Firms, Oil Shocks, and SBTi Validation: An Empirical Analysis of Climate Targeting and Capital Markt Reactions

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Abstract

This thesis “Firms, Oil Shocks, and SBTi Validation: An Empirical Analysis of Climate Targeting and Capital Markt Reactions” by Tom Sebastian Wallner investigates the determinants and capital market implications of Science Based Targets initiative (SBTi) certification among publicly listed firms in Europe and the United States. Despite the increasing relevance of science-based climate commitments, little is known about the firm-level drivers of SBTi validation or how such commitments are perceived by financial markets under conditions of systemic energy shocks. Using a comprehensive dataset of 3,281 firms, the first part of the analysis employs OLS regression to identify significant predictors of SBTi validation, including ESG scores, profitability, company size, and emissions intensity. The second part applies an event study methodology to assess whether SBTi-validated firms respond differently to systematic oil price shocks compared to their non-validated counterparts. The results show that SBTi-validated firms in Europe exhibit significantly weaker abnormal stock price reactions to both positive and negative oil shocks, suggesting a degree of short-term market resilience. Although this effect is less pronounced in the U.S. sample, the overall findings support the hypothesis that externally validated climate targets may serve as credible signals of reduced transition risk. This research contributes to the understanding of corporate climate strategy as both a governance mechanism and a financial signal.

Keywords:

SBTi, ESG, oil price shocks, event study, corporate climate strategy, transition risk, logistic regression, sustainability disclosure, Europe, United States

Resumo

Esta tese “Firms, Oil Shocks, and SBTi Validation: An Empirical Analysis of Climate Targeting and Capital Markt Reactions” de Tom Sebastian Wallner investiga os determinantes e as implicações para o mercado de capitais da certificação da Science Based Targets initiative (SBTi) entre empresas de capital aberto na Europa e nos Estados Unidos. Apesar da crescente relevância dos compromissos climáticos baseados na ciência, pouco se sabe sobre os fatores determinantes da validação SBTi ao nível da empresa ou sobre como tais compromissos são percebidos pelos mercados financeiros em condições de choques sistêmicos de energia. Utilizando um conjunto de dados abrangente de 3.281 empresas, a primeira parte da análise emprega regressão OLS para identificar preditores significativos da validação SBTi, incluindo pontuações ESG, rentabilidade, tamanho da empresa e intensidade das emissões. A segunda parte aplica uma metodologia de estudo de eventos para avaliar se as empresas validadas pela SBTi respondem de forma diferente a choques sistemáticos no preço do petróleo em comparação com suas contrapartes não validadas. Os resultados mostram que as empresas validadas pela SBTi na Europa exibem reações anormais significativamente mais fracas nos preços das ações tanto a choques positivos quanto negativos do petróleo, sugerindo um certo grau de resiliência de curto prazo do mercado. Embora esse efeito seja menos pronunciado na amostra dos EUA, os resultados gerais apoiam a hipótese de que metas climáticas validadas externamente podem servir como sinais credíveis de redução do risco de transição. Esta pesquisa contribui para a compreensão da estratégia climática corporativa como um mecanismo de governança e como um sinal financeiro..

Palavras-chave:

SBTi, ESG, choques no preço do petróleo, estudo de eventos, estratégia climática empresarial, , regressão logística, divulgação de sustentabilidade, Europa, Estados Unidos

Contents

1. Introduction

The global transition toward a climate-neutral economy is not only one of the most urgent policy agendas of the 21st century, but also a profound challenge for corporate strategy and financial markets. As climate risks increasingly materialize—both physically and in the form of regulatory pressures—firms are no longer evaluated solely on traditional financial metrics. Instead, environmental performance, transparency, and long-term sustainability strategies are becoming central components of corporate valuation and stakeholder legitimacy.

In this evolving context, companies are under growing pressure to demonstrate credible climate action. While regulatory frameworks continue to develop, many firms have opted to make voluntary commitments to reduce their greenhouse gas (GHG) emissions. Among the most prominent and globally recognized frameworks is the Science Based Targets initiative (SBTi), which enables companies to set emission reduction targets that align with the objectives of the Paris Agreement—specifically, the goal of limiting global warming to 1.5°C. The SBTi provides methodological guidance and third-party validation to ensure the scientific robustness of such targets. Since its establishment in 2015, over 10,000 companies have committed to or been validated by the SBTi, making it a central benchmark for environmental credibility in the ESG landscape.

