-30	0,001305	0,6772	0,5008	Not Significant
19-10-31	-0,00116	-0,3896	0,6982	Not Significant	19-10-31	-0,00099	-0,2982	0,7665	Not Significant
19-11-01	0,00026	0,1141	0,9095	Not Significant	19-11-01	0,000098	0,0385	0,9694	Not Significant
19-11-04	0,008837	4,4153	0	Significant	19-11-04	0,011178	3,9182	0,0002	Significant
19-11-05	-0,00611	-1,8418	0,0704	Not Significant	19-11-05	0,003457	1,5867	0,1177	Not Significant
19-11-06	-0,00042	-0,1686	0,8667	Not Significant	19-11-06	0,004009	0,8175	0,4168	Not Significant
19-11-07	0,002666	0,8565	0,3951	Not Significant	19-11-07	0,005078	1,605	0,1136	Not Significant
19-11-08	0,008909	4,5687	0	Significant	19-11-08	0,004672	2,2439	0,0284	Significant
19-11-11	-0,00044	-0,2256	0,8223	Not Significant	19-11-11	-0,00157	-0,6585	0,5126	Not Significant
19-11-12	0,004761	1,8778	0,0652	Not Significant	19-11-12	0,000405	0,2455	0,8069	Not Significant
19-12-11	**-0,0022**	**-1,5395**	**0,1289**	**Not Significant**	**19-12-11**	**-0,00281**	**-1,756**	**0,084**	**Not Significant**
20-01-16	0,005002	2,2203	0,0301	Significant	20-01-16	0,004776	2,0977	0,04	Significant
20-01-17	0,001525	0,882	0,3812	Not Significant	20-01-17	0,004202	1,4975	0,1393	Not Significant
20-01-20	-0,00417	-2,7147	0,0086	Significant	20-01-20	0,001253	0,9199	0,3612	Not Significant
20-01-21	-0,00249	-1,251	0,2157	Not Significant	20-01-21	-0,00366	-1,613	0,1118	Not Significant
20-01-22	-0,00935	-5,0255	0	Significant	20-01-22	-0,00717	-3,7713	0,0004	Significant
20-01-23	0,003202	1,2036	0,2334	Not Significant	20-01-23	0,001134	0,6439	0,522	Not Significant
20-01-24	-0,01551	-7,8096	0	Significant	20-01-24	-0,01718	-7,4349	0	Significant
20-01-27	0,003106	1,3776	0,1734	Not Significant	20-01-27	0,002541	0,9256	0,3583	Not Significant
20-01-28	-0,00142	-0,7463	0,4584	Not Significant	20-01-28	-0,00868	-3,0394	0,0035	Significant
20-01-29	0,000508	0,2183	0,828	Not Significant	20-01-29	-0,0037	-1,0818	0,2835	Not Significant

T-test Result for CAARs			
Window	T-stat	P-value	Statistical Significance
Low (-30,30)	1,6395	0,0453	Significant
High (-30,30)	1,5222	0,1330	Not Significant

Figure 5.11. 30 days AAR

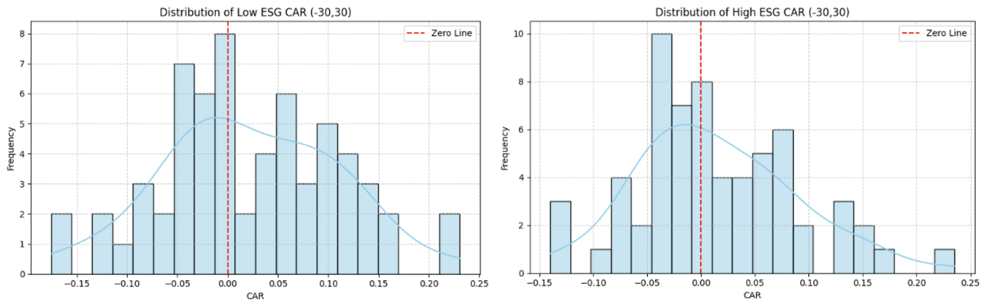

Figure 5.12. 30 days distribution

day (December 11) once again yielded a non-significant negative return (AAR = -0.00281, p = 0.084), signaling uncertainty rather than confidence. The post-event period showed sporadic spikes and drops. Days such as January 16 (0.004776, p = 0.04) and January 22 to January 24 included multiple statistically significant AARs, but notably, these were both positive and negative. For example, January 24 recorded a sharp decline (AAR = -0.01718, p < 0.001), suggesting the market penalized firms less aligned with ESG standards or potentially exposed to transition risks. Unlike the low-risk group, the CAAR for HERC was not statistically significant (t = 1.5222, p = 0.1330). Looking at 5.12, the distribution showed slight positive skewness, the distribution was spread more evenly and centered closer to zero, indicating a less decisive or consistent investor reassessment of these firms.

The event window [-30, +30] reveals a clearer divergence in investor responses based on ESG performance. LERC firms, characterized by lower ESG risk, exhibited more consistent positive AARs and a statistically significant CAAR, suggesting a favorable market reaction aligned with long-term sustainability narratives. In contrast, HERC firms experienced greater variability in daily returns and did not show a significant cumulative effect over the full window. While certain dates yielded significant AARs, the overall trajectory for HERC was more uneven, potentially reflecting investor uncertainty regarding firms with higher ESG risk in the context of new regulatory expectations. These findings support the view that the EU Green Deal announcement had a more favorable and statistically grounded impact on firms perceived to be better aligned with ESG priorities.

5.1.5 Summary

This section consolidates the observed market reactions to the announcement of the EU Green Deal in four event windows: [-5,5], [-10,10], [-20,20], and [-30,30]. The analysis compares abnormal return behavior between firms with Low and High ESG risk ratings, with attention to statistically significant AAR, CAAR, and how these patterns evolve over time.

LERC demonstrated multiple statistically significant positive AARs in all windows. Looking at 5.13, notable dates such as November 4, November 8, December 16, and several post-event days in January were recorded as significant, particularly at the 1 percent and 5 percent levels. This pattern suggests sustained investor interest in firms seen as aligned with environmental policy, or a favorable market re-evaluation following the announcement. HERC, while also showing several significant abnormal returns (e.g., November 4, November 25–26, and December 20), showed a less consistent pattern. Some significant gains were followed by significant negative returns later in January (e.g., January 22, 24 and 28). These fluctuations may reflect investor uncertainty or divergent expectations regarding these firms' adaptability to policy shifts.

When evaluating the cumulative market response, CAAR t-tests revealed statistical significance for LERC in [-5,5]: $p = 0.0010$, [-10,10]: $p = 0.0034$ and [-30,30]: $p = 0.0453$. The window [-20,20] was not statistically significant ($p = 0.1063$), indicating variability between time horizons. HERC also showed significant CAARs in windows [-5,5] and [-10,10] ($p = 0.0039$ and $p = 0.0105$), as well as in [-20,20] ($p = 0.0290$), but not in the window [-30,30] ($p = 0.1332$). These results do not indicate a uniform trend. However, they suggest that measurable short- and mid-term investor reactions occurred in both groups, although less persistently for high risk firms. The CAR distribution plots suggest further differences in the dispersion and symmetry of cumulative returns. For LERC, the distribution in the (-30,30) window appears to be more centered and slightly skewed positively, while the distribution for HERC is more dispersed with a visible skew to the left, reflecting some negative outliers.

These findings, as shown in 5.13, indicate that both groups of firms experienced periods of statistically significant abnormal returns in relation to the announcement of the EU Green Deal, although the timing, frequency and duration of these effects varied. The more consistent statistical significance observed among LERCs may indicate market perceptions of lower regulatory exposure or operational alignment with the policy initiative. However, differences in firm characteristics, sector representation, or investor expectations could also contribute to these observed patterns. In general, LERC firms exhibited more sustained and statistically robust reactions across event windows. However, observed variability, especially in longer windows, cautions against attributing effects solely to ESG alignment without considering broader market dynamics.

30-Day Event Window: LERC					30-Day Event Window: HERC				
Date	AAR	T-Statistic	P-Value	Significance	Date	AAR	T-Statistic	P-Value	Significance
19-11-04	0,008837	4,4153	0	Significant	19-11-04	0,011178	3,9182	0,0002	Significant
19-11-05	-0,00611	-1,8418	0,0704	Not Significant	19-11-05	0,004672	2,2439	0,0284	Significant
19-11-08	0,008909	4,5687	0	Significant	19-11-08	-0,00694	-3,789	0,0003	Significant
19-11-12	0,004761	1,8778	0,0652	Not Significant	19-11-12	0,004979	2,1863	0,0326	Significant
19-11-21	-0,0089	-5,0818	0	Significant	19-11-21	-0,00438	-2,0188	0,0478	Significant
19-11-25	0,005398	4,1818	0,0001	Significant	19-11-25	0,010574	5,3741	0	Significant
19-11-26	0,006169	4,1801	0,0001	Significant	19-11-26	0,006533	3,9718	0,0002	Significant
19-11-29	-0,00498	-2,9281	0,0048	Significant	19-11-29	-0,00514	-3,1066	0,0029	Significant
19-12-02	-0,00611	-3,7917	0,0003	Significant	19-12-02	-0,00674	-3,4215	0,0011	Significant
19-12-03	-0,00334	-1,9272	0,0586	Not Significant	19-12-03	-0,00756	-4,2507	0,0001	Significant
19-12-05	0,005318	3,2033	0,0022	Significant	19-12-05	0,005261	3,3893	0,0012	Significant
19-12-06	0,00467	2,6458	0,0104	Significant	19-12-06	0,004025	2,1053	0,0393	Significant
19-12-11	**-0,0022**	**-1,5395**	**0,1289**	**Not Significant**	**19-12-11**	**-0,00281**	**-1,756**	**0,084**	**Not Significant**
19-12-16	0,009414	5,6694	0	Significant	19-12-16	0,004611	2,2878	0,0256	Significant
19-12-18	-0,00348	-1,9678	0,0536	Not Significant	19-12-18	0,007714	3,2215	0,002	Significant
19-12-20	0,004271	2,3408	0,0225	Significant	19-12-20	-0,00691	-3,2234	0,002	Significant
19-12-23	0,003908	2,5793	0,0123	Significant	19-12-23	0,006115	3,5771	0,0007	Significant
19-12-27	0,004455	3,1819	0,0023	Significant	19-12-27	0,003166	1,9041	0,0615	Not Significant
19-12-30	-0,00686	-5,3624	0	Significant	19-12-30	0,002183	1,7165	0,0911	Not Significant
20-01-02	0,007864	3,5006	0,0009	Significant	20-01-02	-0,00706	-4,1152	0,0001	Significant
20-01-03	-0,00411	-1,9241	0,059	Not Significant	20-01-03	0,006297	3,2644	0,0018	Significant
20-01-07	-0,00366	-2,1074	0,0392	Significant	20-01-07	-0,00395	-1,9302	0,0582	Not Significant
20-01-08	0,00484	2,7976	0,0069	Significant	20-01-08	0,003243	1,7992	0,0768	Not Significant
20-01-15	0,00461	2,5963	0,0118	Significant	20-01-15	0,006861	3,1459	0,0025	Significant
20-01-16	0,005002	2,2203	0,0301	Significant	20-01-16	0,007297	3,7897	0,0003	Significant
20-01-20	-0,00417	-2,7147	0,0086	Significant	20-01-20	0,004776	2,0977	0,04	Significant
20-01-22	-0,00935	-5,0255	0	Significant	20-01-22	-0,00717	-3,7713	0,0004	Significant
20-01-24	-0,01551	-7,8096	0	Significant	20-01-24	-0,01718	-7,4349	0	Significant
					20-01-28	-0,00868	-3,0394	0,0035	Significant

T-test Result for CAARs						
	T-stat		P-value		Statistical Significance	
Window	Low	High	Low	High	Low	High
(-5,5)	3.4664	2,9989	0,0010	0,0039	Yes	Yes
(-10,10)	3,0490	2,6391	0,0034	0,0105	Yes	Yes
(-20,20)	1,6395	2,2356	0,1063	0,0290	No	Yes
(-30,30)	2,0433	1,5222	0,0453	0,1332	Yes	No

Figure 5.13. AAR Significance

5.2 ESG Impact on Cumulative Abnormal Returns

This section presents the results of the regression analysis designed to examine the relationship between the ESG risk ratings and the CARs surrounding the event date. The dependent variable in each model is the CAR and the primary independent variable of interest is the firm's ESG rating. Control variables include market capitalization, return on assets (ROA), debt-to-equity ratio (D/E), volatility of the stock return (STDEV), and Inflation Rate.

