Muted Market Reactions: The Impact of ESG Announcements on Stock Returns and Risk in the Energy Sector

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ABSTRACT: This study investigates short-term financial market reactions to specific Environmental, Social, and Governance (ESG) announcements by energy sector companies. The central research question is whether positive and negative ESG events have a significant impact on companies' cumulative abnormal stock returns (CARs) and market sensitivity (beta). The scientific relevance of the topic stems from the fact that most prior research has analysed the long-term effects of aggregate ESG scores, leaving the immediate market processing of discrete public announcements less explored. Its practical importance is driven by the energy industry's sustainability transition and the growing prominence of ESG-focused investing. The research employs an event study methodology on 20 ESG events from ten traditional and renewable energy companies between 2020 and 2025, using OLS regression. The key findings indicate that the selected ESG announcements generally did not elicit statistically significant market reactions in terms of either returns or risk metrics. Initial significant results were not robust to changes in the market benchmark, suggesting nuanced, methodology-sensitive information processing by the market.

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Introduction

In the contemporary landscape of global finance and corporate strategy, the ascendancy of Environmental, Social, and Governance (ESG) criteria has become an undeniable force, reshaping investment paradigms and compelling industries to navigate a complex terrain of stakeholder expectations and sustainability imperatives. Nowhere is this transformation more acute than in the energy sector, an industry at the very epicentre of the global climate transition, characterised by a fundamental dichotomy between traditional, fossil fuel-reliant incumbents and the vanguard of alternative and renewable energy firms. As investors, regulators, and civil society intensify their scrutiny, the capital markets are increasingly expected to function as an arbiter, rewarding laudable ESG initiatives and penalising transgressions. Foundational financial theories, such as the Efficient Market Hypothesis (EMH), posit that all new, value-relevant information — including significant ESG disclosures — should be rapidly and efficiently incorporated into stock prices. Similarly, Signalling Theory suggests that corporate announcements on ESG serve as critical communiqués to resolve information asymmetry and convey a firm's underlying quality and prospects.

However, despite this compelling theoretical backdrop and the burgeoning volume of research linking aggregate ESG scores to long-term financial performance, a significant and critical gap persists in the literature. There remains a lack of granular, empirical evidence on how financial markets react in the immediate short term to specific, discrete ESG event announcements. Do markets uniformly reward a firm for announcing an ambitious net-zero target? Is a greenwashing allegation met with an immediate and statistically identifiable stock price penalty? Furthermore, does the market's reaction differ when the signal emanates from a traditional oil major versus a renewable energy leader? This study addresses this critical void by moving beyond broad ESG ratings to examine the short-term market impact of tangible, publicly announced corporate ESG actions and disclosures in the high-stakes energy sector.

This paper embarks on a rigorous empirical investigation to answer these questions, examining the short-term financial market impact of a curated set of 20 distinct positive and negative ESG events announced by ten leading traditional and renewable energy companies between early 2020 and early 2025. Employing a quantitative event study methodology, the research assesses two primary dimensions of market reaction: the generation of cumulative abnormal returns (CARs) and, in a more novel contribution to the event-specific literature, the change in systematic risk as measured by market beta. This dual focus allows for a more holistic understanding of whether investors not only re-evaluate a firm's value but also reassess its fundamental risk profile in the immediate aftermath of an ESG announcement.

The findings of this research present a nuanced and compelling narrative that challenges simplistic assumptions about market behaviour. The central, striking conclusion of this paper is that the empirical evidence overwhelmingly indicates

that the short-term financial market impact of these specific ESG announcements was generally limited, inconsistent, and statistically insignificant across the board. While the initial analysis identified two statistically significant positive market reactions to major strategic acquisitions with a clear ESG angle—namely, ExxonMobil's launch of its Low Carbon Solutions business and Chevron's acquisition of Renewable Energy Group—these findings proved fragile. A crucial robustness test, which substituted the global MSCI World index with the more sector-specific S&P 500 Energy benchmark, rendered these initially significant results statistically indistinct from market noise. Similarly, the study found no consistent evidence that negative ESG events triggered significant stock price penalties or that either positive or negative events led to a predictable change in market beta; indeed, one robustness test revealed a counterintuitive decrease in systematic risk following a negative event.

Ultimately, this paper contributes to the academic and practitioner discourse by providing robust, data-driven evidence that the relationship between individual ESG announcements and short-term market valuation in the energy sector is far more complex than often assumed. The results suggest that investors may adopt a more circumspect, long-term view, potentially discounting singular announcements in favour of a holistic assessment of a company's integrated ESG strategy and performance. The findings underscore that market reactions are highly event-specific and acutely sensitive to the chosen analytical methodology, cautioning against a monolithic interpretation of ESG news. For corporate leaders, investors, and policymakers, this research offers a vital insight: in the intricate dance between corporate sustainability signalling and market valuation, the immediate response is not thunderous applause or resounding condemnation, but more often a discerning and telling silence.

Theoretical framework and literature review

The investigation into the financial ramifications of ESG activities is situated at the confluence of several foundational theories in finance and management. A comprehensive understanding of potential market reactions to ESG event announcements requires a theoretical lens grounded in stakeholder relations, market efficiency, information signalling, and risk perception. This review synthesises these theoretical pillars and contextualises the present study within the existing body of empirical literature, thereby identifying the specific research gaps this paper aims to address.

Stakeholder Theory: The Conceptual Underpinning of ESG

At its core, the strategic importance of ESG is deeply rooted in *Stakeholder Theory*, which posits that a firm's long-term success is contingent not merely

on maximising shareholder wealth, but on its ability to effectively manage and balance the interests of a diverse array of stakeholders (Freeman, 1984). This perspective extends the corporate purview beyond shareholders to include employees, customers, suppliers, communities, and the natural environment. The theory argues that proactive engagement with these groups is not an act of altruism but a driver of value creation. Actions that benefit a broad spectrum of stakeholders can foster greater loyalty, enhance operational stability, and reduce regulatory and reputational risks, ultimately contributing to superior and more sustainable financial performance (Donaldson & Preston, 1995).

Within this framework, a specific ESG event — whether a positive announcement of a major investment in renewable technology or a negative disclosure of an environmental incident — serves as direct communication of how a company manages its stakeholder relationships. Such events are therefore potent signals that can lead investors to reassess a firm's risk profile and future cash-generating capabilities. Empirical research substantiates this link, demonstrating that effective stakeholder integration can bolster organisational resilience and innovation (Li et al., 2018) and that a firm's sustainability orientation is demonstrably correlated with financial performance (Danso et al., 2020). Consequently, stakeholder theory provides the fundamental rationale for why the market should perceive ESG event announcements as value-relevant information.

Market Processing of ESG Information: EMH and Signalling Theory

While *Stakeholder Theory* explains why ESG information is relevant, the *Efficient Market Hypothesis (EMH)* and *Signalling Theory* explain how financial markets are expected to process this information. The semi-strong form of the EMH, articulated by Fama (1970), contends that all publicly available information is rapidly and fully reflected in a security's price. This hypothesis forms the bedrock of event study methodology, as it implies that any new, material ESG announcement should trigger an immediate adjustment in the firm's stock price as rational investors update their valuations. Prior research has found evidence consistent with this, showing that strong ESG profiles can enhance market value (Alareeni & Hamdan, 2020) and that significant negative events, such as environmental disasters or governance failures, tend to provoke substantial stock price declines.

However, the world of ESG is characterised by information asymmetry, in which corporate insiders possess more knowledge about a firm's true commitments and risks than external investors. This is where *Signalling Theory* (Spence, 1973) provides a crucial explanatory lens. According to this theory, ESG disclosures and event announcements are signals that firms transmit to the market to convey unobservable qualities, such as their proactive risk management, long-term strategic vision, and commitment to sustainability. The efficacy of such a signal, however, hinges on its perceived credibility.

Vague or unsubstantiated announcements risk being dismissed by the market as "greenwashing," potentially damaging a firm's reputation (Hussain et al., 2024), whereas clear, verifiable, and costly commitments are more likely to be deemed credible and thus elicit a market reaction (Cuartas, 2024).

ESG Events and the Reassessment of Systematic Risk (Market Beta)

Beyond immediate price adjustments, ESG information can fundamentally alter investor perceptions of a firm's systematic risk, as measured by its market beta. A firm's beta reflects its sensitivity to broader market movements, and ESG disclosures provide new data points for investors to reassess this risk profile. Positive ESG announcements — such as credible decarbonization strategies or significant investments in green technologies — can signal proactive management of long-term threats, particularly transition risks in the energy sector. Such signals may lead investors to perceive the firm as more resilient and less volatile, potentially resulting in a lower market beta (Plastun et al., 2022). This perception of derisking is a central tenet of the investment case for ESG.