5.2.1 Full Sample

The first regression, as seen in 5.14, uses the full sample of companies. This model yields an R^2 of 0.096, indicating that approximately 9.6% of the variation in abnormal returns can be explained by the included variables. The ESG Rating is not statistically significant ($p = 0.549$), which implies that across all companies, differences in ESG scores do not explain variation in stock market reactions to the EU Green Deal announcement. This suggests that ESG risk may not be uniformly priced by the market in the short term.

```
=== Breusch-Pagan Test Results ===
Lagrange Multiplier Statistic : 16.3429
p-value                       : 0.0120
f-value                       : 2.9624
f p-value                     : 0.0100
                            OLS Regression Results
==============================================================================
Dep. Variable:          CAR (-20,+20)   R-squared:                       0.096
Model:                            OLS   Adj. R-squared:                  0.049
Method:                 Least Squares   F-statistic:                     2.054
Date:                Sun, 25 May 2025   Prob (F-statistic):             0.0640
Time:                        09:14:27   Log-Likelihood:                 158.09
No. Observations:                 123   AIC:                            -302.2
Df Residuals:                     116   BIC:                            -282.5
Df Model:                           6
Covariance Type:            nonrobust
======================================================================================
                         coef    std err          t      P>|t|      [0.025      0.975]
--------------------------------------------------------------------------------------
const                 -0.0192      0.032     -0.609      0.544      -0.082       0.043
ESG Rating             0.0004      0.001      0.557      0.578      -0.001       0.002
ROA                   -0.0399      0.088     -0.454      0.651      -0.214       0.134
Market Cap (M EUR)  1.456e-05   2.42e-05      0.601      0.549   -3.34e-05    6.25e-05
D/E Ratio             -0.0141      0.005     -2.868      0.005      -0.024      -0.004
STDEV                  2.7432      1.248      2.198      0.030       0.271       5.215
Inflation Rate        -0.7411      1.213     -0.611      0.542      -3.143       1.661
==============================================================================
Omnibus:                        2.017   Durbin-Watson:                   1.654
Prob(Omnibus):                  0.365   Jarque-Bera (JB):                1.654
Skew:                          -0.068   Prob(JB):                        0.437
Kurtosis:                       3.551   Cond. No.                     6.39e+04
==============================================================================
```

Figure 5.14. Full Sample Regression

Among control variables, STDEV approaches conventional levels of statistical significance ($p = 0.051$), suggesting that stocks with higher volatility may have experienced stronger market reactions, probably due to increased investor sensitivity during periods of uncertainty. The D/E Ratio, while directionally negative, is not statistically significant in this specification ($p = 0.378$). Similarly, ROA, market cap, and inflation rate do not show significant relationships with CAR.

Importantly, residual diagnostic tests, as shown in 5.14, support the general validity of the OLS assumptions. The Jarque-Bera ($p = 0.437$) and Omnibus ($p = 0.365$) tests indicate that there is no significant violation of the normality assumption. Skewness (0.068) and kurtosis (3.551) suggest a reasonably symmetric and mildly heavy-tailed residual distribution, while the Durbin-Watson statistic of 1.654 indicates only modest positive autocorrelation.

However, a Breusch-Pagan test for heteroskedasticity reveals a statistically significant result (LM statistic = 16.34, $p = 0.012$), suggesting a violation of the constant variance assumption. As a result, robust standard errors are applied in this and all other regressions to ensure valid inference despite heteroskedasticity.

Full Sample Robustness	Dependent Variable: CAR (-20,20)				
Model	ESG Rating (P)	R²	Durbin-Watson	Jarque Bera (Prob)	Omnibus (Prob)
Main Model	0.578	0,096	1,654	0,437	0,365
Winsorized CAR	0,359	0,100	1,603	0,245	0,071
Trimmed CAR	0,113	0,118	1,734	0,204	0,057
ESG × Leverage	0,293	0,101	1,631	0,465	0,381

Figure 5.15. Full Sample Robustness

In the full sample analysis, it was not found that ESG risk ratings had a statistically significant association with CAR. This result was maintained consistently across all robustness checks, as shown in 5.15. Winsorizing the CAR variable slightly improved model fit, as indicated by better AIC and log-likelihood values, but the ESG coefficient remained statistically insignificant. Removing extreme CAR values (top and bottom 5%) modestly improved the explanatory power of the model ($R^2 = 0.118$), and some control variables such as Market Cap and STDEV became significant. However, ESG risk continued to show no significant effect on CAR, suggesting that ESG-related market responses can be masked when aggregating across a diverse set of firms with varying levels of sustainability and risk. Furthermore, introducing an interaction term between ESG risk and financial leverage did not produce any significant improvement in model performance, nor did it reveal any conditional relationship. These results reinforce the interpretation that ESG risk ratings, when analyzed in a broad and heterogeneous sample, do not have a consistent or material impact on abnormal stock returns.

5.2.2 LERC vs. HERC

To assess whether the market response to ESG risk differs between firms, the sample is divided into two groups based on ESG risk ratings. This stratification enables a more precise examination of whether ESG information is valued differently depending on the firm's baseline risk profile, an effect that can be obscured when analyzing all firms together.

Among LERC, as shown in 5.16, the regression is estimated using an event window of [-10, +10] and yields an R^2 of 0.112, indicating low explanatory power. None of the included variables reach conventional levels of statistical significance. The coefficient of ESG rating is negative (-1.181) but not statistically significant (p = 0.238), suggesting that investors do not react systematically to ESG information for firms already viewed as environmentally or socially responsible. This could imply that such information is either expected or already priced in.

The residual diagnostic tests, also reported in 5.16, indicate that there are no serious violations of the OLS assumptions. The Jarque-Bera test (p = 0.182) and the Omnibus test (p = 0.131) suggest that there is no significant deviation from normality. Skewness (0.342) and kurtosis (3.946) remain within acceptable ranges, and the Durbin-Watson statistic of 2.083 indicates that there are no major autocorrelation issues.

```
=== Breusch-Pagan Test Results ===
Lagrange Multiplier Statistic : 13.8215
p-value                       : 0.0317
f-value                       : 2.6439
f p-value                     : 0.0256
                            OLS Regression Results
==============================================================================
Dep. Variable:          CAR (-10,+10)   R-squared:                       0.112
Model:                            OLS   Adj. R-squared:                  0.012
Method:                 Least Squares   F-statistic:                     1.358
Date:                Sun, 25 May 2025   Prob (F-statistic):              0.249
Time:                        13:18:26   Log-Likelihood:                 98.769
No. Observations:                  60   AIC:                            -183.5
Df Residuals:                      53   BIC:                            -168.9
Df Model:                           6
Covariance Type:                  HC3
==================================================================================
                     coef    std err          z      P>|z|      [0.025      0.975]
----------------------------------------------------------------------------------
const              0.0697      0.058      1.193      0.233      -0.045       0.184
ESG Rating        -0.0028      0.002     -1.181      0.238      -0.007       0.002
ROA                0.0186      0.092      0.202      0.840      -0.162       0.199
log_MarketCap     -0.0044      0.004     -1.091      0.275      -0.012       0.003
D/E Ratio         -0.0134      0.010     -1.365      0.172      -0.033       0.006
STDEV              0.5146      2.088      0.247      0.805      -3.577       4.606
Inflation Rate     0.0612      1.372      0.045      0.964      -2.627       2.750
==============================================================================
Omnibus:                        5.174   Durbin-Watson:                   2.059
Prob(Omnibus):                  0.075   Jarque-Bera (JB):                4.813
Skew:                           0.401   Prob(JB):                       0.0901
Kurtosis:                       4.133   Cond. No.                     3.59e+03
==============================================================================
```

Figure 5.16. LERC Regression

However, the Breusch–Pagan test reveals a p-value of 0.0317, indicating the presence of heteroskedasticity at the significance level 5%. To address this issue and ensure valid inference, robust standard errors are applied in the regression. Despite this, the residual diagnostics overall support the statistical reliability of the model, although its explanatory power remains limited.

The robustness results of LERC further reinforced the lack of a meaningful ESG effect. Across all model variations, including winsorized CAR, trimmed samples, and interaction models, the ESG Rating remained statistically insignificant. The market appears to treat changes in ESG in this subgroup as relatively uninformative, possibly because firms with already strong ESG profiles are not expected to experience material surprises related to ESG. Even when controlling for financial leverage through interaction terms, the results did not change, suggesting that the market does not perceive ESG shifts as significant risk indicators in already sustainable firms. These results confirm that the observed lack of market reaction is not an artifact of sample-specific variability but reflects a consistent

LERC Robustness	Dependent Variable: CAR (-10,10)				
Model	ESG Rating (P)	R^2	Durbin-Watson	Jarque Bera (Prob)	Omnibus (Prob)
Main Model	0.177	0,112	2,059	0,0901	0,075
Winsorized CAR	0.236	0,117	2,079	0,581	0,525
Trimmed CAR	0.308	0,156	2,208	0,851	0,938
ESG × Leverage	0.380	0,126	2,074	0,276	0,194

Figure 5.17. LERC Robustness

pattern. Overall, the findings are notably stable across all robustness checks, supporting the interpretation that ESG signals carry limited informational value in firms where ESG performance is already strong and not a source of investor concern.

The regression results for HERC, as shown in 5.18, paint a markedly different picture. The model achieves a substantially higher R^2 of 0.296, demonstrating considerably stronger explanatory power than in the LERC subgroup. The ESG rating is statistically significant ($p = 0.039$) with a positive coefficient, indicating that HERC experienced higher cumulative abnormal returns (CAR). This result stands in contrast to expectations that investors would penalize firms for poor ESG performance and may instead reflect optimism surrounding their transition potential or general bullish market dynamics during the announcement period. The D/E ratio remains a robust and significant predictor of negative market reactions ($p < 0.001$), while STDEV is again positively and significantly associated with CAR ($p = 0.005$), confirming the importance of leverage and volatility in influencing investor responses. The Inflation Rate approaches significance ($p = 0.059$), suggesting that macroeconomic conditions may also have played a role in shaping stock performance in this group.

The model diagnostics presented in 5.18 reinforce the reliability of these results. The residuals do not exhibit significant deviation from normality, as evidenced by the Jarque-Bera test ($p = 0.971$) and the Omnibus test ($p = 0.822$). Skewness (0.036) and kurtosis (3.131) fall within acceptable limits, and although the Durbin-Watson statistic of 1.381 is slightly below the ideal threshold of 2, it does not indicate serious autocorrelation issues. Furthermore, the Breusch–Pagan test for heteroscedasticity yields a p-value of 0.129, suggesting no statistically significant evidence of non-constant variance in the residuals.

```
=== Breusch-Pagan Test Results ===
Lagrange Multiplier Statistic : 9.9053
p-value                       : 0.1287
f-value                       : 1.7412
f p-value                     : 0.1284
                            OLS Regression Results
==============================================================================
Dep. Variable:          CAR (-20,+20)   R-squared:                       0.296
Model:                            OLS   Adj. R-squared:                  0.220
Method:                 Least Squares   F-statistic:                     3.915
Date:                Sun, 25 May 2025   Prob (F-statistic):            0.00246
Time:                        14:00:26   Log-Likelihood:                 89.702
No. Observations:                  63   AIC:                            -165.4
Df Residuals:                      56   BIC:                            -150.4
Df Model:                           6
Covariance Type:            nonrobust
======================================================================================
                         coef    std err          t      P>|t|      [0.025      0.975]
--------------------------------------------------------------------------------------
const                 -0.0742      0.050     -1.481      0.144     -0.174       0.026
ESG Rating             0.0028      0.001      2.116      0.039      0.000       0.006
ROA                   -0.1715      0.115     -1.491      0.142     -0.402       0.059
Market Cap (M EUR) -9.968e-06   3.59e-05     -0.278      0.782   -8.19e-05    6.2e-05
D/E Ratio             -0.0196      0.005     -3.819      0.000     -0.030      -0.009
STDEV                  4.8012      1.638      2.932      0.005      1.521       8.082
Inflation Rate        -3.0799      1.600     -1.925      0.059     -6.285       0.126
==============================================================================
Omnibus:                        0.392   Durbin-Watson:                   1.381
Prob(Omnibus):                  0.822   Jarque-Bera (JB):                0.059
Skew:                           0.036   Prob(JB):                        0.971
Kurtosis:                       3.131   Cond. No.                     6.94e+04
==============================================================================
```

Figure 5.18. HERC Regression

HERC Robustness	Dependent Variable: CAR (-20,20)				
Model	ESG Rating (P)	R^2	Durbin-Watson	Jarque Bera (Prob)	Omnibus (Prob)
Main Model	0.039	0,296	1,381	0,971	0,822
Winsorized CAR	0.023	0,284	1,423	0,390	0,150
Trimmed CAR	0.012	0,207	1,391	0,569	0,491
ESG × Leverage	0.026	0,356	1,367	0,558	0,445

Figure 5.19. HERC Robustness

In contrast, as shown in 5.19, HERC presented a distinct and robust pattern. In this subgroup, the ESG rating consistently emerged as a statistically significant predictor of CAR in all model specifications. The direction of the relationship was unexpected: firms with worse ESG ratings tended to experience more positive abnormal returns around the event date. This counterintuitive result may suggest that the market viewed these firms as having upside potential under the Green Deal framework or that expectations for improvement were already priced in. These results were maintained after winorizing and trimming the CAR variable, indicating that the findings are not driven by a few extreme values. Furthermore, the inclusion of an interaction term between the ESG rating and the D / E ratio increased the explanatory power of the model ($R^2 = 0.356$). Although the interaction term (ESG $\times$ Leverage) does not reach statistical significance ($p = 0.199$), the negative coefficient indicates a possible modulating effect - suggesting that ESG-related concerns may be perceived more negatively by the market when coupled with higher financial leverage. However, due to the lack of statistical significance, this interpretation remains tentative and should be approached with caution.

Together, robustness across multiple specifications and statistical techniques supports the view that ESG signals are most meaningful when they intersect with other dimensions of firm-level risk, even if those interactions are not always statistically robust.

5.3 Subgroup: Countries

5.3.1 Denmark

The Danish regression analysis, as shown in 5.20, yields a notably strong model fit, with an R-squared of 0.667 and an adjusted R-squared of 0.557. This indicates that more than 55% of the variation in CAR during the event window [-30, + 30] is explained by the included variables, suggesting a significant degree of explanatory power in the model. Among independent variables, the ESG rating emerges as a statistically significant predictor of CAR, with a coefficient of 0.0084 and a p-value of 0.012. This positive and significant relationship suggests that Danish companies with higher ESG risk rating tend to exhibit more favorable abnormal returns surrounding the event. The implication is that, in the Danish context, ESG performance may be perceived by the market as a value-relevant signal, possibly reflecting investor confidence in firm long-term risk management and reputational strength.