Conversely, negative ESG events, such as environmental accidents, regulatory breaches, or social controversies, can reveal underlying operational vulnerabilities and governance weaknesses. Such news can heighten investor perceptions of the firm's susceptibility to systemic shocks and increase its perceived riskiness, which, in theory, would manifest as a statistically significant increase in its market beta. The literature suggests that poor ESG performance is associated with heightened stock price volatility (Alareeni & Hamdan, 2020), reinforcing the hypothesis that adverse ESG news should lead to an upward revision in a firm's systematic risk.

Empirical Landscape and Identified Research Gaps

The empirical literature on the ESG-finance nexus presents a complex and often mixed picture. A landmark meta-analysis by Friede et al. (2015) found that the vast majority of over 2,000 empirical studies reported a non-negative relationship between ESG and corporate financial performance, suggesting that, at a minimum, responsible investing does not harm financial returns. More recently, studies have found a negative correlation between ESG ratings and systematic risk, particularly in emerging markets (Rattanakom et al., 2023). However, the relationship is not uniformly positive, with some research indicating that ESG investments might incur short-term costs (Li, 2024) or that the link is highly context-dependent.

Despite this extensive body of work, a review of the literature reveals several critical gaps that this study aims to fill. First, a significant portion of existing research focuses on the relationship between aggregate ESG scores and long-

term performance, with comparatively less analysis of the short-term market impact of specific ESG news announcements. Second, while the link between overall ESG standing and systematic risk is discussed, there is a scarcity of studies that empirically model and test for short-term changes in a company's market beta immediately following a discrete ESG event. Finally, within the uniquely pressured energy sector, a clear gap exists in understanding whether the market reacts differently to similar types of ESG announcements when they originate from traditional fossil fuel firms versus their renewable energy counterparts. By focusing on discrete events, their impact on abnormal returns and market beta, and exploring nuances within the energy sector, this research seeks to provide a more granular, empirically grounded understanding of how financial markets process and value ESG-related information in real time.

Research questions and hypotheses development

The preceding review of the theoretical and empirical literature has established a clear rationale for investigating the short-term market impact of discrete ESG announcements, particularly within the transitioning energy sector. While foundational theories suggest that such events should be value-relevant, the specific nature, magnitude, and consistency of these market reactions remain underexplored. To address the identified research gaps, this study formulates a series of specific research questions and corresponding testable hypotheses to guide the econometric investigation into the financial market's real-time processing of ESG-related news. The inquiry is structured around two primary dimensions of market performance: abnormal stock returns and changes in systematic risk (market beta).

The Impact of ESG Events on Abnormal Stock Returns

The most direct test of market reaction to new information is the analysis of abnormal stock returns. According to the *Efficient Market Hypothesis* (EMH), any unanticipated information with material implications for a firm's future cash flows or risk profile should be immediately incorporated into its stock price (Fama, 1970). The first set of research questions and hypotheses examines this core proposition in the context of both positive and negative ESG event announcements.

Research Question 1 (RQ1): *What is the nature and statistical significance of the impact of positive ESG event announcements on the cumulative abnormal stock returns of individual energy companies over a short-term event window?*

Research Question 2 (RQ2): *What is the nature and statistical significance of the impact of negative ESG event announcements on the cumulative abnormal stock returns of individual energy companies over a short-term event window?*

Stemming from these questions, and drawing upon *Signalling and Stakeholder Theories*, the following hypotheses are developed:

Hypothesis 1: *The market will react positively to positive ESG event announcements.*

H_0 (Null Hypothesis): *Positive ESG events have no statistically significant impact on the cumulative abnormal stock returns of individual energy companies over the specified event window.*

H_a (Alternative Hypothesis): *Positive ESG events lead to statistically significant positive cumulative abnormal stock returns for individual energy companies over the specified event window.*

Multiple theoretical streams underpin this hypothesis. From the perspective of *Signalling Theory,* a credible positive ESG announcement (e.g., a major investment in carbon capture technology or a strategic acquisition of a renewable energy firm) serves as a powerful signal of proactive management, superior operational quality, and a commitment to long-term sustainable value creation (Spence, 1973). Such signals can reduce information asymmetry and lead investors to revise their expectations of future cash flows upwards. Furthermore, *Stakeholder Theory* suggests that actions beneficial to a wide range of stakeholders — such as communities, employees, or the environment — can enhance firm reputation, build loyalty, and reduce long-term risks, thereby creating intangible value that should be recognised by the market (Freeman, 1984). The EMH framework implies that this new, positive information, if deemed material, will lead to an upward adjustment in the stock price.

Hypothesis 2: *The market will react negatively to negative ESG event announcements.*

H_0 (Null Hypothesis): *Negative ESG events have no statistically significant impact on the cumulative abnormal stock returns of individual energy companies over the specified event window.*

H_a (Alternative Hypothesis): *Negative ESG events lead to statistically significant negative cumulative abnormal stock returns for individual energy companies over the specified event window.*

This hypothesis posits that adverse ESG news functions as a negative signal to the market. Events such as environmental incidents, regulatory sanctions, or credible allegations of greenwashing can reveal operational deficiencies, weak internal controls, or future liabilities that could impair profitability. According to *Signalling Theory*, such events signal a firm's mismanagement of critical non-financial risks. From a *Stakeholder Theory* perspective, actions that harm stakeholders can erode trust, damage brand equity, and invite costly litigation or regulatory intervention. In an efficient market, this new information about heightened risk and potential future costs should lead rational investors to revise their valuations downwards, resulting in a negative stock price reaction.

The Impact of ESG Events on Systematic Risk (Market Beta)

Beyond immediate valuation effects, ESG events may fundamentally alter investor perceptions of a company's systematic risk — its sensitivity to overall market fluctuations. This is a more nuanced, but arguably more profound, potential impact of ESG information.

Research Question 3 (RQ3): *Do positive ESG event announcements lead to a statistically significant change in the market sensitivity (beta) of individual energy companies during the event window?*

Research Question 4 (RQ4): *Do negative ESG event announcements lead to a statistically significant change in the market sensitivity (beta) of individual energy companies during the event window?*

These questions lead to the formulation of the second set of hypotheses:

Hypothesis 3: *Positive ESG events will lead to a decrease in a firm's systematic risk.*

H_0 (Null Hypothesis): *Positive ESG events do not lead to a statistically significant change in an individual energy company's market sensitivity (beta) over the event window.*

H_a (Alternative Hypothesis): *Positive ESG events lead to a statistically significant decrease in an individual energy company's market sensitivity (beta) over the event window.*

A firm's market beta is a measure of its systematic, non-diversifiable risk. Positive ESG announcements that signal enhanced resilience, proactive management of long-term transition risks, or diversification into less volatile business areas (e.g., a traditional oil firm investing heavily in renewables) can lead to a perception of derisking. Investors may conclude that the company is better insulated from future regulatory shocks, less exposed to commodity price volatility, or more aligned with long-term economic trends. This perception of enhanced stability and reduced long-term risk should, in theory, translate into a lower beta, as the stock becomes less sensitive to broad market fluctuations.

Hypothesis 4: *Negative ESG events will lead to an increase in a firm's systematic risk.*

H_0 (Null Hypothesis): *Negative ESG events do not lead to a statistically significant change in an individual energy company's market sensitivity (beta) over the event window.*

H_a (Alternative Hypothesis): *Negative ESG events lead to a statistically significant increase in an individual energy company's market sensitivity (beta) over the event window.*

Negative ESG events can expose a company's underlying vulnerabilities to operational, regulatory, or reputational threats. An environmental disaster, for instance, not only signals immediate clean-up costs and fines but also reveals potential weaknesses in risk management systems, thereby increasing the company's perceived exposure to future adverse events. Investors may interpret such an event as a signal that the company is more susceptible to systemic shocks and broader market downturns, leading them to demand a higher risk

premium. This heightened perception of systematic risk should be reflected in a statistically significant increase in the company's market beta.

Comparative Analysis within the Energy Sector

Finally, recognising the unique dichotomy of the energy industry, a guiding qualitative question is also formulated:

Research Question 5 (RQ5): *To what extent, and in what ways, do short-term market reactions to specific ESG events appear to differ between traditional fossil fuel-focused companies and those primarily oriented towards renewable energy sources?*

While the limited number of events per company constrains a formal, robust statistical comparison between the two subgroups, this question will guide the qualitative interpretation and discussion of the empirical findings, exploring potential nuances in how the market processes similar ESG signals from entities with fundamentally different core business models and baseline ESG profiles.