The D/E ratio is also highly significant (p = 0.005), with a positive coefficient. This contrasts with findings in some other countries and may reflect investor expectations about leveraged firms benefiting more from specific market conditions or being more actively scrutinized and thus pressured to improve ESG compliance. Volatility, measured by STDEV, is statistically significant (p = 0.044), suggesting that more volatile firms experienced higher cumulative abnormal returns. Although the effect size is large (coefficient = 6.8622), it can also reflect market overreaction or sensitivity to ESG news in riskier stocks. In particular, the inflation rate also enters the model with a significant negative coefficient (-39.29, p = 0.009), indicating that macroeconomic uncertainty is

```
=== Breusch-Pagan Test Results ===
Lagrange Multiplier Statistic : 5.0241
p-value                       : 0.4129
f-value                       : 0.9434
f p-value                     : 0.4815
                            OLS Regression Results
==============================================================================
Dep. Variable:          CAR (-30,+30)   R-squared:                       0.667
Model:                            OLS   Adj. R-squared:                  0.557
Method:                 Least Squares   F-statistic:                     6.020
Date:                Sun, 25 May 2025   Prob (F-statistic):            0.00300
Time:                        12:52:23   Log-Likelihood:                 33.461
No. Observations:                  21   AIC:                            -54.92
Df Residuals:                      15   BIC:                            -48.66
Df Model:                           5
Covariance Type:            nonrobust
======================================================================================
                          coef    std err          t      P>|t|      [0.025      0.975]
--------------------------------------------------------------------------------------
ESG Rating              0.0084      0.003      2.872      0.012       0.002       0.015
ROA                     0.0296      0.154      0.192      0.850      -0.298       0.357
Market Cap (M EUR) -8.989e-05   9.06e-05     -0.992      0.337      -0.000       0.000
D/E Ratio               0.0638      0.019      3.315      0.005       0.023       0.105
STDEV                   6.8622      3.126      2.195      0.044       0.199      13.526
Inflation Rate        -39.2868     13.013     -3.019      0.009     -67.024     -11.550
==============================================================================
Omnibus:                        0.160   Durbin-Watson:                   2.595
Prob(Omnibus):                  0.923   Jarque-Bera (JB):                0.376
Skew:                           0.013   Prob(JB):                        0.829
Kurtosis:                       2.345   Cond. No.                     2.28e+05
==============================================================================
```

Figure 5.20. Danish Sample Regression

associated with reduced CAR during the event window. This may point to a broader sensitivity of the Danish market to macro-level economic conditions, especially when ESG factors are simultaneously in focus. The diagnostics of the Danish sample, as presented in 5.20, affirm its robustness and reliability. Both the Omnibus (p = 0.923) and Jarque-Bera (p = 0.829) tests show no indication of residual non-normality, supporting the assumption of normally distributed errors. Furthermore, the Durbin-Watson statistic of 2.595 suggests the absence of autocorrelation among the residuals. To assess heteroskedasticity, as shown in 5.20, a Breusch-Pagan test was carried out. The results (LM statistic = 5.02, p = 0.413) indicate no statistically significant heteroskedasticity, suggesting that the variance of the residuals is approximately constant between observations. Together, these diagnostic indicators validate the statistical integrity of the regression and reinforce confidence in the robustness of the model findings.

The robustness tests conducted for the Danish sample, as shown in 5.21, offer strong confirmation of the initial findings of the main regression. Across alternative model specifications, including winsorization, trimming, and interaction effects, the relationship between ESG Rating and CAR remains directionally consistent and generally statistically significant. In the winsorized CAR model, extreme CAR values are capped at the fifth and 95th percentiles to reduce the influence of outliers. Despite this adjustment, the ESG coefficient remains positive and significant (p = 0.023), with only a modest drop in R^2 to 0.554. The diagnostic statistics remain acceptable, with Durbin-Watson (2.572) and Jarque-Bera (p = 0.779) values indicating stable residual behavior. This supports the idea that the main ESG effect is not driven by extreme observations. The trimmed CAR model, which removes rather than caps outliers, yields very similar results: ESG remains significant (p = 0.025), and R^2 even slightly improves to 0.564. However, the Durbin-Watson statistic dips somewhat to 2.182, which may suggest minor autocorrelation, though still within acceptable bounds. Importantly, the overall pattern of ESG significance and the model's explanatory capacity remain intact. When an interaction term between ESG and D/E ratio is introduced to test for conditional effects, the coefficient of ESG becomes marginally insignificant (p = 0.062), although the model's R^2 increases to 0.689. This suggests that the interaction slightly weakens the direct ESG effect, but enhances the explanatory power of the model. The diagnostics remain strong, with no indication of misspecification or violation of assumptions.

Danish Robustness	Dependent Variable: CAR (-30,30)				
Model	ESG Rating (P)	R^2	Durbin-Watson	Jarque Bera (Prob)	Omnibus (Prob)
Main Model	0,007	0,667	2,595	0,829	0,936
Winsorized CAR	0,023	0,554	2,572	0,779	0,614
Trimmed CAR	0,025	0,564	2,182	0,729	0,715
ESG × Leverage	0,062	0,689	2,505	0,899	0,979

Figure 5.21. Danish Sample Robustness

5.3.2 Sweden

The main regression results for the Swedish sample shown in 5.22, suggest that the ESG rating does not have a statistically significant impact on the CAR in the event window [-20, +20]. The coefficient of ESG Rating is negative (-0.0023), but the corresponding p-value (0.119) is well above the conventional significance thresholds, indicating that the market did not react systematically to the risk of ESG for Swedish firms in this context. None of the control variables, ROA, Market Cap, or D/E ratio, are statistically significant either, though STDEV just crosses the 5% threshold with a p-value of 0.045. This suggests that volatility was a factor in explaining the variation of the CAR, potentially reflecting market sensitivity to perceived firm-level risk during the event. The coefficient for STDEV (6.12) is positive, indicating that more volatile firms may have earned higher abnormal returns during the event window, perhaps due to risk taking or overreaction behavior. The model's explanatory power is modest, with an R^2 of 0.189 and an adjusted R^2 of 0.085, suggesting a limited ability to explain cross-sectional differences in CARs between firms. Still, this is a better fit than random noise, and the F-statistic p-value of 0.132 suggests that the overall model is not statistically significant at the 5% level. The diagnostic statistics presented in 5.22 support the reliability of the regression model. The residuals appear to be normally distributed, as indicated by the high p-values from the Omnibus (0.836) and Jarque-Bera (0.829) tests, both of which fail to reject the null hypothesis of normality. Furthermore, the Durbin-Watson statistic of 1.674 is close to the benchmark value of 2, suggesting that there are no serious issues with autocorrelation in the residuals. Furthermore, the Breusch-Pagan test for heteroskedasticity (LM statistic = 5.42, p = 0.367) does not indicate a statistically significant violation of the heteroskedasticity assumption. These diagnostics confirm the technical adequacy of the model, although the substantive effects, particularly

```
=== Breusch-Pagan Test Results ===
Lagrange Multiplier Statistic : 5.4223
p-value                       : 0.3665
f-value                       : 1.0686
f p-value                     : 0.3925
                            OLS Regression Results
==============================================================================
Dep. Variable:         CAR (-20,+20)   R-squared:                       0.189
Model:                           OLS   Adj. R-squared:                  0.085
Method:                Least Squares   F-statistic:                     1.816
Date:               Sun, 25 May 2025   Prob (F-statistic):              0.132
Time:                       13:21:54   Log-Likelihood:                 63.323
No. Observations:                 45   AIC:                            -114.6
Df Residuals:                     39   BIC:                            -103.8
Df Model:                          5
Covariance Type:           nonrobust
======================================================================================
                         coef    std err          t      P>|t|      [0.025      0.975]
--------------------------------------------------------------------------------------
ESG Rating            -0.0023      0.001     -1.593      0.119      -0.005       0.001
ROA                    0.0103      0.158      0.065      0.948      -0.310       0.330
Market Cap (M EUR)  1.469e-05   4.82e-05      0.305      0.762   -8.27e-05       0.000
D/E Ratio              0.0200      0.028      0.705      0.485      -0.037       0.077
STDEV                  6.1165      2.949      2.074      0.045       0.151      12.082
Inflation Rate        -3.9616      3.923     -1.010      0.319     -11.896       3.973
==============================================================================
Omnibus:                        0.359   Durbin-Watson:                   1.674
Prob(Omnibus):                  0.836   Jarque-Bera (JB):                0.375
Skew:                           0.195   Prob(JB):                        0.829
Kurtosis:                       2.780   Cond. No.                     1.27e+05
==============================================================================
```

Figure 5.22. Swedish Sample Regression

those related to ESG, remain limited.

Swedish Robustness	Dependent Variable: CAR (-20,20)				
Model	ESG Rating (P)	R^2	Durbin-Watson	Jarque Bera (Prob)	Omnibus (Prob)
Main Model	0,273	0,189	1,674	0,829	0,836
Winsorized CAR	0,328	0,156	1,711	0,739	0,766
Trimmed CAR	0,764	0,121	2,086	0,555	0,538
ESG × Leverage	0.021	0,289	1,639	0,948	0,954

Figure 5.23. Swedish Sample Robustness

The robustness analysis for the Swedish sample, shown in 5.23, provides an important context to interpret the weak ESG effect observed in the main regression. Across several alternative model specifications, the ESG rating remains statistically insignificant until interaction effects are introduced. In both the winsorized and the trimmed models, the ESG Rating does not reach significance ($p = 0.328$ and $p = 0.764$, respectively), reinforcing the idea that any potential ESG effect is not driven by outliers or extreme CAR values. These alternative models also exhibit slightly lower explanatory power ($R^2 = 0.156$ and 0.121), suggesting that the whole sample - although it contains more noise - retains a marginally better ability to explain abnormal returns. However, the introduction of an interaction term between ESG Rating and financial leverage (D/E Ratio) reveals a notably different result. In this model, the term ESG becomes statistically significant ($p = 0.021$), and the explanatory power improves markedly ($R^2 = 0.289$). This suggests that ESG risk, by itself, may not be priced in a uniform way across companies but becomes material when paired with elevated financial risk. In other words, the market appears to respond more strongly.

strongly to ESG signals when they reinforce other underlying vulnerabilities. The model diagnostics (Jarque-Bera = 0.948, Omnibus = 0.954) also improve in the interaction model, indicating a better distributional fit. Although the Durbin-Watson statistic remains close to 2 throughout all models, signaling that there are no major autocorrelation issues, the combined evidence from this robustness check highlights the importance of considering conditional ESG effects. However, STDEV, the proxy for firm-specific volatility, is significant at the level 10% ($p = 0.0689$) and the average R^2 between iterations is 0.2883. This suggests that although the effects of ESG remain inconclusive in isolation, the overall model retains a moderate degree of explanatory power, reinforcing the notion that ESG signals gain importance when considered in tandem with other risk dimensions.

5.3.3 Norway

The Norwegian regression model, as shown in 5.24, investigates the relationship between ESG ratings and CAR in the event window [-20, + 20]. The model yields an R-squared of 0.246, indicating that about 25% of the variation in CAR can be explained by the included explanatory variables. However, the adjusted R^2 is considerably lower at 0.101,

```
=== Breusch-Pagan Test Results ===
Lagrange Multiplier Statistic : 3.4872
p-value                       : 0.6253
f-value                       : 0.6360
f p-value                     : 0.6741
                            OLS Regression Results
==============================================================================
Dep. Variable:         CAR (-20,+20)   R-squared:                       0.246
Model:                           OLS   Adj. R-squared:                  0.101
Method:                Least Squares   F-statistic:                     1.699
Date:               Sun, 25 May 2025   Prob (F-statistic):              0.170
Time:                       12:54:12   Log-Likelihood:                 42.735
No. Observations:                 32   AIC:                            -73.47
Df Residuals:                     26   BIC:                            -64.68
Df Model:                          5
Covariance Type:           nonrobust
========================================================================================
                          coef    std err          t      P>|t|      [0.025      0.975]
----------------------------------------------------------------------------------------
ESG Rating              0.0012      0.001      0.994      0.330      -0.001       0.004
ROA                     0.2088      0.242      0.862      0.396      -0.289       0.707
Market Cap (M EUR) -3.952e-05   5.08e-05     -0.778      0.443      -0.000    6.48e-05
D/E Ratio              -0.0160      0.006     -2.620      0.014      -0.029      -0.003
STDEV                   2.8629      2.496      1.147      0.262      -2.267       7.993
Inflation Rate         -2.0740      2.499     -0.830      0.414      -7.211       3.063
==============================================================================
Omnibus:                      11.438   Durbin-Watson:                   1.825
Prob(Omnibus):                 0.003   Jarque-Bera (JB):               11.426
Skew:                         -1.059   Prob(JB):                      0.00330
Kurtosis:                      5.022   Cond. No.                     1.02e+05
==============================================================================
```

Figure 5.24. Norwegian Sample Regression

suggesting the presence of explanatory variables that may not contribute significantly to the predictive accuracy of the model. The coefficient in the ESG rating is positive (0.0012) but statistically insignificant (p = 0.330), implying that within the Norwegian market, the performance of ESG does not appear to systematically influence investor reactions during the event window. This lack of significance is consistent with the idea that, in the Norwegian context, ESG factors may already be priced in or are not perceived as sufficiently informative. Among the control variables, financial leverage (D/E Ratio) is the only statistically significant predictor (p = 0.014). The negative coefficient (-0.016) indicates that more highly leveraged firms tend to experience more negative abnormal returns around the event date. This aligns with established financial theory, suggesting that markets penalize firms with weaker financial structures in periods of greater uncertainty.

From a diagnostic point of view, as shown in 5.24, there are notable concerns about the assumptions of the regression model. The Jarque-Bera (p = 0.003) and Omnibus (p = 0.000) tests reject the null hypothesis of normally distributed residuals, indicating a significant departure from normality. This is further supported by the skewness value of -1.059 and a kurtosis of 5.022, suggesting a left-skewed and leptokurtic distribution. Furthermore, the Breusch-Pagan test for heteroskedasticity (LM statistic = 3.49, p = 0.625) does not reveal a statistically significant violation of the homoskedasticity assumption. However, the Durbin-Watson statistic of 1.825 falls near the ideal value of 2, implying that there are no substantial issues with autocorrelation. These results suggest that, while heteroskedasticity is not a concern, the residuals' non-normality may necessitate robust inference methods.

The robustness analysis for the Norwegian sample, as shown in 5.25, reinforces the

Norwegian Robustness	Dependent Variable: CAR (-20,20)				
Model	ESG Rating (P)	R²	Durbin-Watson	Jarque Bera (Prob)	Omnibus (Prob)
Main Model	0,465	0,246	1,825	0,0033	0,003
Winsorized CAR	0,505	0,284	1,781	0,303	0,162
Trimmed CAR	0.589	0,163	1,768	0,712	0,725
ESG × Leverage	0.422	0,271	1,716	0,0002	0,001

Figure 5.25. Norwegian Sample Robustness

conclusion of the main model that ESG risk does not significantly influence the CAR. Across all alternative specifications, including winsorized CAR, trimmed samples, and an interaction term between ESG and leverage, the p-values for the ESG coefficient remain well above conventional significance levels (ranging from 0.422 to 0.589). This consistency suggests that ESG performance does not carry meaningful information for abnormal returns in the Norwegian context during the event window. Interestingly, while R^2 improves slightly when the CAR variable is winsorized (from 0.246 to 0.284) and decreases under trimming (to 0.163), none of these transformations makes the ESG coefficient statistically significant. Adding the ESG × Leverage interaction raises the explanatory power to 0.271, but again fails to produce a significant ESG-related effect.

However, diagnostic metrics improve across robustness checks. Both the Jarque-Bera and Omnibus tests indicate a better residual normality in the winzorized and trimmed models (for example, the p-value of Jarque-Bera increases from 0.0033 to 0.712 in the trimmed model), suggesting that outliers were affecting the residual distribution of the original model. This reinforces the importance of robustness tests in ensuring reliable inference, even when the main effect of interest (ESG) remains statistically null. These results indicate moderate explanatory power overall, but again emphasize that ESG risk does not appear to be a key driver of market response in Norway during the event window studied.

5.3.4 Finland

The Finnish regression model, as shown in 5.26, examines the relationship between the ESG rating and the CAR in the event window [-5, + 5] and reveals no significant impact of the ESG performance on market reactions. The ESG coefficient is negative (–0.0003) but far from significant ($p = 0.861$), suggesting that in the Finnish context, the ESG scores do not systematically explain the short-term return deviations around the event date. None of the control variables reach statistical significance either. While D/E Ratio and STDEV exhibit moderate t-values (–1.510 and 1.520 respectively), their p-values remain well above 0.10. This indicates a lack of robust explanatory power from traditional firm-level financial metrics in this specific window. The model's R-squared is 0.255, implying that just over a quarter of the variation in CARs is explained by the included variables. However, the adjusted R^2 is considerably lower (0.059), indicating a weak fit to the model once the number of predictors is taken into account. From a diagnostic point of view, as shown in

```
=== Breusch-Pagan Test Results ===
Lagrange Multiplier Statistic : 4.8822
p-value                       : 0.4304
f-value                       : 0.9222
f p-value                     : 0.4881
                            OLS Regression Results
==============================================================================
Dep. Variable:            CAR (-5,+5)   R-squared:                       0.255
Model:                            OLS   Adj. R-squared:                  0.059
Method:                 Least Squares   F-statistic:                     1.303
Date:                Sun, 25 May 2025   Prob (F-statistic):              0.304
Time:                        13:24:00   Log-Likelihood:                 49.050
No. Observations:                  25   AIC:                            -86.10
Df Residuals:                      19   BIC:                            -78.79
Df Model:                           5
Covariance Type:            nonrobust
======================================================================================
                         coef    std err          t      P>|t|      [0.025      0.975]
--------------------------------------------------------------------------------------
ESG Rating            -0.0003      0.001     -0.177      0.861      -0.003       0.003
ROA                   -0.1778      0.168     -1.057      0.304      -0.530       0.174
Market Cap (M EUR)  3.156e-07   2.58e-05      0.012      0.990   -5.37e-05    5.43e-05
D/E Ratio             -0.0248      0.016     -1.510      0.148      -0.059       0.010
STDEV                  2.3374      1.538      1.520      0.145      -0.881       5.556
Inflation Rate        -0.0606      4.127     -0.015      0.988      -8.699       8.577
==============================================================================
Omnibus:                        5.263   Durbin-Watson:                   2.816
Prob(Omnibus):                  0.072   Jarque-Bera (JB):                3.355
Skew:                           0.812   Prob(JB):                        0.187
Kurtosis:                       3.766   Cond. No.                     2.03e+05
==============================================================================
```

Figure 5.26. Finnish Sample Regression

5.26, the residuals of the model exhibit moderate skewness (0.812) and kurtosis (3.766), suggesting a slight departure from normality. However, the Jarque-Bera (p = 0.187) and Omnibus (p = 0.072) test statistics do not provide strong evidence against the assumption of normality, indicating that any deviation is not substantial. The Breusch-Pagan test further confirms the adequacy of the variance structure of the model, with no significant heteroskedasticity detected (LM statistic = 4.88, p = 0.430). These results imply that the residual distribution is approximately normal and homoskedastic, supporting valid inference. Furthermore, the Durbin-Watson statistic (2.816) suggests that there is no significant autocorrelation present in the residuals, which reinforces the reliability of the regression estimates.

The robustness analysis for the Finnish sample, as shown in 5.27, reaffirms the conclusions drawn from the main regression model. The ESG rating does not have a statistically significant effect on cumulative abnormal returns (CAR) within the short window (-5, +5). Across all specifications, including winsorized CAR, trimmed samples, and interaction

Finnish Robustness	Dependent Variable: CAR (-5,5)				
Model	ESG Rating (P)	R^2	Durbin-Watson	Jarque Bera (Prob)	Omnibus (Prob)
Main Model	0,870	0,255	2,816	0,187	0,072
Winsorized CAR	0,826	0,255	2,826	0,394	0,183
Trimmed CAR	0,451	0,158	2,115	0,632	0,518
ESG × Leverage	0,972	0,255	2,819	0,184	0,071

Figure 5.27. Finnish Sample Robustness

models, the ESG coefficient remains insignificant, with p-values ranging from 0.451 to 0.972. These consistent results suggest that ESG-related signals carry little to no short-term market relevance in Finland during the event window studied. The model fit remains moderate in most specifications, with R^2 values consistently around 0.255, except in the trimmed model, where it drops to 0.158, indicating some reduction in explanatory power when extreme values are removed. Importantly, diagnostic tests improve slightly on robustness checks. The Jarque-Bera and Omnibus test statistics show higher p-values post-winsorization (0.394 and 0.183), suggesting a better approximation to normal residual distribution and reducing concerns over specification errors. Taken together, these results suggest that ESG considerations may not be incorporated into market reactions for Finnish firms in the short term.

5.3.5 Summary

Taken together, the cross-country analysis reveals that the market reaction to ESG risk is heterogeneous in the Nordic region. Denmark stands out as the only case where ESG Rating consistently emerges as a statistically significant driver of abnormal returns. The ESG coefficient is positive and significant in the main model ($p = 0.012$) and remains robust in all winsorized and trimmed specifications. This indicates that, in the Danish market, firms with higher ESG risk experienced higher abnormal returns. Although counterintuitive, this may suggest that investors perceived these firms as having greater transition potential or benefiting from supportive policy expectations, thus interpreting ESG risk not as a liability, but as an opportunity. In contrast, in Sweden, the ESG effect is mostly muted in standard and robust regressions. The ESG coefficient is insignificant in the main, winsorized and trimmed models, but becomes significant only when interacting with leverage ($p = 0.021$), suggesting that the risk of ESG becomes relevant only to investors when combined with financial vulnerability.

For Norway, the findings are consistently null in all specifications. The ESG rating remains statistically insignificant throughout and even the interaction with leverage does not produce a meaningful effect. Although model diagnostics improve in robustness tests, especially after removing outliers, the overall evidence indicates that ESG factors were not priced by the Norwegian market in this event window. Finland similarly shows no significant ESG effect in any model. Across the main regression and robustness checks, the ESG coefficient is consistently insignificant and the fit of the model remains moderate at best. This suggests that Finnish investors, like their Norwegian counterparts, did not systematically react to ESG-related information during the observed event period.

In summary, these findings underscore the context-dependent nature of the relevance of ESG. In Denmark, ESG appears to be a credible signal of firm value; in Sweden, its materiality depends on the presence of financial risk; while in Norway and Finland, ESG performance appears largely irrelevant for short-term market reactions.

6 Discussion

The first hypothesis posited that the announcement of the EU Green Deal had a positive impact on the stock performance of Nordic companies with low ESG risk ratings. The results of the analysis of the events provide significant support for this hypothesis. Specifically, as shown in 5.13, the CAARs for LERC are statistically significant in three of the four window events: [-5, +5], [-10, +10], and [-30, +30], with p values of 0.0001, 0.0034 and 0.0453, respectively. This suggests that firms with stronger ESG profiles experienced positive and statistically reliable stock price reactions surrounding the Green Deal announcement, both in the immediate aftermath and over a longer 60-day horizon.

These findings imply that the market may have rewarded firms already aligned with sustainability principles, likely anticipating future regulatory or investment advantages under the Green Deal framework. This interpretation is further strengthened by the consistently positive AARs on key dates within the window, many of which were also statistically significant. In sum, the evidence supports Hypothesis 1: the EU Green Deal announcement was positively received by the market for Nordic firms with low ESG risk, reinforcing the relevance of ESG alignment in anticipating policy-driven valuation effects.

The second hypothesis posits that the announcement of the EU Green Deal had a negative impact on the stock performance of Nordic firms with high ESG risk. However, the empirical results do not support this hypothesis. Although three of four window events show statistically significant results, if we look at 5.13, all corresponding t-statistics are positive, indicating that the abnormal results were positive, not negative. This is in direct contradiction to the hypothesized negative impact.

In particular, the short windows [-5, +5] and [-10, +10] HERC have p-values of 0.0039 and 0.0105, respectively, confirming the significance. However, since these are accompanied by positive t-statistics (2.999 and 2.6391), they suggest that HERC actually benefited, at least in the short term, from the announcement. One possible explanation is that these firms were already priced with risk related to ESG and may have been perceived by investors as having upside potential through transition strategies or green pivots. In the longer windows [–20, +20] and [–30, +30], the results lose statistical significance, with p-values of 0.0290 and 0.1332, respectively, although the direction remains positive. This may indicate diminishing effects over time, but not in the hypothesized negative direction. In sum, the second hypothesis is rejected. Rather than experiencing negative abnormal returns, HERC shows positive and partially significant abnormal returns, which may indicate that some investors viewed the Green Deal as offering potential opportunities, rather than immediate penalties. Another contributing factor could be the strong overall performance of the Nordic equity markets during the announcement period. The OMX Nordic 40 index rose approximately 7.8% during the fourth quarter of 2019 (OECD, 2020), reflecting a larger wave of investor optimism across the region. In such a bullish environment, even HERC have benefited from market-wide momentum, which can temporarily obscure or override firm-specific concerns. This contextual background may help explain why HERC experienced positive and statistically significant abnormal returns, contrary to the hypothesis. This finding diverges from established expectations and suggests a reassessment of how ESG risk interacts with broad policy shifts under bullish market conditions. It underscores how favorable macroeconomic or market conditions can modulate investor reactions to news related to ESG, particularly during shorter event windows.

To assess the third hypothesis, we turn to the evidence from the OLS regression analyzes applied to both the full sample and the ESG-segmented sub-samples. In the full sample regression, as shown in 5.14, the ESG Rating variable is statistically insignificant ($p = 0.578$). This indicates that there is no generalizable effect of ESG risk on CAR across the broader set of Nordic firms. The low R^2 of 0.096 further reflects the limited explanatory power of the model, suggesting that only a small fraction of the variation in cumulative abnormal returns can be accounted for by the included variables. This modest explanatory capacity may stem from the exclusion of relevant firm- or market-specific factors that drive investor behavior. For example, incorporating fixed effects for industry sectors could help control for sector-specific shocks or sensitivities to sustainability regulation, as ESG implications can vary significantly across sectors (e.g., utilities vs. technology). Furthermore, macroeconomic indicators or financial market instruments related to sustainability, such as green bond yields or issuance volume, could serve as proxies for broader investor sentiment toward environmental finance and regulatory change. These variables might capture more directly how market participants priced in the implications of the Green Deal between different firms.

However, when the data are disaggregated by ESG risk, a more differentiated picture emerges. Among HERC, the ESG rating becomes statistically significant ($p = 0.039$) as shown in 5.18, with a positive coefficient, suggesting that a higher ESG risk was associated with a higher CAR. This counterintuitive result may be attributable to several factors. For example, HERC could have been concentrated in sectors expected to benefit from Green Deal initiatives, such as infrastructure or energy transition programs. Alternatively, investors may already have priced in ESG-related risks, leading the announcement to function as a signal for stability or future opportunity. Furthermore, market-wide optimism during Q4 2019 could have amplified short-term gains across sectors, potentially masking ESG-related penalization effects. These explanations suggest that the relationship between ESG risk and market reaction is more nuanced and may depend on contextual and sector-specific variables. In contrast, as shown in 5.16, LERC does not show a statistically significant relationship between the ESG rating and CAR ($p = 0.177$), and the overall model remains weak ($R^2 = 0.112$). This implies that firms already perceived as environmentally or socially responsible did not experience additional market rewards from the Green Deal news, possibly because their ESG alignment was already priced in.