The following chapter details the econometric methodology and data used to rigorously test these hypotheses.

Research Methodology

To empirically test the hypotheses concerning the financial market's short-term reaction to ESG event announcements, this study employs a *Quantitative Event Study Methodology*. This approach is a well-established and powerful tool in financial economics, specifically designed to isolate and measure the valuation effects of unanticipated corporate events by analysing security price movements around the announcement date. Its suitability for addressing the research questions is affirmed by its foundational literature (Fama et al., 1969; MacKinlay, 1997) and its frequent application in contemporary ESG research (e.g., Huang et al., 2024; Suresha et al., 2022). The methodology's core premise is that, in an efficient market, the effects of an event are reflected immediately in the firm's stock prices, allowing for the measurement of abnormal returns attributable solely to the event while controlling for general market movements.

Sample Selection and Data Collection

The empirical analysis is based on a meticulously constructed dataset covering the period from January 2020 through early 2025. The company sample comprises 10 large, publicly traded energy firms, curated to provide a balanced view of the sector. This sample is bifurcated into five traditional fossil fuel

companies (BP, Shell, ExxonMobil, Chevron, and Saudi Aramco) and five firms with a significant focus on alternative or renewable energy (NextEra Energy, Iberdrola, Constellation Energy, GE Vernova, and Vestas Wind Systems). This selection was predicated on the public availability of distinct ESG event data and corresponding high-frequency financial data for the study period.

A curated list of 21 distinct ESG-related events for these companies was compiled from publicly available and reputable sources, including official company press releases and major financial news outlets. Each event was qualitatively classified as either "positive" or "negative" based on its generally perceived implications for the company's ESG profile, as detailed in the Appendix.

The process for selecting the specific ESG events used in this study was guided by several key principles to ensure the analysis was rigorous, replicable, and relevant. The goal was to create a "curated list" of distinct, potentially material events rather than a random sample. The criteria were as follows:

- *Public and Verifiable Information*: Each event was sourced from publicly available and reputable channels, such as official company press releases or major financial news outlets. This is a critical requirement for an event study, as it allows for the precise identification of "Day 0" — the day the information became widely available to the market.
- *Clear ESG Relevance*: The events had to be unambiguously related to ESG issues. This included strategic announcements on sustainability (e.g., Net Zero goals), major green investments or acquisitions, significant regulatory or legal rulings, and credible allegations of corporate ESG misconduct.
- *Distinctiveness and Potential Materiality:* The study focused on specific, discrete announcements rather than general, ongoing performance updates. The chosen events were significant enough to be perceived as financially material by investors, even if the results ultimately showed they were not.

The financial data consists of daily closing stock prices for each of the ten companies and for the market indices. The primary global market benchmark is the MSCI World Index, with the S&P 500 Energy Index used for robustness checks. All price data were sourced from Investing.com, a recognised financial data provider. To ensure desirable statistical properties standard in financial econometrics, daily logarithmic returns (continuously compounded returns) were calculated for both company stocks and the market indices using the formula, which is a standard procedure in financial time series analysis (Fama, 1970):

$$r_t = \ln\left(\frac{P_t}{P_{t-1}}\right) \tag{1}$$

The analysis is based on the daily adjusted closing price series (P_t). As price series in their level form are typically non-stationary — a condition that would

lead to spurious results in econometric modelling the analysis is conducted using stationary logarithmic returns (r_t)

Event Study Design and Variables

The study defines the day of the public ESG announcement as *Day 0*. The primary analytical focus for hypothesis testing is an *11-trading-day event window*, encompassing the *announcement day* and the *ten subsequent trading days*, denoted as *[0,+10]*. This *post-event window* was chosen to capture not only the immediate market processing of the information but also any slightly delayed reactions as the news disseminates more widely.

The key variables used in the econometric models are defined as follows:

- *Dependent Variable*: The primary dependent variable is the daily logarithmic return for company i on trading day t, denoted as $R_{i,t}$.
- *Independent Variables*: The main independent variable is the daily logarithmic return of the market index (MSCI World) on day t, denoted as $R_{m,t}$ which serves as the proxy for systematic market-wide movements.

To isolate event-specific effects, a series of dummy variables is constructed. For analysing daily abnormal returns, a set of dummy variables, $D_{i,k,d,t}$ is created, which equals 1 if day t is d days relative to the event day for event type k of company i (where d ranges from 0 to 10), and 0 otherwise. For analysing the average effect over the entire window, an event window indicator dummy, $D_{i,k,window,t}$ is used, which equals 1 if day t falls within the [0,+10] window for a specific event, and 0 otherwise. Throughout the models, the subscript i denotes the firm, k refers to the specific event for that firm, t indicates the trading day, and d representsthe day within the event window.

Econometric Models

The empirical analysis is conducted using *Ordinary Least Squares (OLS)* regression. The expected return for each stock, which represents the return attributable to general market movements, is estimated using the standard market model:

$$E(R_{i,t}) = \alpha_i + \beta_i R_{m,t} \tag{2}$$

Here, ($R_{i,t}$) is the expected return for company i on day t, αi is the intercept (alpha) for the stock, and β_i is the stock's market beta, which measures its systematic risk. The Abnormal Return (AR)on any given day is the portion of the actual return not explained by the market, calculated as:

$$AR_{i,t} = R_{i,t} - E(R_{i,t}) \tag{3}$$

To test for the presence of statistically significant abnormal returns during the event window, the market model is augmented with daily event window dummies. The following regression is estimated for each of the 21 events:

$$R_{i,t} = \alpha_i + \beta_i R_{m,t} + \sum_{d=0}^{10} \delta_{i,k,d} D_{i,k,d,t} + \epsilon_{i,t} \quad (4)$$

In this model, the coefficients $\delta_{i,k,d}$ represent the estimated daily abnormal return for each day d within the [0,+10] event window. The primary interest lies in the Cumulative Abnormal Return (CAR) over the entire window, which is calculated as the sum of these daily coefficients:

$$CAR_{i,k,[0,+10]} = \sum_{d=0}^{10} \delta_{i,k,d} \quad (5)$$

A Wald test is then employed to determine if this sum is statistically significantly different from zero, thereby formally testing Hypotheses 1 and 2.

To investigate whether an ESG event alters a company's systematic risk, the market model is further augmented with an event window dummy and, crucially, an interaction term. This term is constructed by multiplying the event window dummy by the market return. The model specified to test for a change in beta is:

$$R_{i,t} = \alpha_i + \beta_i R_{m,t} + \gamma_{i,k,1} D_{i,k,window,t} + \gamma_{i,k,2} \left(D_{i,k,window,t} \times R_{m,t} \right) + \epsilon_{i,t} \quad (6)$$

In this specification, the coefficient of primary interest is $\gamma_{i,k,2}$ This coefficient captures the change in the market beta during the [0,+10] event window. A statistically significant $\gamma_{i,k,2}$ would indicate that the firm's sensitivity to market movements has changed following the ESG event. A significant negative $\gamma_{i,k,2}$ for a positive ESG event would support Hypothesis 3 (derisking), while a significant positive $\gamma_{i,k,2}$ for a negative ESG event would support Hypothesis 4 (increased risk).

Methodological Limitations

While the chosen methodology is robust and standard for this line of inquiry, it is essential to acknowledge its inherent limitations. The most significant constraint is the limited number of distinct events for each company (the "small N" problem), which restricts the statistical power of the analysis and the ability to generalise findings broadly. Furthermore, the single-factor market model does not control for other potential influences on stock returns, thereby risking omitted-variable bias. Other factors, such as contemporaneous company-specific news or broader macroeconomic announcements, could confound the

results. Finally, classifying events as purely "positive" or "negative" involves an element of subjectivity. These limitations are carefully considered in the interpretation of the results.

Empirical Findings

This chapter presents the empirical results of the econometric analysis detailed in the preceding methodology section. The findings are organised to systematically address the research hypotheses. We begin with a descriptive analysis of the financial time series data to establish its core characteristics. This is followed by the primary event study results concerning the impact of ESG announcements on both cumulative abnormal returns (CARs) and market sensitivity (beta). Finally, we present the crucial findings from the robustness checks, which serve to validate or qualify the initial results.

Descriptive Statistics and Data Characteristics

Prior to conducting the event study analysis, it is essential to understand the distributional properties of the daily logarithmic returns for the sampled companies. These statistics provide foundational insights into the volatility, central tendency, and potential deviations from normality that characterise the data, which is crucial for the correct interpretation of regression results.

Table 1: Descriptive Statistics for Traditional Energy Companies

Statistic	Shell	ExxonMobil	Chevron	Saudi Aramco	BP
Mean	0.03241	0.053535	0.039116	-0.006167	0.00534
Median	0.03118	0.012777	0.08512	0.0000	0.0000
Maximum	19.6795	12.6868	22.74069	9.859155	21.6053
Minimum	-17.172	-12.22479	-22.12477	-9.094243	-19.104
Std. Dev.	2.32766	2.158681	2.233941	1.07395	2.40151
Skewness	-0.3764	0.028954	-0.288105	0.253279	-0.0247
Kurtosis	15.752	7.448681	23.91952	15.9126	15.5894
Jarque-Bera	9002.1	1091.975	24160.7	9212.39	8743.62
Probability	0.0000	0.0000	0.0000	0.0000	0.0000
Sum	42.9059	70.87993	51.78895	-8.165585	7.06962
Sum Sq. Dev.	7167.99	6165.055	6602.419	1525.905	7630.08

Source: personal computations

Table 2: Descriptive Statistics for Renewable/Alternative Energy Focused Companies

Statistic	Vestas Wind Systems	NextEra Energy	Iberdrola	GE Vernova	Constellation Energy
Mean	0.01111	0.028062	0.040861	0.079153	0.14839
Median	0.0000	0.076125	0.041463	0.0000	0.0000
Maximum	15.1967	13.69742	10.09139	13.91474	25.1599
Minimum	-15.614	-13.41403	-14.06233	-21.52013	-20.85
Std. Dev.	2.9949	1.928303	1.436261	1.620941	2.47142
Skewness	0.2279	-0.169217	-0.573824	-0.955991	1.31724
Kurtosis	6.17485	10.12494	13.65893	40.52806	26.0124
Jarque-Bera	567.524	2806.842	6340.301	77895.93	29597.5
Probability	0.0000	0.0000	0.0000	0.0000	0.0000
Sum	14.7084	37.15347	54.09999	104.7989	196.462
Sum Sq. Dev.	11866.6	4919.381	2729.145	3476.118	8080.76

Source: personal computations

An examination of Tables 1 and 2 reveals several key stylised facts common to financial time series data. The mean daily returns for most companies are positive but cluster very close to zero, with Constellation Energy exhibiting the highest average return (0.15%) and Saudi Aramco a slightly negative average (-0.006%) over the period. The standard deviation, a proxy for daily volatility, shows considerable variation. For instance, Vestas Wind Systems (2.99%) displays the highest volatility in the sample, while Saudi Aramco (1.07%) exhibits the lowest, suggesting different risk profiles. More importantly, the shape of the return distributions deviates significantly from normality. The skewness statistics indicate asymmetry, with several firms (e.g., Shell, Chevron, Iberdrola) showing negative skewness, suggesting a greater frequency of small gains and a few large losses. All companies without exception display kurtosis values substantially greater than the normal distribution's value of 3. This condition, known as leptokurtosis, indicates that the return distributions have "fat tails" and a more pronounced peak. This is a critical finding, as it means that the probability of observing extreme returns (both positive and negative) is much higher than a normal distribution would predict, a feature visually confirmed by the return plots. Consequently, the Jarque-Bera test for normality strongly rejects the null hypothesis for every company in the sample, with probability values of zero. This non-normality is a fundamental characteristic of the data that underscores the energy sector's inherent volatility.

Chart 1: Daily Return Series of Traditional Energy Companies

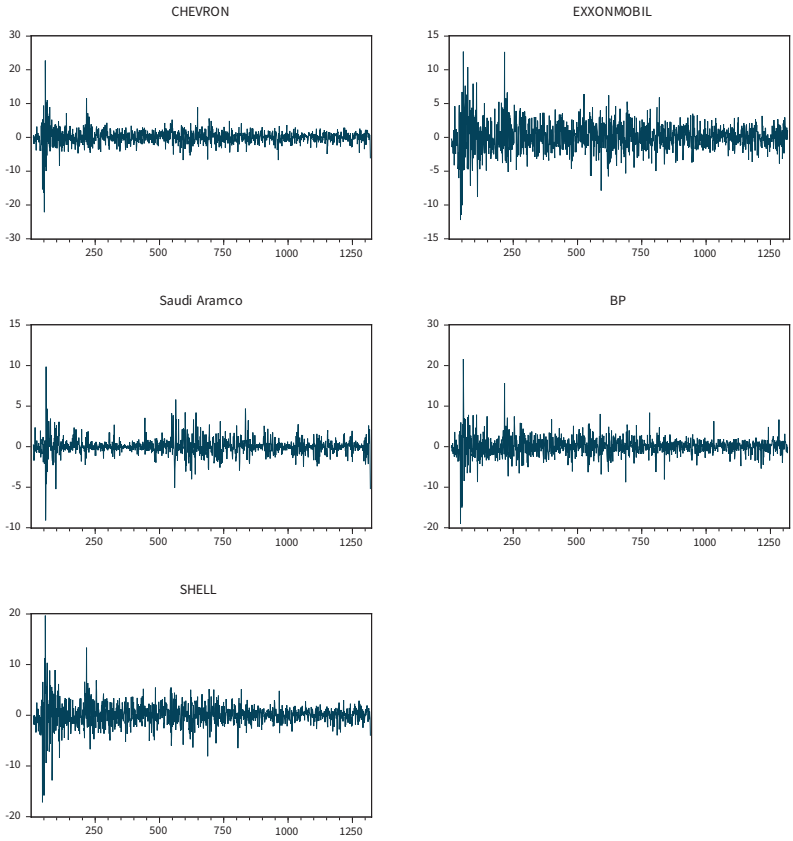
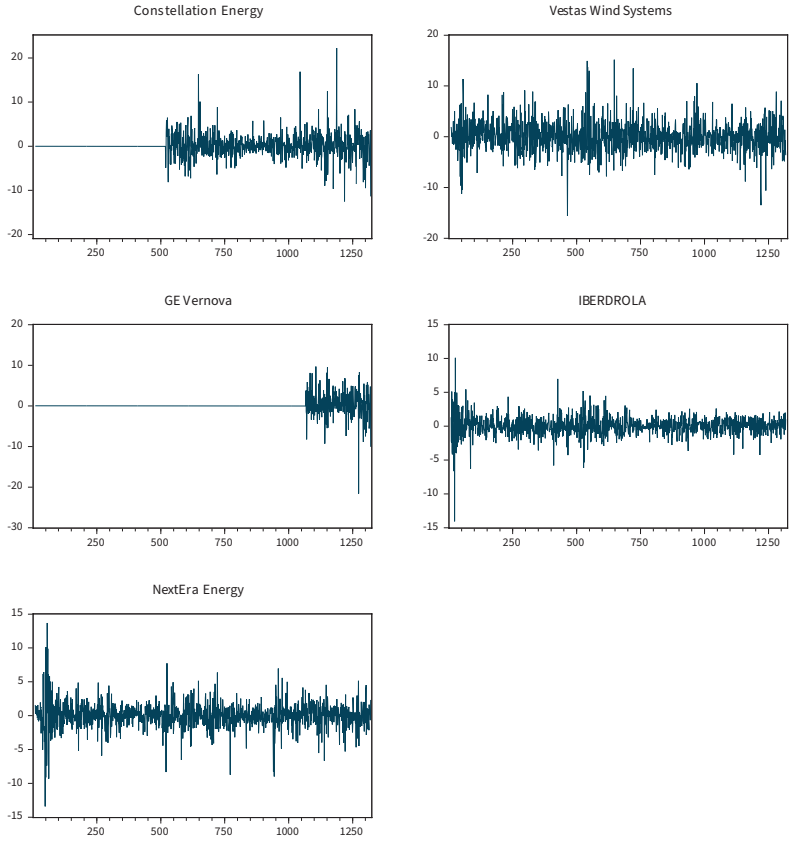


Chart 2: Daily Return Series of Alternative/Renewable Energy Companies



Source: personal computations

The time series plots in Charts 1 and 2 visually corroborate the statistical findings. The charts clearly illustrate volatility clustering, where large price changes are followed by other large changes, a phenomenon particularly evident in traditional energy firms like Chevron and Shell. These visual patterns reinforce evidence of leptokurtic, non-normal return distributions, which must be accounted for when assessing the significance of event-driven market movements.

Event Study Results: Impact on Cumulative Abnormal Returns (CAR)

This section presents the primary findings related to Hypotheses 1 and 2, which test for the existence of statistically significant cumulative abnormal returns

(CARs) over the [0,+10] day event window following positive and negative ESG announcements, respectively.