To further investigate whether these relationships were maintained in different market contexts, country-specific regressions were performed. Looking at 5.20, Denmark emerged as the only market in which the ESG rating had a positive and statistically significant effect ($p = 0.012$) on CAR. This suggests that, in Denmark, companies with higher ESG risk may have experienced more favorable market reactions following the EU Green Deal announcement. This is notably consistent with the broader findings related to HERC, as mentioned before. In contrast, Sweden, Norway, and Finland did not show a significant ESG coefficient. In Sweden, the ESG rating was negative and insignificant ($p = 0.119$), while in Norway and Finland, the ESG was also not significant ($p = 0.330$ and 0.861). This cross-country variation implies that the effect of ESG risk on CAR is not uniform across Nordic countries, possibly due to differences in regulatory readiness, investor composition, or national ESG disclosure norms.

Together, these results do not support Hypothesis 3. The significant relationship between ESG and CAR among HERC firms and in Danish companies suggests that ESG ratings can indeed influence market reactions in specific contexts. The lack of significance for the entire sample and the LERC, as well as the fact that HERC has a positive coefficient, indicates that the effect is neither widespread nor robust in the region. Therefore, the findings suggest a nuanced conclusion: The ESG risk rating showed a statistically significant effect on CAR, but the direction of this effect was context-dependent. Among HERC, the relationship was positive, indicating that firms with high ESG risk ratings experienced higher abnormal returns. This suggests that ESG risk may influence market reactions, but not in the expected penalizing direction particularly in contexts like HERC firms and national markets such as Denmark.

The empirical findings of this thesis can partially add to the nuance of the growing literature on ESG and financial performance, particularly in the context of regulatory announcements such as the EU Green Deal. One of the most consistent findings in the existing literature is that ESG performance tends to be positively or at least neutrally associated with firm value and stock returns. Friede, Busch, and Bassen's (2015) meta-analysis, for example, reports that in more than 90% of the studies surveyed, the relationship between ESG and corporate financial performance is positive or insignificant. In this sense, the significantly positive CARs observed for LERC in this study, especially around the event windows [-5, + 5], [-10, +10] and [-30, + 30], support the notion that the market rewards firms with strong ESG credentials. This aligns with earlier studies such as those by Klassen and McLaughlin (1996) and Flammer (2013), which found that firms perceived as environmentally or socially responsible are more resilient in periods of uncertainty or policy changes.

In contrast, the findings related to HERC complicate that narrative. Hypothesis 2 assumed a negative market response for firms with elevated ESG risk. However, in several event windows, the regression results show that these firms did not experience significantly negative abnormal returns. In fact, in three out of four windows, the CARs were significantly positive and the ESG rating remained a significant predictor in the OLS regressions. This contrasts with research by Krüger, Aouadi and Marsat, who found that markets tend to penalize firms for poor ESG performance or controversies (Aouadi et al., 2018; Kruger, 2015). One plausible explanation for this discrepancy is that the Green Deal announcement was interpreted as a rising tide for the entire sustainable finance space. As such, even firms lagging on ESG may have benefited from increased investor interest in the region or sector, anticipating future improvements or compliance pressure. This suggests that even firms with weaker ESG profiles may have been perceived by the market as having potential to adapt or improve, aligning with investor expectations of future resilience or transition, an interpretation that fits within established financial theories. Moreover, this aligns with Serafeim and Yoon, who argue that ESG rating consensus and divergence influence market reactions. In this case, even firms with higher ESG risks may not have been penalized due to broader investor optimism and the expectation that regulatory momentum would drive eventual alignment with sustainability goals, potentially muting the typical negative reaction seen in prior studies (Serafeim & Yoon, 2022).

These findings remain broadly consistent with theoretical frameworks such as Signaling Theory (Spence, 1973) and the Efficient Market Hypothesis (Fama, 1965), which assert that markets incorporate new information, including ESG disclosures, based on expectations about future firm value. Although ESG risk is typically interpreted as a negative signal that indicates potential vulnerability, the Green Deal may have altered this perception. Investors could have viewed the policy announcement as a catalyst for sector-wide transformation, thereby reassessing high-ESG-risk companies as future beneficiaries of regulatory support or transition incentives. In this sense, the market response does not contradict the EMH; rather, it reflects a rational revaluation of future prospects in light of new public information. This highlights how investor expectations and policy signals shape ESG risk perceptions and pricing.

Furthermore, while the interaction between ESG risk and financial leverage was not significant across the entire sample or in all countries, the results of the Swedish robustness analysis indicate that the ESG × Leverage interaction becomes statistically significant when explicitly modeled. In that specification, the model's explanatory power improved ($R^2 = 0.289$), and ESG itself emerged as a significant predictor. This suggests that ESG concerns can exert a greater influence on market outcomes when they intersect with increased financial vulnerability. These results support the view advanced by Serafeim and Yoon (2022), who argue that the market relevance of ESG factors increases when they align with other dimensions of firm-level risk (Serafeim & Yoon, 2022).

In addition, the country-level results introduce an important layer of institutional and regional nuance. Denmark demonstrated a strong and consistent relationship between

ESG ratings and CAR in all specifications, although still positive, implying a more advanced integration of ESG into financial decision making. This aligns with research by Capelle-Blancard, Hsouna and Petit (2022), who emphasize the role of governance quality, transparency of ESG ratings, and investor awareness in shaping market responses to sustainability metrics. However, countries like Finland did not show statistically significant effects of ESG, which could reflect more limited integration of ESG, lower investor sensitivity, or differences in national regulatory or financial contexts. These geographic discrepancies suggest that the pricing of ESG risk is not only firm-specific but also context-dependent, shaped by broader market infrastructure and cultural attitudes toward sustainability. However, before drawing final conclusions, it is important to consider the inherent limitations of the ESG measurement itself.

Although this study explores the potential relationship between ESG ratings and abnormal returns around the announcement of the EU Green Deal, it is crucial to acknowledge the limitations and complexity surrounding ESG scores. ESG ratings are often marketed as comprehensive assessments of a firm's sustainability profile, but often only offer a partial view, shaped by what companies choose to disclose and how rating agencies interpret those data. One of the most well-documented issues is the lack of correlation between ESG ratings across different providers. Berg, Koelbel and Rigobon (2022) shows that the average correlation between the major ESG rating agencies is only around 0.61, significantly lower than the credit rating correlations, which typically exceed 0.90. This divergence arises from differences in scope, measurement, and weighting, meaning agencies can not only look at different indicators, but also assign varying levels of importance to them. This inconsistency undermines the reliability of ESG scores as standardized signals to the market.

As a result, firms can be simultaneously rated leaders in ESG and laggards, depending on the data provider. For example, Dimson, Marsh, and Staunton (2022) highlight that investors relying on ESG data may be making decisions based on nonaligned or even conflicting information. This inconsistency weakens the explanatory power of ESG ratings in quantitative analyses such as event studies and can lead to spurious or muted statistical effects. This raises important questions about their use in regulatory frameworks or academic studies without clear disclosure of which rating provider is being used and why. Building on this concern, Christensen, Serafeim, and Sikochi (2022) provide empirical evidence that much of the disagreement between ESG ratings stems not from divergent interpretations of the same information, but from differences in what aspects of ESG are being measured and how. Their study reinforces the view that ESG ratings are not standardized metrics but reflect the methodological choices and priorities of individual rating agencies. This further complicates their use in empirical settings like event studies, where consistency and comparability of input variables are crucial to draw reliable conclusions.

Given these issues, future research might consider disaggregating ESG into individual pillars (Environmental, Social, Governance) or focusing on raw sustainability indicators, rather than composite scores. In addition, increased efforts to standardize ESG disclosures, such as those pursued by the EU through CSRD and ISSB globally, may improve the quality of ESG data in the coming years.

7 Limitations

Although this thesis provides partial information on the stock market effects of ESG risk in the context of the EU Green Deal, several limitations must be acknowledged. First, the geographic and sample constraints of the study can limit the generalizability of its findings. By focusing solely on Nordic companies, the analysis benefits from regional consistency in market structures and awareness of ESG, but may not fully reflect investor behavior in other European or global contexts. In addition, subgroup regressions by ESG risk level or country are based on modest sample sizes, which can reduce statistical power and increase susceptibility to outliers or noise.

Second, a key limitation relates to the use of ESG ratings. Ratings were sourced from a third party provider and dated 2024, which means they reflect companies' ESG risk assessments of companies five years after the event window under analysis (December 2019). This temporal mismatch introduces a risk of measurement error, as the ESG profiles may have changed significantly during that period. In addition, ESG ratings vary between providers in terms of methodology and scope, and their subjective nature can lead to inconsistency and limited comparability. Future research could benefit from triangulating multiple sources of ESG rating to increase data depth, mitigate provider bias, and improve the robustness of ESG-related findings. Third, the event study methodology assumes that markets react efficiently and primarily to the announcement in question in this case, the EU Green Deal. However, in real-world financial environments, multiple macroeconomic, political, and firm-specific events occur simultaneously. This makes it difficult to fully isolate the market response to the Green Deal from other confounding influences during the event window.

Fourth, although several robustness and sensitivity tests were performed, including winsorization, trimming, and interaction terms, the models still rely on short-term CARs calculated from daily returns. These may not capture more gradual investor responses or long-term ESG valuation effects. Regression models also explain a modest share of variance in CARs, indicating that other unobserved factors may play a role. Lastly, regional variation in ESG integration, investor sophistication, and governance standards across Nordic countries may contribute to the differences in results observed between Denmark, Sweden, Norway, and Finland. These institutional factors are acknowledged, but not directly incorporated into the models, representing a potential area for future research.

Conclusion 8

This thesis aimed to explore how the announcement of the EU Green Deal influenced stock market performance among Nordic firms, with a specific focus on whether the effect differed between firms with low and high ESG risk ratings. Using event study methodology and OLS regression analysis, the study aimed to test whether ESG risk moderated investor reactions to this major sustainability policy initiative.

The empirical findings provide a nuanced answer to the research question. ESG risk ratings were not uniformly priced in the market reaction in the full sample of Nordic companies. Although LERC experienced consistent and statistically significant positive abnormal returns in both the short and extended windows following the announcement, HERC also exhibited positive abnormal returns, particularly in the shorter event windows, contradicting initial expectations. These results suggest that investors rewarded firms with stronger ESG profiles, but did not systematically penalize those with weaker ones.

Regression results further clarify this dynamic. ESG risk was not a significant predictor of cumulative abnormal returns in the entire sample, indicating a limited general pricing of ESG risk. However, ESG became statistically significant in certain subgroups, such as among HERC and in the Danish market, where a higher ESG risk was associated with a higher CAR, an outcome counterintuitive to the standard theory of ESG evaluation. These exceptions imply that under certain market conditions or national contexts, firms with elevated ESG risk may be perceived as having transition potential or standing to benefit from policy momentum. It is also important to consider that ESG ratings have inherent limitations, which can affect their precision as indicators of firm sustainability or market expectations. These constraints could contribute to the mixed findings observed in different segments of the data. Thus, the pricing of ESG risk ratings was conditional: Although ESG-aligned firms were rewarded slightly more consistently, higher-risk firms could still benefit under favorable circumstances, possibly due to optimistic narratives around regulatory adaptation or sectoral transformation.

In answering the research question, this thesis contributes to the growing ESG finance literature by showing that ESG risk ratings are indeed priced in, but not in a universal or linear fashion. These findings reinforce the importance of a granular, context-aware approach when analyzing how ESG risk is incorporated into stock market behavior, particularly during periods of major regulatory shifts such as the EU Green Deal.