Market Reaction to Positive ESG Announcements

Hypothesis 1 posited that positive ESG events would lead to significant positive CARs. The results, summarised in Table 3, provide very limited support for this hypothesis.

Table 3: Market Reaction to Positive ESG Announcements – CAR [0, +10]

Event ID	Company	Date	Event Name	Estimated CAR	F-statistic	p-value	H1 Supported (at 5% sig.)?	Notes
BP_pos1	BP	12/02/20	BP Net Zero Goal Announcement	-14.84988	3.438399	0.0639	No	p > 0.05. CAR is negative.
SH_pos	Shell	15/12/20	Northern Lights CO2 Storage FID	-1.128194	0.021135	0.8844	No	p > 0.05. CAR is negative.
EX_pos1	ExxonMobil	01/02/21	ExxonMobil Low Carbon Solutions Launch	14.75798	4.225295	0.04	Yes	p < 0.05. CAR is positive.
IB_pos1	Iberdrola	21/05/21	Vineyard Wind 1 FID	-2.933154	0.375659	0.54	No	p > 0.05.
CH_pos1	Chevron	28/02/2022	Chevron-REG Acquisition	17.27267	5.400433	0.0203	Yes	p < 0.05. CAR is positive.
NE_pos	NextEra Energy	14/06/22	NextEra Real Zero Goal Announcement	4.814728	0.564487	0.4526	No	p > 0.05.
BP_pos2	BP	19/10/22	BP-Archaea Energy Acquisition	7.420568	0.855168	0.3553	No	p > 0.05.
EX_pos2	ExxonMobil	11/10/23	ExxonMobil-Pioneer Acquisition	-2.241654	0.096777	0.7558	No	p > 0.05.
CE_pos	Constella-tion Energy	18/03/24	Constellation Green Bond Issuance	11.93715	2.097463	0.1478	No	p > 0.05.
SA_pos	Saudi Aramco	20/03/24	Saudi Aramco DAC Launch	-3.894233	1.181754	0.2772	No	p > 0.05.
CH_pos2	Chevron	04/04/24	Chevron-ION Clean Energy Investment	-2.199991	0.08671	0.7684	No	p > 0.05.
GE_pos	GE Vernova	18/09/24	GE Vernova Sustainability Report	5.535537	1.052124	0.3052	No	p > 0.05.

Event ID	Company	Date	Event Name	Estimated CAR	F-statistic	p-value	H1 Supported (at 5% sig.)?	Notes
VW_pos	Vestas Wind Systems	15/01/25	Vestas Global Sustainability Ranking	8.422833	0.715003	0.3979	No	p > 0.05.
IB_pos2	Iberdrola	21/03/25	Iberdrola Share-Linked Green Bond	-0.630445	0.017443	0.8949	No	p > 0.05.

Source: personal computations

Out of the 14 positive ESG events analysed, only two yielded statistically significant positive CARs at the 5% level in the initial analysis. These were ExxonMobil's launch of its 'Low Carbon Solutions' business (EX_pos1), which generated a CAR of +14.76% (p=0.0400), and Chevron's acquisition of Renewable Energy Group (CH_pos1), with a CAR of +17.27% (p=0.0203). For the overwhelming majority of positive announcements (12 out of 14), the null hypothesis of no significant effect could not be rejected. Notably, several events, such as BP's ambitious Net Zero Goal announcement (BP_pos1), resulted in negative, albeit statistically insignificant, CARs.

Market Reaction to Negative ESG Announcements

Hypothesis 2, which predicted significant negative CARs following adverse ESG news, finds no empirical support in this study's data.

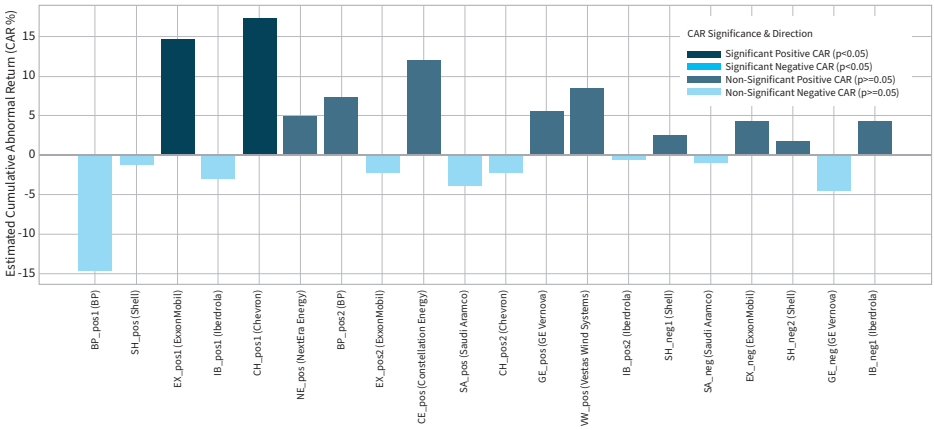
Table 4: Market Reaction to Negative ESG Announcements – CAR [0, +10]

Event ID	Company	Date	Event Name	Estimated CAR	F-statistic	p-value	H1 Supported (at 5% sig.)?	Notes
SH_neg1	Shell	26/05/21	Dutch Court Emission Ruling	2.467097	0.100496	0.7513	No	p > 0.05. CAR is positive.
SA_neg	Saudi Aramco	28/11/23	Greenwashing Allegation	-0.9246	0.066338	0.7968	No	p > 0.05.
EX_neg	Exxon-Mobil	21/01/24	ExxonMobil Lawsuit Against Shareholder	4.141695	0.329824	0.5659	No	p > 0.05. CAR is positive.
SH_neg2	Shell	14/03/24	Shell Energy Transition Strategy	1.829654	0.055178	0.8143	No	p > 0.05. CAR is positive.
GE_neg	GE Vernova	13/07/24	Vineyard Wind Turbine Failure	-4.544802	0.746453	0.3878	No	p > 0.05. CAR is negative but not significant.
IB_neg1	Iberdrola	30/07/24	Iberdrola LNG Arbitration Dispute	4.290872	0.797882	0.3719	No	p > 0.05. CAR is positive.

Source: personal computations

As shown in Table 4, none of the six negative ESG events analysed resulted in statistically significant negative CARs at conventional levels. While events such as the greenwashing allegation against Saudi Aramco (SA_neg) produced a negative estimated CAR, the effect was statistically indistinguishable from zero. More surprisingly, several negative events, including the Dutch court ruling against Shell (SH_neg1), prompted a positive (though statistically insignificant) market reaction. Therefore, the evidence fails to support the hypothesis that the market consistently penalises firms with negative abnormal returns in the immediate aftermath of adverse ESG news.

Chart 3: Cumulative Abnormal Returns (CARs)
Following ESG Event Announcements [0, +10 Day Window]



Source: personal computations

Event Study Results: Impact on Market Sensitivity (Beta)

This section moves beyond returns to test Hypotheses 3 and 4, which investigate whether ESG events lead to a statistically significant change in a firm's systematic risk, as captured by its market beta.

Beta Changes Following Positive ESG Announcements

The findings regarding Hypothesis 3 are inconsistent and largely statistically insignificant, offering only event-specific evidence of a change in risk perception.

Table 5: Summary of Results for Hypothesis 3 – Impact of Positive ESG Events on Market Sensitivity (Beta)

Event ID	Company	Date	Event Name	Interaction Term Coefficient ()	p-value	Significance & Direction of Change in Beta
BP_pos1	BP	12/02/20	BP Net Zero Goal Announcement	0.919634	0.0982	Significant at 10% (Increase)
SH_pos	Shell	15/12/20	Northern Lights CO2 Storage FID	0.018883	0.9805	Not Significant
EX_pos1	ExxonMobil	01/02/21	ExxonMobil Low Carbon Solutions Launch	1.765828	0.2780	Not Significant
IB_pos1	Iberdrola	21/05/21	Vineyard Wind 1 FID	0.032310	0.9536	Not Significant
CH_pos1	Chevron	28/02/22	Chevron-REG Acquisition	0.698399	0.2477	Not Significant
NE_pos	NextEra Energy	14/06/22	NextEra Real Zero Goal Announcement	0.268243	0.6736	Not Significant
BP_pos2	BP	19/10/22	BP-Archaea Energy Acquisition	−0.012120	0.9868	Not Significant
EX_pos2	ExxonMobil	11/10/23	ExxonMobil-Pioneer Acquisition	−1.547675	0.1310	Not Significant (though p-value is low, still > 0.10)
CE_pos	Constellation Energy	18/03/24	Constellation Green Bond Issuance	−0.523686	0.6887	Not Significant
SA_pos	Saudi Aramco	20/03/24	Saudi Aramco DAC Launch	−0.913189	0.1147	Not Significant (though p-value is low, still > 0.10)
CH_pos2	Chevron	04/04/24	Chevron-ION Clean Energy Investment	0.230182	0.7845	Not Significant
GE_pos	GE Vernova	18/09/24	GE Vernova Sustainability Report	−0.591060	0.5799	Not Significant
VW_pos	Vestas Wind Systems	15/01/2025	Vestas Global Sustainability Ranking	−2.475162	0.0789	Significant at 10% (Decrease)
IB_pos2	Iberdrola	21/03/2025	Iberdrola Share-Linked Green Bond	0.303164	0.1664	Not Significant

Source: personal computations

As detailed in Table 5, the majority of positive ESG events did not result in a significant change in beta. Only two events showed a statistically significant change at the 10% level, and they pointed in opposite directions. BP's Net Zero Goal announcement (BP_pos1) was associated with a statistically significant increase in beta, contrary to the de-risking hypothesis. Conversely, Vestas Wind Systems' high global sustainability ranking (VW_pos) was associated with a statistically significant decrease in beta, consistent with the theoretical expectation that strong ESG credentials can be perceived as a form of derisking.

Beta Changes Following Negative ESG Announcements

Hypothesis 4, which predicted an increase in systematic risk following negative ESG news, is not supported by the data.

Table 6: Summary of Results for Hypothesis 4 – Impact of Negative ESG Events on Market Sensitivity (Beta)

Event ID	Company	Date	Event Name	Interaction Term Coefficient ()	p-value	Significance & Direction of Change in Beta
SH_neg1	Shell	26/05/2021	Dutch Court Emission Ruling	0.157495	0.9076	Not Significant
SA_neg	Saudi Aramco	28/11/2023	Greenwashing Allegation	0.048805	0.9343	Not Significant
EX_neg	ExxonMobil	21/01/2024	ExxonMobil Lawsuit Against Shareholder	−0.644380	0.4721	Not Significant (Direction contrary to H4)
SH_neg2	Shell	14/03/2024	Shell Energy Transition Strategy	−0.281215	0.8201	Not Significant (Direction contrary to H4)
GE_neg	GE Vernova	13/07/2024	Vineyard Wind Turbine Failure	0.243542	0.4719	Not Significant
IB_neg1	Iberdrola	30/07/2024	Iberdrola LNG Arbitration Dispute	−0.802738	0.2425	Not Significant (Direction contrary to H4)

Source: personal computations

The results in Table 6 are unambiguous: none of the six negative ESG events led to a statistically significant increase in market beta. In fact, in several events, the coefficient for the change in beta was negative, suggesting a potential (though insignificant) decrease in risk, contrary to the hypothesis.

Robustness Checks

To assess the stability and reliability of the initial findings, a series of robustness tests was performed by re-estimating all models using an alternative, sector-specific market benchmark: the S&P 500 Energy index. These tests revealed critical sensitivities in the initial results.

Table 7: Market Reaction to Positive ESG Announcements – CAR [0, +10] (S&P 500 Energy Benchmark)

Event ID (Conceptual)	EViews Eq. Name	Company	Event Name	Robust Estimated CAR (S&P 500 Energy)	Robust p-value (S&P 500 Energy)	H1 Supported (Rob., at 5% sig.)?	Notes (Robustness Test)	Original CAR (MSCI)	Original p-value (MSCI)
BP_pos1	EQ_R1_SP500	BP	BP Net Zero Goal Announcement	-1.351115	0.8212	No	p > 0.05. CAR is negative.	-14.84988	0.0639
SH_pos	EQ_R2_SP500	Shell	Northern Lights CO2 Storage FID	0.739237	0.8978	No	p > 0.05.	-1.128194	0.8844
EX_pos1	EQ_R3_SP500	ExxonMobil	ExxonMobil Low Carbon Solutions Launch	4.994206	0.3095	No	p > 0.05. (Orig. was Yes)	14.75798	0.0400
IB_pos1	EQ_R4_SP500	Iberdrola	Vineyard Wind 1 FID	-2.764486	0.5633	No	p > 0.05. CAR is negative.	-2.933154	0.5400
CH_pos1	EQ_R5_SP500	Chevron	Chevron-REG Acquisition	7.567033	0.1202	No	p > 0.05. (Orig. was Yes)	17.27267	0.0203
NE_pos	EQ_R6_SP500	NextEra Energy	NextEra Real Zero Goal Announcement	7.853398	0.2080	No	p > 0.05.	4.814728	0.4526
BP_pos2	EQ_R7_SP500	BP	BP-Archaea Energy Acquisition	2.024026	0.7344	No	p > 0.05.	7.420568	0.3553
EX_pos2	EQ_R8_SP500	ExxonMobil	ExxonMobil-Pioneer Acquisition	-0.747294	0.8791	No	p > 0.05. CAR is negative.	-2.241654	0.7558
CE_pos	EQ_R9_SP500	Constellation Energy	Constellation Green Bond Issuance	11.05371	0.1793	No	p > 0.05.	11.93715	0.1478
SA_pos	EQ_R10_SP500	Saudi Aramco	Saudi Aramco DAC Launch	-3.970759	0.2676	No	p > 0.05. CAR is negative.	-3.894233	0.2772

Event ID (Conceptual)	EViews Eq. Name	Company	Event Name	Robust Estimated CAR (S&P 500 Energy)	Robust p-value (S&P 500 Energy)	H1 Supported (Rob., at 5% sig.)?	Notes (Robustness Test)	Original CAR (MSCI)	Original p-value (MSCI)
CH_pos2	EQ_R11_SP500	Chevron	Chevron-ION Clean Energy Investment	0.534472	0.9136	No	p > 0.05.	-2.199991	0.7684
GE_pos	EQ_R12_SP500	GE Vernova	GE Vernova Sustainability Report	5.504600	0.3081	No	p > 0.05.	5.535537	0.3052
VW_pos	EQ_R13_SP500	Vestas Wind Systems	Vestas Global Sustainability Ranking	10.03174	0.3032	No	p > 0.05.	8.422833	0.3979
IB_pos2	EQ_R14_SP500	Iberdrola	Iberdrola Share-Linked Green Bond	-1.137706	0.8108	No	p > 0.05. CAR is negative.	-0.630445	0.8949

Source: personal computations

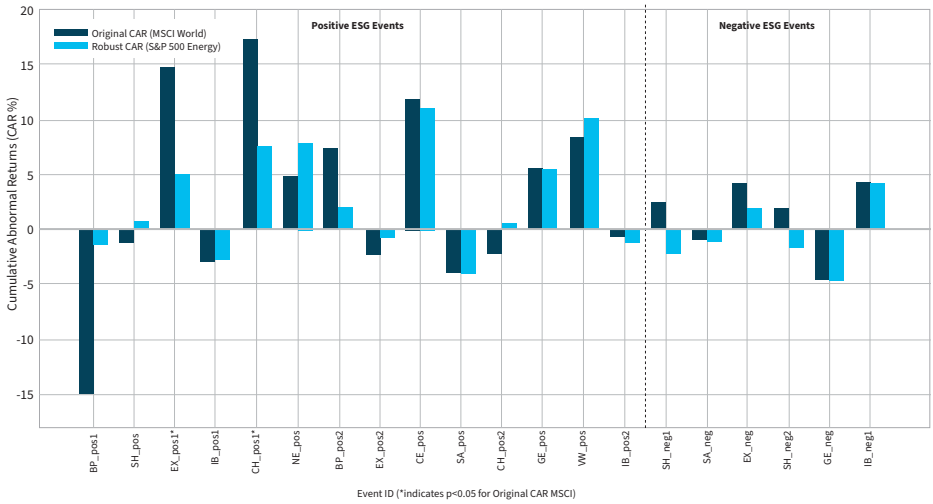
Table 8: Market Reaction to Negative ESG Announcements – CAR [0, +10] (S&P 500 Energy Benchmark)