References

Andersson, M., Bolton, P. and Samama, F. (2016). *Hedging Climate Risk. Financial Analysts Journal*, 72(3), 13–32, 2016. doi: 10.2469/faj.v72.n3.4.
https://www.tandfonline.com/doi/full/10.2469/faj.v72.n3.4

Aouadi, A. and Marsat, S. (2018). *Do ESG Controversies Matter for Firm Value? Evidence from International Data. Journal of Business Ethics*, 151(4), 1027–1047, 2018. doi: 10.1007/s10551-016-3213-8.
https://link.springer.com/article/10.1007/s10551-016-3213-8

Berg, F., Koelbel, J.F. and Rigobon, R. (2022). *Aggregate Confusion: The Divergence of ESG Ratings. Review of Finance*, 26(6), 1315–1344, 2022. doi: 10.1093/rof/rfac033.
https://academic.oup.com/rof/article/26/6/1315/6590670

Bolton, P. and Kacperczyk, M. (2021). *Do Investors Care About Carbon Risk? Journal of Financial Economics*, 142(2), 517–549, 2021. doi: 10.1016/j.jfineco.2021.05.008.
https://www.sciencedirect.com/science/article/pii/S0304405X21002090

Bua, G. and Dunz, N. (2022). *The Green Swan and the Politics of Monetary Policy. Ecological Economics*, 193, 107311, 2022. doi: 10.1016/j.ecolecon.2021.107311.
https://www.sciencedirect.com/science/article/pii/S0921800921003175

Capelle-Blancard, G., Hsouna, A. and Petit, A. (2022). *Do Markets Value Sustainability? A Meta-Analysis. Journal of Corporate Finance*, 74, 102230, 2022. doi: 10.1016/j.jcorpfin.2021.10223
https://www.sciencedirect.com/science/article/pii/S0929119921002200

Carney, M. (2019). *A role for financial and monetary policies in climate change mitigation.* International Monetary Fund (IMF) Blog, September 4, 2019.
https://www.imf.org/en/Blogs/Articles/2019/09/04/a-role-for-financial-and-monetary-polic

Christensen, D.M., Serafeim, G. and Sikochi, A. (2022). *Why is Corporate Virtue in the Eye of the Beholder? The Case of ESG Ratings. The Accounting Review*, 97(1), 147–175, 2022. doi: 10.2308/TAR-2019-0506.
https://doi.org/10.2308/TAR-2019-0506

Dimson, E., Marsh, P. and Staunton, M. (2020). *Divergent ESG Ratings.* In: *Credit Suisse Global Investment Returns Yearbook 2020*, Credit Suisse Research Institute, pp. 54–63.

https://www.credit-suisse.com/about-us/en/reports-research/global-investment-returns-yearbook

European Commission, (2005). *EU Emissions Trading System (EU ETS)*. European Commission. Accessed: 2025-05-05.
https://climate.ec.europa.eu/eu-action/eu-emissions-trading-system-eu-ets_en

European Commission, (2018). *EU Sustainable Finance Action Plan*. European Commission. Accessed: 2025-05-05.
https://finance.ec.europa.eu/sustainable-finance/overview-sustainable-finance/strategy-sustai

European Commission, (2019). *The European Green Deal*. European Commission. Accessed: 2025-05-05.
https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en

European Commission (2020). *The EU Green Deal: Promoting a green, notable circular economy*. SWITCH to Green, January 2020.
https://www.switchtogreen.eu/the-eu-green-deal-promoting-a-green-notable-circular-economy

ESMA. (2020). *ESMA Annual Statistical Report 2020*. European Securities and Markets Authority.
https://www.esma.europa.eu/

Environmental Performance Index. (2024). *2024 Environmental Performance Index (EPI)*. Yale Center for Environmental Law & Policy. Accessed: 2025-05-05.
https://epi.yale.edu/measure/2024/EPI

Fama, E.F. (1965) *The Behavior of Stock-Market Prices. The Journal of Business*, **38**(1), 34–105, 1965.
https://www.jstor.org/stable/2350752

Fatemi, A., Fooladi, Z. and Tehranian, H. (2018) *Corporate Social Responsibility and Firm Value: The Moderating Role of Disclosure. Journal of International Business Studies*, **49**(6), 963–989, 2018. doi: 10.1057/s41267-017-0089-4.
https://link.springer.com/article/10.1057/s41267-017-0089-4

Flammer, C. (2013) *Corporate Social Responsibility and Shareholder Reaction: The Environmental Awareness of Investors. Academy of Management Journal*, **56**(3), 758–781, 2013. doi: 10.5465/amj.2011.0744.
https://journals.aom.org/doi/abs/10.5465/amj.2011.0744

Friede, G., Busch, T. and Bassen, A. (2015). *ESG and Financial Performance: Aggregated Evidence from More Than 2000 Empirical Studies. Journal of Sustainable Finance & Investment*, **5**(4), 210–233, 2015. doi: 10.1080/20430795.2015.1118917.
https://www.tandfonline.com/doi/full/10.1080/20430795.2015.1118917

Joyce, N. (2021). *Private Sector's Role in Financing the EU Green Deal.* William Fry, September 30, 2021.
https://www.williamfry.com/knowledge/private-sectors-role-in-financing-the-eu-green-deal

Klassen, R.D. and McLaughlin, C.P. (1996). *The Impact of Environmental Management on Firm Performance. Management Science*, 42(8), 1199–1214, 1996. doi: 10.1287/mnsc.42.8.1199.
https://pubsonline.informs.org/doi/abs/10.1287/mnsc.42.8.1199

Krüger, P. (2015). *Does Corporate Social Responsibility Affect Firm Risk? Evidence from a Natural Experiment. Journal of Business Ethics*, 132(2), 253–276, 2015. doi: 10.1007/s10551-016-3213-8.
https://link.springer.com/article/10.1007/S10551-016-3213-8

MacKinlay, A.C. (1997) *Event Studies in Economics and Finance. Journal of Economic Literature*, 35(1), 13–39, 1997.
https://www.jstor.org/stable/2729691

Mahajan, R., Lim, W.M., Sareen, M., Kumar, S. and Panwar, R. (2023). *Stakeholder theory. Journal of Business Research*, 166, 114104, November 2023. doi: 10.1016/j.jbusres.2023.114104.
https://doi.org/10.1016/j.jbusres.2023.114104

Nasdaq (2020). *OMX Nordic 40 Index Performance.* Nasdaq OMX Nordic.
https://www.nasdaqomxnordic.com/indexes

OECD. (2020). *OECD Economic Outlook, Volume 2019 Issue 2.* Organisation for Economic Co-operation and Development.
https://doi.org/10.1787/9b89401b-en

Ramelli, S., Zaldokas, A., Kölbel, J. and Wagner, A.F. (2021). *Corporate Immunity to the COVID-19 Pandemic. Review of Finance*, 25(4), 619–655, 2021. doi: 10.1093/rof/rfab002.
https://academic.oup.com/rof/article/25/4/619/6133794

Serafeim, G. and Yoon, A. (2022). *Which Corporate ESG News Does the Market React To? Financial Analysts Journal*, 78(1), 87–103, 2022. doi: 10.1080/0015198X.2021.2001126.
https://www.tandfonline.com/doi/full/10.1080/0015198X.2021.2001126

Sparkes, R. and Cowton, C.J. (2004). *The Maturing of Socially Responsible Investment: A Review of the Developing Link with Corporate Social Responsibility. Journal of Business Ethics*, 52(1), 45–57, 2004. doi: 10.1023/B:BUSI.0000033106.43260.99.
https://link.springer.com/article/10.1023/B:BUSI.0000033106.43260.99

Spence, M. (1973). *Job Market Signaling. The Quarterly Journal of Economics*, 87(3), 355–374, 1973. doi: 10.2307/1882010.
https://www.jstor.org/stable/4470248

Standard & Poor's. (2020). *S&P 500 Total Returns 2019.* S&P Dow Jones Indices.
https://www.spglobal.com/spdji/en/indices/equity/sp-500/

United Nations (2006). *Principles for Responsible Investment.* UNEP Finance Initiative and UN Global Compact. Accessed: 2025-05-05.
https://www.unpri.org/about-us/what-are-the-principles-for-responsible-investment

United Nations (2015). *Paris Agreement.* Adopted at COP21 in Paris on 12 December 2015. Entered into force on 4 November 2016. Accessed: 2025-05-05.
https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement

Appendix A

Appendix A: Data Files

The following dataset is included as an attached supplementary file:

- `NordicPrices.xlsx` – Contains daily stock prices for all companies used in this study.
- `Variables.xlsx` – Contains a detailed overview of all variables used in this study.

Appendix B: Data Visualization

```
=== Winsorized CAR ((-20,+20)) ===
                            OLS Regression Results
==============================================================================
Dep. Variable:        CAR_winsorized   R-squared:                       0.100
Model:                           OLS   Adj. R-squared:                  0.054
Method:                Least Squares   F-statistic:                     2.155
Date:               Sun, 25 May 2025   Prob (F-statistic):             0.0524
Time:                       20:01:05   Log-Likelihood:                 174.55
No. Observations:                123   AIC:                            -335.1
Df Residuals:                    116   BIC:                            -315.4
Df Model:                          6
Covariance Type:           nonrobust
======================================================================================
                         coef    std err          t      P>|t|      [0.025      0.975]
--------------------------------------------------------------------------------------
const                 -0.0297      0.028     -1.077      0.284      -0.084       0.025
ESG Rating             0.0005      0.001      0.650      0.517      -0.001       0.002
ROA                   -0.0334      0.077     -0.435      0.665      -0.186       0.119
Market Cap (M EUR)  1.399e-06   2.12e-05      0.066      0.947   -4.06e-05    4.34e-05
D/E Ratio             -0.0120      0.004     -2.787      0.006      -0.021      -0.003
STDEV                  2.9274      1.092      2.681      0.008       0.765       5.090
Inflation Rate        -0.2904      1.061     -0.274      0.785      -2.392       1.811
==============================================================================
Omnibus:                        5.283   Durbin-Watson:                   1.603
Prob(Omnibus):                  0.071   Jarque-Bera (JB):                2.815
Skew:                           0.103   Prob(JB):                        0.245
Kurtosis:                       2.288   Cond. No.                     6.39e+04
==============================================================================
```

Figure A.1. Full Sample Winsorized Car

```
=== Trimmed CAR ((-20,+20)) ===
                            OLS Regression Results
==============================================================================
Dep. Variable:          CAR (-20,+20)   R-squared:                       0.118
Model:                            OLS   Adj. R-squared:                  0.066
Method:                 Least Squares   F-statistic:                     2.264
Date:                Sun, 25 May 2025   Prob (F-statistic):             0.0431
Time:                        20:01:05   Log-Likelihood:                 173.87
No. Observations:                 109   AIC:                            -333.7
Df Residuals:                     102   BIC:                            -314.9
Df Model:                           6
Covariance Type:            nonrobust
=====================================================================================
                        coef    std err          t      P>|t|      [0.025      0.975]
-------------------------------------------------------------------------------------
const                -0.0340      0.028     -1.233      0.221      -0.089       0.021
ESG Rating            0.0009      0.001      1.403      0.164      -0.000       0.002
ROA                  -0.0073      0.071     -0.103      0.918      -0.148       0.133
Market Cap (M EUR) -4.193e-05   1.95e-05     -2.151      0.034   -8.06e-05   -3.26e-06
D/E Ratio            -0.0124      0.009     -1.381      0.170      -0.030       0.005
STDEV                 2.5316      1.038      2.438      0.016       0.472       4.591
Inflation Rate        0.0823      0.961      0.086      0.932      -1.823       1.987
==============================================================================
Omnibus:                        5.737   Durbin-Watson:                   1.734
Prob(Omnibus):                  0.057   Jarque-Bera (JB):                3.177
Skew:                           0.193   Prob(JB):                        0.204
Kurtosis:                       2.258   Cond. No.                     6.16e+04
==============================================================================
```

Figure A.2. Full Sample Trimmed Car

```
=== With Interaction Term ((-20,+20)) ===
                            OLS Regression Results
==============================================================================
Dep. Variable:          CAR (-20,+20)   R-squared:                       0.101
Model:                            OLS   Adj. R-squared:                  0.046
Method:                 Least Squares   F-statistic:                     1.848
Date:                Sun, 25 May 2025   Prob (F-statistic):             0.0847
Time:                        20:01:05   Log-Likelihood:                 158.44
No. Observations:                 123   AIC:                            -300.9
Df Residuals:                     115   BIC:                            -278.4
Df Model:                           7
Covariance Type:            nonrobust
=====================================================================================
                        coef    std err          t      P>|t|      [0.025      0.975]
-------------------------------------------------------------------------------------
const                -0.0424      0.043     -0.992      0.323      -0.127       0.042
ESG Rating            0.0010      0.001      0.942      0.348      -0.001       0.003
ROA                  -0.0163      0.093     -0.175      0.861      -0.200       0.168
Market Cap (M EUR)  1.447e-05   2.43e-05      0.596      0.552   -3.36e-05    6.25e-05
D/E Ratio             0.0051      0.024      0.211      0.834      -0.043       0.054
STDEV                 2.9901      1.287      2.323      0.022       0.441       5.539
Inflation Rate       -0.6821      1.217     -0.561      0.576      -3.092       1.728
ESG_x_Leverage       -0.0006      0.001     -0.806      0.422      -0.002       0.001
==============================================================================
Omnibus:                        1.932   Durbin-Watson:                   1.631
Prob(Omnibus):                  0.381   Jarque-Bera (JB):                1.533
Skew:                          -0.081   Prob(JB):                        0.465
Kurtosis:                       3.522   Cond. No.                     6.55e+04
==============================================================================
```

Figure A.3. Full Sample With Interaction Term

```
=== Winsorized CAR ((-10,+10)) ===
                            OLS Regression Results
==============================================================================
Dep. Variable:         CAR_winsorized   R-squared:                       0.117
Model:                            OLS   Adj. R-squared:                  0.017
Method:                 Least Squares   F-statistic:                     1.391
Date:                Sun, 25 May 2025   Prob (F-statistic):              0.236
Time:                        20:08:52   Log-Likelihood:                 108.60
No. Observations:                  60   AIC:                            -203.2
Df Residuals:                      53   BIC:                            -188.5
Df Model:                           6
Covariance Type:                  HC3
==================================================================================
                     coef    std err          z      P>|z|      [0.025      0.975]
----------------------------------------------------------------------------------
const              0.0494      0.042      1.187      0.235      -0.032       0.131
ESG Rating        -0.0021      0.002     -1.069      0.285      -0.006       0.002
ROA                0.0155      0.072      0.213      0.831      -0.127       0.157
log_MarketCap     -0.0044      0.003     -1.322      0.186      -0.011       0.002
D/E Ratio         -0.0107      0.008     -1.258      0.208      -0.027       0.006
STDEV              0.9485      1.354      0.701      0.484      -1.705       3.602
Inflation Rate     0.1285      1.159      0.111      0.912      -2.143       2.400
==============================================================================
Omnibus:                        1.289   Durbin-Watson:                   2.079
Prob(Omnibus):                  0.525   Jarque-Bera (JB):                1.087
Skew:                           0.326   Prob(JB):                        0.581
Kurtosis:                       2.906   Cond. No.                     3.59e+03
==============================================================================
```

Figure A.4. LERC Winsorized Car

```
=== Trimmed CAR ((-10,+10)) ===
                            OLS Regression Results
==============================================================================
Dep. Variable:          CAR (-10,+10)   R-squared:                       0.156
Model:                            OLS   Adj. R-squared:                  0.048
Method:                 Least Squares   F-statistic:                     1.660
Date:                Sun, 25 May 2025   Prob (F-statistic):              0.152
Time:                        20:08:52   Log-Likelihood:                 107.71
No. Observations:                  54   AIC:                            -201.4
Df Residuals:                      47   BIC:                            -187.5
Df Model:                           6
Covariance Type:                  HC3
==================================================================================
                     coef    std err          z      P>|z|      [0.025      0.975]
----------------------------------------------------------------------------------
const              0.0340      0.037      0.920      0.358      -0.038       0.106
ESG Rating        -0.0015      0.002     -0.902      0.367      -0.005       0.002
ROA               -0.0129      0.061     -0.211      0.833      -0.133       0.107
log_MarketCap     -0.0061      0.003     -2.258      0.024      -0.011      -0.001
D/E Ratio         -0.0042      0.011     -0.364      0.716      -0.027       0.018
STDEV              1.4204      1.087      1.307      0.191      -0.710       3.551
Inflation Rate     0.1500      1.054      0.142      0.887      -1.916       2.216
==============================================================================
Omnibus:                        0.127   Durbin-Watson:                   2.208
Prob(Omnibus):                  0.938   Jarque-Bera (JB):                0.322
Skew:                           0.059   Prob(JB):                        0.851
Kurtosis:                       2.640   Cond. No.                     3.88e+03
==============================================================================
```

Figure A.5. LERC Trimmed Car

```
=== With Interaction Term ((-10,+10)) ===
                            OLS Regression Results
==============================================================================
Dep. Variable:         CAR (-10,+10)   R-squared:                       0.126
Model:                           OLS   Adj. R-squared:                  0.008
Method:                Least Squares   F-statistic:                    0.8198
Date:               Sun, 25 May 2025   Prob (F-statistic):              0.575
Time:                       20:08:52   Log-Likelihood:                 99.218
No. Observations:                 60   AIC:                            -182.4
Df Residuals:                     52   BIC:                            -165.7
Df Model:                          7
Covariance Type:                 HC3
==================================================================================
                     coef    std err          z      P>|z|      [0.025      0.975]
----------------------------------------------------------------------------------
const              0.0977      0.076      1.278      0.201      -0.052       0.247
ESG Rating        -0.0047      0.005     -1.007      0.314      -0.014       0.004
ROA                0.0127      0.100      0.126      0.900      -0.184       0.209
log_MarketCap     -0.0047      0.004     -1.179      0.238      -0.013       0.003
D/E Ratio         -0.0583      0.084     -0.694      0.488      -0.223       0.106
STDEV              0.8974      2.397      0.374      0.708      -3.800       5.595
Inflation Rate    -0.0559      1.408     -0.040      0.968      -2.816       2.705
ESG_x_Leverage     0.0027      0.005      0.505      0.614      -0.008       0.013
==============================================================================
Omnibus:                        3.283   Durbin-Watson:                   2.074
Prob(Omnibus):                  0.194   Jarque-Bera (JB):                2.578
Skew:                           0.267   Prob(JB):                        0.276
Kurtosis:                       3.864   Cond. No.                     5.16e+03
==============================================================================
```

Figure A.6. LERC With Interaction Term

```
=== Winsorized CAR ((-20,+20)) ===
                            OLS Regression Results
==============================================================================
Dep. Variable:        CAR_winsorized   R-squared:                       0.284
Model:                           OLS   Adj. R-squared:                  0.207
Method:                Least Squares   F-statistic:                     3.701
Date:               Sun, 25 May 2025   Prob (F-statistic):            0.00362
Time:                       19:50:34   Log-Likelihood:                 97.253
No. Observations:                 63   AIC:                            -180.5
Df Residuals:                     56   BIC:                            -165.5
Df Model:                          6
Covariance Type:           nonrobust
======================================================================================
                         coef    std err          t      P>|t|      [0.025      0.975]
--------------------------------------------------------------------------------------
const                 -0.0785      0.044     -1.769      0.082      -0.167       0.010
ESG Rating             0.0028      0.001      2.344      0.023       0.000       0.005
ROA                   -0.1487      0.102     -1.457      0.151      -0.353       0.056
Market Cap (M EUR) -1.997e-05   3.19e-05     -0.627      0.533   -8.38e-05    4.38e-05
D/E Ratio             -0.0162      0.005     -3.555      0.001      -0.025      -0.007
STDEV                  4.4703      1.453      3.077      0.003       1.560       7.380
Inflation Rate        -2.5314      1.419     -1.783      0.080      -5.375       0.312
==============================================================================
Omnibus:                        3.799   Durbin-Watson:                   1.423
Prob(Omnibus):                  0.150   Jarque-Bera (JB):                1.885
Skew:                          -0.044   Prob(JB):                        0.390
Kurtosis:                       2.157   Cond. No.                     6.94e+04
==============================================================================
```

Figure A.7. HERC Winsorized Car

```
=== Trimmed CAR ((-20,+20)) ===
                            OLS Regression Results
==============================================================================
Dep. Variable:          CAR (-20,+20)   R-squared:                       0.207
Model:                            OLS   Adj. R-squared:                  0.108
Method:                 Least Squares   F-statistic:                     2.086
Date:                Sun, 25 May 2025   Prob (F-statistic):             0.0723
Time:                        19:50:34   Log-Likelihood:                 91.378
No. Observations:                  55   AIC:                            -168.8
Df Residuals:                      48   BIC:                            -154.7
Df Model:                           6
Covariance Type:            nonrobust
======================================================================================
                         coef    std err          t      P>|t|      [0.025      0.975]
--------------------------------------------------------------------------------------
const                 -0.0617      0.042     -1.458      0.151      -0.147       0.023
ESG Rating             0.0029      0.001      2.602      0.012       0.001       0.005
ROA                   -0.0884      0.097     -0.908      0.368      -0.284       0.107
Market Cap (M EUR) -3.737e-05   2.96e-05     -1.264      0.212   -9.68e-05    2.21e-05
D/E Ratio             -0.0292      0.018     -1.595      0.117      -0.066       0.008
STDEV                  2.9584      1.428      2.071      0.044       0.087       5.830
Inflation Rate        -1.6286      1.424     -1.144      0.258      -4.492       1.234
==============================================================================
Omnibus:                        1.424   Durbin-Watson:                   1.391
Prob(Omnibus):                  0.491   Jarque-Bera (JB):                1.127
Skew:                           0.109   Prob(JB):                        0.569
Kurtosis:                       2.334   Cond. No.                     6.94e+04
==============================================================================
```

Figure A.8. HERC Trimmed Car

```
=== With Interaction Term ((-20,+20)) ===
                            OLS Regression Results
==============================================================================
Dep. Variable:          CAR (-20,+20)   R-squared:                       0.356
Model:                            OLS   Adj. R-squared:                  0.274
Method:                 Least Squares   F-statistic:                     4.350
Date:                Sun, 25 May 2025   Prob (F-statistic):           0.000676
Time:                        19:50:34   Log-Likelihood:                 92.548
No. Observations:                  63   AIC:                            -169.1
Df Residuals:                      55   BIC:                            -151.9
Df Model:                           7
Covariance Type:            nonrobust
======================================================================================
                         coef    std err          t      P>|t|      [0.025      0.975]
--------------------------------------------------------------------------------------
const                 -0.2106      0.077     -2.739      0.008      -0.365      -0.057
ESG Rating             0.0061      0.002      3.162      0.003       0.002       0.010
ROA                   -0.0482      0.123     -0.390      0.698      -0.296       0.199
Market Cap (M EUR) -1.805e-05   3.48e-05     -0.519      0.606   -8.78e-05    5.17e-05
D/E Ratio              0.1130      0.058      1.936      0.058      -0.004       0.230
STDEV                  6.0310      1.669      3.613      0.001       2.686       9.376
Inflation Rate        -3.0282      1.544     -1.962      0.055      -6.122       0.065
ESG_x_Leverage        -0.0038      0.002     -2.280      0.026      -0.007      -0.000
==============================================================================
Omnibus:                        0.445   Durbin-Watson:                   1.367
Prob(Omnibus):                  0.801   Jarque-Bera (JB):                0.558
Skew:                          -0.180   Prob(JB):                        0.757
Kurtosis:                       2.713   Cond. No.                     7.18e+04
==============================================================================
```

Figure A.9. HERC With Interaction Term

```
=== Winsorized CAR ((-30,+30)) ===
                            OLS Regression Results
==============================================================================
Dep. Variable:          CAR_winsorized   R-squared:                      0.554
Model:                            OLS   Adj. R-squared:                  0.405
Method:                 Least Squares   F-statistic:                     3.724
Date:                Sun, 25 May 2025   Prob (F-statistic):             0.0216
Time:                        16:36:14   Log-Likelihood:                 33.236
No. Observations:                  21   AIC:                            -54.47
Df Residuals:                      15   BIC:                            -48.21
Df Model:                           5
Covariance Type:            nonrobust
======================================================================================
                         coef    std err          t      P>|t|      [0.025      0.975]
--------------------------------------------------------------------------------------
ESG Rating             0.0075      0.003      2.535      0.023       0.001       0.014
ROA                   -0.0158      0.155     -0.102      0.920      -0.347       0.315
Market Cap (M EUR)    -0.0001   9.16e-05     -1.375      0.189      -0.000    6.93e-05
D/E Ratio              0.0465      0.019      2.389      0.030       0.005       0.088
STDEV                  6.3573      3.160      2.012      0.063      -0.378      13.093
Inflation Rate       -33.5041     13.154     -2.547      0.022     -61.540      -5.468
==============================================================================
Omnibus:                        0.974   Durbin-Watson:                   2.572
Prob(Omnibus):                  0.614   Jarque-Bera (JB):                0.779
Skew:                          -0.123   Prob(JB):                        0.677
Kurtosis:                       2.089   Cond. No.                     2.28e+05
==============================================================================
```

Figure A.10. Danish Winzorized CAR

```
=== Trimmed CAR ((-30,+30)) ===
                            OLS Regression Results
==============================================================================
Dep. Variable:          CAR (-30,+30)   R-squared:                       0.564
Model:                            OLS   Adj. R-squared:                  0.396
Method:                 Least Squares   F-statistic:                     3.357
Date:                Sun, 25 May 2025   Prob (F-statistic):             0.0364
Time:                        16:36:14   Log-Likelihood:                 31.936
No. Observations:                  19   AIC:                            -51.87
Df Residuals:                      13   BIC:                            -46.20
Df Model:                           5
Covariance Type:            nonrobust
======================================================================================
                        coef    std err          t      P>|t|      [0.025      0.975]
--------------------------------------------------------------------------------------
ESG Rating            0.0070      0.003      2.450      0.029       0.001       0.013
ROA                  -0.0687      0.154     -0.446      0.663      -0.401       0.264
Market Cap (M EUR)   -0.0001   8.98e-05     -1.245      0.235      -0.000    8.22e-05
D/E Ratio             0.0507      0.023      2.206      0.046       0.001       0.100
STDEV                 6.8343      2.956      2.312      0.038       0.448      13.220
Inflation Rate      -32.3971     13.252     -2.445      0.030     -61.026      -3.768
==============================================================================
Omnibus:                        0.671   Durbin-Watson:                   2.182
Prob(Omnibus):                  0.715   Jarque-Bera (JB):                0.632
Skew:                           0.007   Prob(JB):                        0.729
Kurtosis:                       2.107   Cond. No.                     2.10e+05
==============================================================================
```

Figure A.11. Danish Trimmed Car

```
=== With Interaction Term ((-30,+30)) ===
                            OLS Regression Results
==============================================================================
Dep. Variable:          CAR (-30,+30)   R-squared:                       0.689
Model:                            OLS   Adj. R-squared:                  0.556
Method:                 Least Squares   F-statistic:                     5.174
Date:                Sun, 25 May 2025   Prob (F-statistic):            0.00536
Time:                        16:36:14   Log-Likelihood:                 34.173
No. Observations:                  21   AIC:                            -54.35
Df Residuals:                      14   BIC:                            -47.03
Df Model:                           6
Covariance Type:            nonrobust
======================================================================================
                        coef    std err          t      P>|t|      [0.025      0.975]
--------------------------------------------------------------------------------------
ESG Rating            0.0064      0.004      1.781      0.097      -0.001       0.014
ROA                   0.0221      0.154      0.143      0.888      -0.308       0.352
Market Cap (M EUR)   -0.0001   9.25e-05     -1.166      0.263      -0.000    9.05e-05
D/E Ratio            -0.0036      0.071     -0.052      0.960      -0.155       0.148
STDEV                 6.9732      3.130      2.228      0.043       0.260      13.687
Inflation Rate      -33.3785     14.321     -2.331      0.035     -64.094      -2.663
ESG_x_Leverage        0.0032      0.003      0.991      0.339      -0.004       0.010
==============================================================================
Omnibus:                        0.042   Durbin-Watson:                   2.505
Prob(Omnibus):                  0.979   Jarque-Bera (JB):                0.212
Skew:                          -0.087   Prob(JB):                        0.899
Kurtosis:                       2.539   Cond. No.                     2.50e+05
==============================================================================
```

Figure A.12. Danish With Interaction Term

```
=== Winsorized CAR ((-20,+20)) ===
                            OLS Regression Results
==============================================================================
Dep. Variable:         CAR_winsorized   R-squared:                       0.156
Model:                            OLS   Adj. R-squared:                  0.048
Method:                 Least Squares   F-statistic:                     1.439
Date:                Sun, 25 May 2025   Prob (F-statistic):              0.232
Time:                        15:39:28   Log-Likelihood:                 67.768
No. Observations:                  45   AIC:                            -123.5
Df Residuals:                      39   BIC:                            -112.7
Df Model:                           5
Covariance Type:            nonrobust
======================================================================================
                        coef    std err          t      P>|t|      [0.025      0.975]
--------------------------------------------------------------------------------------
ESG Rating           -0.0018      0.001     -1.386      0.174      -0.004       0.001
ROA                   0.0530      0.143      0.370      0.713      -0.237       0.343
Market Cap (M EUR) -9.751e-06   4.36e-05     -0.224      0.824    -9.8e-05    7.85e-05
D/E Ratio             0.0221      0.026      0.861      0.394      -0.030       0.074
STDEV                 5.6188      2.672      2.103      0.042       0.215      11.023
Inflation Rate       -4.2641      3.554     -1.200      0.237     -11.452       2.924
==============================================================================
Omnibus:                        0.532   Durbin-Watson:                   1.711
Prob(Omnibus):                  0.766   Jarque-Bera (JB):                0.605
Skew:                           0.235   Prob(JB):                        0.739
Kurtosis:                       2.681   Cond. No.                     1.27e+05
==============================================================================
```