Event ID (Conceptual)	EViews Eq. Name	Company	Event Name	Robust Estimated CAR (S&P 500 Energy)	Robust p-value (S&P 500 Energy)	H2 Supported (Rob., at 5% sig.)?	Notes (Robustness Test)	Original CAR (MSCI)	Original p-value (MSCI)
SH_neg1	EQ_R15_SP500	Shell	Dutch Court Emission Ruling	-2.180803	0.7057	No	p > 0.05. CAR is negative.	2.467097	0.7513
SA_neg	EQ_R16_SP500	Saudi Aramco	Greenwashing Allegation	-1.079320	0.7637	No	p > 0.05. CAR is negative.	-0.924600	0.7968
EX_neg	EQ_R17_SP500	Exxon-Mobil	ExxonMobil Lawsuit Against Shareholder	1.866785	0.7044	No	p > 0.05. CAR is positive.	4.141695	0.5659
SH_neg2	EQ_R18_SP500	Shell	Shell Energy Transition Strategy	-1.606920	0.7808	No	p > 0.05. CAR is negative.	1.829654	0.8143
GE_neg	EQ_R19_SP500	GE Vernova	Vineyard Wind Turbine Failure	-4.637856	0.3781	No	p > 0.05. CAR is negative but not significant.	-4.544802	0.3878
IB_neg1	EQ_R20_SP500	Iberdrola	Iberdrola LNG Arbitration Dispute	4.260962	0.3743	No	p > 0.05. CAR is positive.	4.290872	0.3719

Source: personal computations

The robustness check on abnormal returns is perhaps the most critical finding of this study. As shown, the two positive events (EX_pos1 and CH_pos1) that were statistically significant in the original analysis lost their significance when benchmarked against the energy sector index. For ExxonMobil, the p-value increased from 0.0400 to 0.3095, and for Chevron, it rose from 0.0203 to 0.1202. This indicates that their strong initial performance may have been driven by broader positive sentiment in the energy sector rather than being an abnormal return specific to the ESG event itself. The lack of significant findings for both positive and negative events was confirmed.

Chart 4: Market Reaction to ESG Announcements: Original vs. Robust CARs



Source: personal computations

The robustness tests for beta changes also yielded noteworthy results.

Table 9: Summary of Robustness Results for Hypothesis 3 – Impact of Positive ESG Events on Beta (S&P 500 Energy Benchmark)

Event ID	Company	Event Name	Original	Original p-value	Robust S&P500	Robust p-value S&P500	Significance & Direction of Change in Beta (Robustness)
BP_pos1	BP	BP Net Zero Goal Announcement	0.919634	0.0982	-0.601070	0.7826	Not Significant
SH_pos	Shell	Northern Lights CO2 Storage FID	0.018883	0.9805	52.81339	0.1598	Not Significant
EX_pos1	ExxonMobil	ExxonMobil Low Carbon Solutions Launch	1.765828	0.2780	-0.160480	0.7728	Not Significant
IB_pos1	Iberdrola	Vineyard Wind 1 FID	0.032310	0.9536	-42.15508	0.1751	Not Significant
CH_pos1	Chevron	Chevron-REG Acquisition	0.698399	0.2477	-56.31565	0.0221	Significant at 5% (Decrease)
NE_pos	NextEra Energy	NextEra Real Zero Goal Announcement	0.268243	0.6736	-21.92670	0.1562	Not Significant
BP_pos2	BP	BP-Archaea Energy Acquisition	-0.012120	0.9868	-31.41511	0.4377	Not Significant
EX_pos2	ExxonMobil	ExxonMobil-Pioneer Acquisition	-1.547675	0.1310	58.16373	0.1074	Not Significant (p-value close to 0.10, suggests Increase)
CE_pos	Constellation Energy	Constellation Green Bond Issuance	-0.523686	0.6887	36.22318	0.7604	Not Significant
SA_pos	Saudi Aramco	Saudi Aramco DAC Launch	-0.913189	0.1147	57.18825	0.2676	Not Significant
CH_pos2	Chevron	Chevron-ION Clean Energy Investment	0.230182	0.7845	19.78922	0.7657	Not Significant
GE_pos	GE Vernova	GE Vernova Sustainability Report	-0.591060	0.5799	-42.54266	0.2218	Not Significant
VW_pos	Vestas Wind Systems	Vestas Global Sustainability Ranking	-2.475162	0.0789	-150.7576	0.0690	Significant at 10% (Decrease)
IB_pos2	Iberdrola	Iberdrola Share-Linked Green Bond	0.303164	0.1664	10.78094	0.4208	Not Significant

Source: personal computations

Table 10: Summary of Robustness Results for Hypothesis 4 – Impact of Negative ESG Events on Beta (S&P 500 Energy Benchmark)

Event ID	Company	Event Name	Original	Original p-value	Robust S&P500	Robust p-value S&P500	Significance & Direction of Change in Beta (Robustness)
SH_neg1	Shell	Dutch Court Emission Ruling	0.157495	0.9076	8.936951	0.9275	Not Significant
SA_neg	Saudi Aramco	Greenwashing Allegation	0.048805	0.9343	8.946225	0.8026	Not Significant
EX_neg	ExxonMobil	ExxonMobil Lawsuit Against Shareholder	-0.644380	0.4721	48.98746	0.2930	Not Significant
SH_neg2	Shell	Shell Energy Transition Strategy	-0.281215	0.8201	-28.98844	0.7605	Not Significant (Direction contrary to H4)
GE_neg	GE Vernova	Vineyard Wind Turbine Failure	0.243542	0.4719	-137.3277	0.0043	Significant at 1% (Decrease) (Direction contrary to H4)
IB_neg1	Iberdrola	Iberdrola LNG Arbitration Dispute	-0.802738	0.2425	-5.395016	0.8619	Not Significant (Direction contrary to H4)

Source: personal computations

For positive events, the initial counterintuitive increase in beta for BP (BP_pos1) disappeared. However, Chevron's acquisition (CH_pos1) now showed a statistically significant decrease in beta, providing some robust support for the de-risking hypothesis for that specific event, while the finding for Vestas (VW_pos) remained stable. Most strikingly, for negative events, the turbine failure for GE Vernova (GE_neg) now produced a statistically significant decrease in beta at the 1% level (p=0.0043). This result directly opposes Hypothesis 4 and suggests a complex market reaction that defies simple theoretical predictions.

Discussion and Conclusion

The empirical findings presented in the preceding chapter offer a nuanced, and in many respects counter-narrative, perspective on the short-term financial impact of ESG event announcements in the energy sector. The general absence of statistically significant and robust market reactions invites a deeper examination of how investors process ESG information and challenges some straightforward theoretical predictions. This section interprets these results, compares them with the established literature, discusses their practical implications for key stakeholders, and outlines the study's limitations and avenues for future research.

Interpretation of Key Findings

The central and most striking finding of this study is the pervasive lack of a strong, consistent, and statistically significant market reaction to the curated set of 20 distinct ESG events. The overwhelming conclusion is one of market reticence. Neither positive announcements of strategic ESG initiatives nor negative disclosures of adverse events consistently prompted the significant abnormal returns or shifts in systematic risk that foundational financial theories might predict.

The initial, statistically significant positive CARs observed for ExxonMobil's low-carbon venture (EX_pos1) and Chevron's renewable energy acquisition (CH_pos1) appeared to be exceptions. However, their fragility, as revealed by the robustness check in which their significance evaporated relative to a sector-specific benchmark, is a profound finding in itself. It suggests that what might appear to be an event-specific abnormal return could, in fact, reflect broader industry trends or beta effects not fully captured by a global market index. The market, it seems, did not unequivocally reward these firms with a valuation premium that was robust to alternative analytical specifications.

Similarly, the complete absence of statistically significant negative CARs following adverse news — such as regulatory rulings or greenwashing allegations — is equally telling. This does not necessarily imply that such events are inconsequential; rather, it suggests that their financial impact may be perceived by the market as either long-term in nature, already priced in due to prior expectations, or not sufficiently material to warrant an immediate, statistically identifiable revaluation amid daily market volatility.

The analysis of market beta yielded perhaps the most complex results. The general lack of significant changes suggests that single-event announcements are typically insufficient to cause an immediate, broad-based reassessment of a company's fundamental risk profile. The isolated instances of significance were themselves contradictory: the derisking effect observed for Vestas (VW_pos) and, in the robustness test, for Chevron (CH_pos1) aligns with theory, but the counterintuitive, significant decrease in beta for GE Vernova (GE_neg) following a negative event defies simple explanation and highlights the highly context-dependent nature of risk perception.

Comparison with Prior Literature and Theoretical Implications

These findings offer a valuable, granular counterpoint to the existing literature and have important implications for applying core financial theories to ESG information.

Implications for the Efficient Market Hypothesis (EMH): While the EMH (Fama, 1970) posits a rapid incorporation of new, value-relevant information, this study's findings suggest that the processing of ESG news is more complex. The muted

reactions could imply several possibilities within an EMH framework: (a) the market did not consistently perceive these discrete events as sufficiently material to justify immediate revaluation; (b) the informational content of the announcements was largely anticipated and already reflected in prices; or (c) the inherent ambiguity and non-financial nature of some ESG information leads to a slower, more diffuse, or less uniform processing compared to conventional financial data.