Figure A.13. Swedish Winsorized Car

```
=== Trimmed CAR ((-20,+20)) ===
                            OLS Regression Results
==============================================================================
Dep. Variable:          CAR (-20,+20)   R-squared:                       0.121
Model:                            OLS   Adj. R-squared:                 -0.012
Method:                 Least Squares   F-statistic:                    0.9081
Date:                Sun, 25 May 2025   Prob (F-statistic):              0.488
Time:                        15:39:28   Log-Likelihood:                 67.090
No. Observations:                  39   AIC:                            -122.2
Df Residuals:                      33   BIC:                            -112.2
Df Model:                           5
Covariance Type:            nonrobust
==========================================================================================
                         coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------------------
ESG Rating            -0.0005      0.001     -0.452      0.655      -0.003       0.002
ROA                    0.1125      0.138      0.814      0.421      -0.169       0.393
Market Cap (M EUR) -5.954e-05   4.07e-05     -1.462      0.153      -0.000    2.33e-05
D/E Ratio              0.0153      0.023      0.658      0.515      -0.032       0.063
STDEV                  4.1584      2.267      1.834      0.076      -0.454       8.771
Inflation Rate        -4.0783      3.031     -1.345      0.188     -10.246       2.089
==============================================================================
Omnibus:                        1.240   Durbin-Watson:                   2.086
Prob(Omnibus):                  0.538   Jarque-Bera (JB):                1.176
Skew:                           0.389   Prob(JB):                        0.555
Kurtosis:                       2.658   Cond. No.                     1.06e+05
==============================================================================
```

Figure A.14. Swedish Trimmmed Car

```
=== With Interaction Term ((-20,+20)) ===
                            OLS Regression Results
==============================================================================
Dep. Variable:          CAR (-20,+20)   R-squared:                       0.289
Model:                            OLS   Adj. R-squared:                  0.176
Method:                 Least Squares   F-statistic:                     2.570
Date:                Sun, 25 May 2025   Prob (F-statistic):             0.0345
Time:                        15:39:28   Log-Likelihood:                 66.276
No. Observations:                  45   AIC:                            -118.6
Df Residuals:                      38   BIC:                            -105.9
Df Model:                           6
Covariance Type:            nonrobust
==========================================================================================
                         coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------------------
ESG Rating            -0.0078      0.003     -2.835      0.007      -0.013      -0.002
ROA                   -0.0512      0.152     -0.336      0.739      -0.360       0.257
Market Cap (M EUR)  2.028e-05   4.58e-05      0.443      0.660   -7.23e-05       0.000
D/E Ratio             -0.1306      0.071     -1.852      0.072      -0.273       0.012
STDEV                  7.2193      2.838      2.544      0.015       1.473      12.965
Inflation Rate         0.9464      4.286      0.221      0.826      -7.730       9.623
ESG_x_Leverage         0.0081      0.004      2.309      0.026       0.001       0.015
==============================================================================
Omnibus:                        0.094   Durbin-Watson:                   1.639
Prob(Omnibus):                  0.954   Jarque-Bera (JB):                0.107
Skew:                           0.085   Prob(JB):                        0.948
Kurtosis:                       2.832   Cond. No.                     1.35e+05
==============================================================================
```

Figure A.15. Swedish With interaction Term

```
=== Winsorized CAR ((-20,+20)) ===
                            OLS Regression Results
==============================================================================
Dep. Variable:          CAR_winsorized   R-squared:                       0.284
Model:                            OLS   Adj. R-squared:                  0.146
Method:                 Least Squares   F-statistic:                     2.060
Date:                Sun, 25 May 2025   Prob (F-statistic):              0.103
Time:                        16:34:07   Log-Likelihood:                 45.657
No. Observations:                  32   AIC:                            -79.31
Df Residuals:                      26   BIC:                            -70.52
Df Model:                           5
Covariance Type:            nonrobust
==========================================================================================
                         coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------------------
ESG Rating             0.0011      0.001      0.970      0.341      -0.001       0.003
ROA                    0.2011      0.221      0.910      0.371      -0.253       0.655
Market Cap (M EUR) -4.217e-05   4.63e-05     -0.910      0.371      -0.000    5.31e-05
D/E Ratio             -0.0165      0.006     -2.964      0.006      -0.028      -0.005
STDEV                  3.1720      2.278      1.392      0.176      -1.510       7.854
Inflation Rate        -2.0761      2.281     -0.910      0.371      -6.765       2.612
==============================================================================
Omnibus:                        3.645   Durbin-Watson:                   1.781
Prob(Omnibus):                  0.162   Jarque-Bera (JB):                2.391
Skew:                          -0.640   Prob(JB):                        0.303
Kurtosis:                       3.392   Cond. No.                     1.02e+05
==============================================================================
```

Figure A.16. Norwegian Winsorized Car

```
=== Trimmed CAR ((-20,+20)) ===
                            OLS Regression Results
==============================================================================
Dep. Variable:          CAR (-20,+20)   R-squared:                       0.163
Model:                            OLS   Adj. R-squared:                 -0.027
Method:                 Least Squares   F-statistic:                    0.8595
Date:                Sun, 25 May 2025   Prob (F-statistic):              0.523
Time:                        16:34:07   Log-Likelihood:                 45.520
No. Observations:                  28   AIC:                            -79.04
Df Residuals:                      22   BIC:                            -71.05
Df Model:                           5
Covariance Type:            nonrobust
======================================================================================
                         coef    std err          t      P>|t|      [0.025      0.975]
--------------------------------------------------------------------------------------
ESG Rating             0.0009      0.001      0.928      0.363      -0.001       0.003
ROA                    0.0269      0.204      0.132      0.896      -0.396       0.450
Market Cap (M EUR) -4.066e-05   3.93e-05     -1.035      0.312      -0.000    4.08e-05
D/E Ratio             -0.0099      0.015     -0.670      0.510      -0.041       0.021
STDEV                  3.1884      2.323      1.373      0.184      -1.629       8.006
Inflation Rate        -1.7729      2.284     -0.776      0.446      -6.509       2.963
==============================================================================
Omnibus:                        0.642   Durbin-Watson:                   1.768
Prob(Omnibus):                  0.725   Jarque-Bera (JB):                0.681
Skew:                          -0.121   Prob(JB):                        0.712
Kurtosis:                       2.275   Cond. No.                     1.14e+05
==============================================================================
```

Figure A.17. Norwegian Trimmed Car

```
=== With Interaction Term ((-20,+20)) ===
                            OLS Regression Results
==============================================================================
Dep. Variable:          CAR (-20,+20)   R-squared:                       0.271
Model:                            OLS   Adj. R-squared:                  0.096
Method:                 Least Squares   F-statistic:                     1.546
Date:                Sun, 25 May 2025   Prob (F-statistic):              0.204
Time:                        16:34:07   Log-Likelihood:                 43.261
No. Observations:                  32   AIC:                            -72.52
Df Residuals:                      25   BIC:                            -62.26
Df Model:                           6
Covariance Type:            nonrobust
======================================================================================
                         coef    std err          t      P>|t|      [0.025      0.975]
--------------------------------------------------------------------------------------
ESG Rating             0.0025      0.002      1.340      0.192      -0.001       0.006
ROA                    0.2806      0.255      1.099      0.282      -0.245       0.806
Market Cap (M EUR)  -3.49e-05   5.12e-05     -0.682      0.502      -0.000    7.05e-05
D/E Ratio              0.0291      0.050      0.585      0.564      -0.073       0.132
STDEV                  3.7763      2.696      1.401      0.174      -1.776       9.328
Inflation Rate        -4.9560      4.029     -1.230      0.230     -13.254       3.342
ESG_x_Leverage        -0.0013      0.001     -0.914      0.370      -0.004       0.002
==============================================================================
Omnibus:                       14.236   Durbin-Watson:                   1.716
Prob(Omnibus):                  0.001   Jarque-Bera (JB):               16.781
Skew:                          -1.191   Prob(JB):                     0.000227
Kurtosis:                       5.629   Cond. No.                     1.41e+05
==============================================================================
```

Figure A.18. Norwegian With Interaction Term

```
=== Winsorized CAR ((-5,+5)) ===
                            OLS Regression Results
==============================================================================
Dep. Variable:         CAR_winsorized   R-squared:                       0.255
Model:                            OLS   Adj. R-squared:                  0.058
Method:                 Least Squares   F-statistic:                     1.298
Date:                Sun, 25 May 2025   Prob (F-statistic):              0.306
Time:                        15:32:58   Log-Likelihood:                 51.602
No. Observations:                  25   AIC:                            -91.20
Df Residuals:                      19   BIC:                            -83.89
Df Model:                           5
Covariance Type:            nonrobust
======================================================================================
                         coef    std err          t      P>|t|      [0.025      0.975]
--------------------------------------------------------------------------------------
ESG Rating            -0.0003      0.001     -0.252      0.804      -0.003       0.002
ROA                   -0.1495      0.152     -0.985      0.337      -0.467       0.168
Market Cap (M EUR)  2.926e-07   2.33e-05      0.013      0.990   -4.85e-05    4.91e-05
D/E Ratio             -0.0236      0.015     -1.594      0.128      -0.055       0.007
STDEV                  2.0990      1.388      1.512      0.147      -0.807       5.005
Inflation Rate         0.1143      3.726      0.031      0.976      -7.685       7.914
==============================================================================
Omnibus:                        3.394   Durbin-Watson:                   2.826
Prob(Omnibus):                  0.183   Jarque-Bera (JB):                1.864
Skew:                           0.607   Prob(JB):                        0.394
Kurtosis:                       3.560   Cond. No.                     2.03e+05
==============================================================================
```

Figure A.19. Finnish Winsorized Car

```
=== Trimmed CAR ((-5,+5)) ===
                            OLS Regression Results
==============================================================================
Dep. Variable:            CAR (-5,+5)   R-squared:                       0.158
Model:                            OLS   Adj. R-squared:                 -0.123
Method:                 Least Squares   F-statistic:                    0.5626
Date:                Sun, 25 May 2025   Prob (F-statistic):              0.727
Time:                        15:32:58   Log-Likelihood:                 48.013
No. Observations:                  21   AIC:                            -84.03
Df Residuals:                      15   BIC:                            -77.76
Df Model:                           5
Covariance Type:            nonrobust
=====================================================================================
                         coef    std err          t      P>|t|      [0.025      0.975]
-------------------------------------------------------------------------------------
ESG Rating            -0.0011      0.001     -0.979      0.343      -0.003       0.001
ROA                    0.1023      0.160      0.641      0.531      -0.238       0.442
Market Cap (M EUR) -1.416e-05   2.07e-05     -0.686      0.503   -5.82e-05    2.99e-05
D/E Ratio             -0.0137      0.013     -1.057      0.307      -0.041       0.014
STDEV                  0.9244      1.471      0.628      0.539      -2.211       4.060
Inflation Rate         1.4374      3.368      0.427      0.676      -5.740       8.615
==============================================================================
Omnibus:                        1.315   Durbin-Watson:                   2.115
Prob(Omnibus):                  0.518   Jarque-Bera (JB):                0.918
Skew:                           0.498   Prob(JB):                        0.632
Kurtosis:                       2.761   Cond. No.                     2.26e+05
==============================================================================
```

Figure A.20. Finnish Trimmed Car

```
=== With Interaction Term ((-5,+5)) ===
                            OLS Regression Results
==============================================================================
Dep. Variable:            CAR (-5,+5)   R-squared:                       0.255
Model:                            OLS   Adj. R-squared:                  0.007
Method:                 Least Squares   F-statistic:                     1.029
Date:                Sun, 25 May 2025   Prob (F-statistic):              0.439
Time:                        15:32:58   Log-Likelihood:                 49.050
No. Observations:                  25   AIC:                            -84.10
Df Residuals:                      18   BIC:                            -75.57
Df Model:                           6
Covariance Type:            nonrobust
=====================================================================================
                         coef    std err          t      P>|t|      [0.025      0.975]
-------------------------------------------------------------------------------------
ESG Rating            -0.0002      0.004     -0.041      0.967      -0.009       0.008
ROA                   -0.1809      0.220     -0.821      0.422      -0.644       0.282
Market Cap (M EUR)  3.597e-07   2.66e-05      0.014      0.989   -5.55e-05    5.62e-05
D/E Ratio             -0.0231      0.077     -0.301      0.767      -0.184       0.138
STDEV                  2.3193      1.768      1.312      0.206      -1.395       6.033
Inflation Rate        -0.1407      5.507     -0.026      0.980     -11.710      11.428
ESG_x_Leverage        -0.0001      0.005     -0.023      0.982      -0.011       0.011
==============================================================================
Omnibus:                        5.297   Durbin-Watson:                   2.819
Prob(Omnibus):                  0.071   Jarque-Bera (JB):                3.383
Skew:                           0.814   Prob(JB):                        0.184
Kurtosis:                       3.774   Cond. No.                     2.57e+05
==============================================================================
```

Figure A.21. Finnish With Interaction Term