Implications for Signalling Theory: The general lack of strong market reactions challenges a simplistic application of Signalling Theory (Spence, 1973). It suggests that in the highly scrutinised energy sector, many individual ESG announcements may function as weak or noisy signals. The market appears to be discerning, potentially discounting aspirational goals or announcements that lack immediate, substantial capital commitments. This aligns with literature emphasising the paramount importance of signal credibility (Cuartas, 2024) and suggests that investors are wary of "greenwashing" (Hussain et al., 2024), demanding substantive action over performative discourse.

Comparison with Aggregate ESG Score Literature: The results do not necessarily contradict the broad findings of studies like the meta-analysis by Friede et al. (2015), which found a non-negative long-term link between aggregate ESG scores and financial performance. Instead, this study highlights a critical distinction: the path from individual corporate actions to sustained impact on overall ESG performance and long-term valuation is likely a slow, cumulative process, not one that is always reflected in immediate, statistically significant reactions to every announcement.

Practical and Managerial Implications

The findings of this study yield several actionable recommendations for key stakeholders:

For Corporate Leaders and Managers: The primary takeaway for energy companies is to prioritise substance over signalling. Management should focus on the genuine integration of a robust, long-term ESG strategy into core business operations, capital allocation, and risk management. Expecting immediate, positive stock price movements from individual announcements is likely unrealistic. The market's muted response suggests that credibility is built over time through consistent, tangible actions, not a high volume of press releases.

For Investors: The results serve as a caution against event-driven trading strategies based solely on individual ESG news releases. Such an approach is unlikely to yield consistent alpha. A more prudent strategy would involve a holistic, long-term assessment of a company's ESG performance, its strategic positioning for the energy transition, and the credibility of its management, rather than attempting to time short-term market reactions.

For Policymakers and Regulators: The complexity and nuance of market reactions underscore the continued need for standardised, mandatory, and

reliable ESG disclosure frameworks. Clear and comparable information reduces asymmetry and can help the market price ESG risks and opportunities more efficiently over the long run, even if immediate reactions to single events are inconsistent.

Limitations and Avenues for Future Research

This study's conclusions are framed by certain limitations that simultaneously offer clear directions for future research. The most significant constraint was the limited number of distinct events per company (the "small N" problem), which restricts statistical power. Future studies utilising larger, multi-industry datasets over longer time horizons could provide more generalizable findings. Furthermore, this study relied on a single-factor market model; the inclusion of multi-factor models (e.g., Fama-French) and other control variables (e.g., firm size, leverage) could help to isolate the ESG event effect more precisely. Future research could also develop more nuanced event classifications beyond a simple positive/negative dichotomy, incorporating measures of materiality or capital commitment. Finally, while this study focused on short-term market reactions, investigating the long-term impacts of these events on other financial metrics, such as the cost of capital, profitability, and credit ratings, remains a crucial area for exploration.

Conclusion

This paper set out to investigate the short-term financial market impact of specific ESG event announcements in the energy sector, a critical nexus of global economic activity and the sustainability transition. By employing a rigorous event study methodology to analyse both abnormal returns and changes in systematic risk for a sample of traditional and renewable energy firms from 2020 to 2025, the study sought to move beyond aggregate ratings and to uncover how the market processes discrete ESG-related news in real time.

The primary conclusion of this research is that the market's immediate reaction to such events is overwhelmingly one of restraint. The empirical evidence revealed a general lack of statistically significant and robust abnormal returns for both positive and negative announcements. The few initially significant findings were not stable to changes in the analytical framework, highlighting a profound sensitivity to methodological choices. Similarly, the study found no consistent evidence that these events led to an immediate and significant reassessment of the companies' systematic risk profiles.

The main contribution of this paper, therefore, is to provide nuanced, data-driven evidence that challenges the assumption of a simple, direct, and immediate causal link between individual ESG announcements and short-term

stock market performance. The findings suggest that investors in the energy sector, rather than reacting impulsively to every news item, may adopt a more discerning, long-term perspective, weighing the credibility, materiality, and strategic substance of ESG actions. In the intricate dance between corporate sustainability signalling and market valuation, the immediate response is not always thunderous applause or resounding condemnation, but more often a discerning, telling silence that calls for a deeper focus on substantive, long-term value creation. ■

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Appendix: List of ESG Events

The color coding in the appendix event table is a simple visual key to help quickly distinguish between the two event categories used throughout the study. Events marked in green are those classified as "Positive" ESG events. These are announcements that are generally perceived as beneficial to the company's ESG profile and stakeholder relations. Events marked in red are those classified as "Negative" ESG events. These are disclosures or occurrences that are generally perceived as detrimental to the company's ESG standing.

The following table details the specific ESG events identified and utilized in this study.

Table A: ESG Events

Date	Company	Event Type	Event Description	Event Name	Event ID
12/02/2020	BP	Positive	Announced ambition to become a net-zero company by 2050 or sooner.	BP Net Zero Goal Announcement	BP_pos1
15/12/2020	Shell	Positive	Partners announced Final Investment Decision (FID) for Phase 1 of the Northern Lights CO2 storage project.	Northern Lights CO2 Storage FID	SH_pos
01/02/2021	ExxonMobil	Positive	Launched ‚ExxonMobil Low Carbon Solutions' business to commercialize CCS technology.	ExxonMobil Low Carbon Solutions Launch	EX_pos1
21/05/2021	Iberdrola	Positive	Reached Final Investment Decision (FID) for Vineyard Wind 1, the first major US offshore wind farm.	Vineyard Wind 1 FID	IB_pos1
26/05/2021	Shell	Negative	Dutch court ordered Shell to cut its global carbon emissions by 45% by 2030 (relative to 2019).	Dutch Court Emission Ruling	SH_neg1
28/02/2022	Chevron	Positive	Announced agreement to acquire Renewable Energy Group (REG), expanding into biofuels.	Chevron-REG Acquisition	CH_pos1
14/06/2022	NextEra Energy	Positive	Announced „Real Zero" goal to eliminate all carbon emissions by 2045.	NextEra Real Zero Goal Announcement	NE_pos
19/10/2022	BP	Positive	Announced agreement to acquire US biogas producer Archaea Energy for $4.1 billion.	BP-Archaea Energy Acquisition	BP_pos2
11/10/2023	ExxonMobil	Positive	Announced agreement to acquire Pioneer Natural Resources in a major shale oil deal.	ExxonMobil-Pioneer Acquisition	EX_pos2
28/11/2023	Saudi Aramco	Negative	Faced greenwashing accusations via ClientEarth complaint submitted to OECD (UK NCP).	Greenwashing Allegation	SA_neg
21/01/2024	ExxonMobil	Negative	Filed lawsuit to block climate shareholder proposal (Arjuna Capital).	ExxonMobil Lawsuit Against Shareholder	EX_neg
14/03/2024	Shell	Negative	Released Energy Transition Strategy update, weakening 2030 carbon intensity target.	Shell Energy Transition Strategy	SH_neg2
18/03/2024	Constellation Energy	Positive	Issued $900M green bond to fund nuclear energy investment.	Constellation Green Bond Issuance	CE_pos
20/03/2024	Saudi Aramco	Positive	Launched first direct air capture test unit in Saudi Arabia.	Saudi Aramco DAC Launch	SA_pos
04/04/2024	Chevron	Positive	Announced $45M lead investment in carbon capture company ION Clean Energy.	Chevron-ION Clean Energy Investment	CH_pos2
13/07/2024	GE Vernova	Negative	Wind turbine blade failure occurred at Vineyard Wind farm.	Vineyard Wind Turbine Failure	GE_neg
30/07/2024	Iberdrola	Negative	News broke regarding ~$535M arbitration claim over LNG contract (Pavilion Energy).	Iberdrola LNG Arbitration Dispute	IB_neg1

Date	Company	Event Type	Event Description	Event Name	Event ID
18/09/2024	GE Vernova	Positive	Released first sustainability report post-spinoff.	GE Vernova Sustainability Report	GE_pos
15/01/2025	Vestas Wind Systems	Positive	Ranked #2 sustainable company globally by Corporate Knights (Global 100 list).	Vestas Global Sustainability Ranking	VW_pos
21/03/2025	Iberdrola	Positive	Issued €500M share price-linked green bond.	Iberdrola Share-Linked Green Bond	IB_pos2

Source: official company press releases or major financial news outlets