Despite its global relevance, the SBTi "Companies Taking Action" database has received surprisingly limited attention in academic research. While the initiative plays a growing role in investor communication, climate reporting, and public corporate strategy, little is known about the factors that influence whether firms choose to pursue SBTi validation, and whether such validation has any observable implications for capital market behaviour. In particular, the economic signaling power of SBTi commitments remains underexplored. Do investors interpret them as credible indicators of lower transition risk? Or do they perceive them as symbolic actions, disconnected from a firm's actual risk exposure or future cash flows?

This research is motivated by this empirical gap. It seeks to shed light on two critical aspects of corporate climate commitment: first, the structural determinants that increase the likelihood of a company engaging with the SBTi; and second, the question of whether SBTi validation moderates market reactions to exogenous energy shocks. The latter is of particular relevance, as systematic oil price shocks are widely seen as a proxy for fossil fuel dependency and transition risk. Firms that are strategically aligned with low-carbon pathways should, in theory, be less sensitive to such shocks.

The study therefore addresses the intersection of corporate sustainability strategy, climate communication, and financial market perception. It aims to contribute to the understanding of how climate commitments function not just as internal governance tools, but also as external signals that may—or may not—be priced in by capital markets.

To achieve these goals, the thesis applies a two-stage empirical design. In the first part, an OLS regression is used to assess which firm-level and industry-level characteristics are statistically associated with the likelihood of SBTi validation. This analysis draws on a dataset of over 3,200 publicly listed companies from Europe and the United States, incorporating financial indicators, ESG scores, emissions intensity, and risk metrics. Country and industry fixed effects are used to account for contextual differences in regulatory and sectoral environments.

The second part employs a market-based event study to evaluate whether SBTi-validated firms exhibit different stock price behaviour during periods of systematic oil price shocks. For this purpose, a sample of 110 SBTi-validated firms (as of January 1, 2022) was matched with non-validated counterparts based on firm size, industry, and country using nearest-neighbour matching. Abnormal returns were calculated over a 7-day event window (–3, +3) using the Fama-French 5-factor model, and differences between groups were tested using paired t-tests. The underlying idea is to assess whether SBTi validation signals structural differences in fossil exposure or climate-related risk management that become visible under market stress.

This study makes a contribution to the growing field of empirical sustainability research by combining firm-level predictive analysis with market-based outcome evaluation. It also aims to generate insights of practical relevance—for corporate decision-makers seeking to understand the strategic value of SBTi participation, for investors aiming to interpret climate signals, and for regulators and academics interested in the effectiveness of voluntary climate governance.

The remainder of this thesis is structured as follows: Chapter 2 reviews the relevant literature on voluntary climate commitments, investor behaviour, and the pricing of climate risks. Chapter 3 develops the hypotheses Chapter 4 introduces the dataset and variable construction. Chapter 5 presents the empirical methodology. Chapter 6 reports the results of the regression and event study analyses. Chapter 7 provides a critical discussion of the findings, their limitations, and their implications. Finally, Chapter 8 concludes with key takeaways and suggestions for future research.

2. Literature Review

This chapter provides a structured overview of the existing literature relevant to the empirical and theoretical foundations of this thesis. It explores the institutional role and validation framework of the Science Based Targets initiative (SBTi), examines the financial implications of climate change at the firm level, and analyses how capital markets and investors respond to climate-related risks and disclosures. Moreover, it highlights the complex relationship between voluntary climate commitments and firm valuation, with particular emphasis on the credibility and market perception of such pledges. The final section discusses how exogenous financial shocks—such as oil price volatility—interact with environmental transparency and corporate risk management strategies. Together, these strands of literature form the conceptual basis for the study's dual focus on the determinants and capital market effects of SBTi validation.

2.1. SBTi Initiative and SBTi Targets

The Science Based Targets initiative (SBTi) is a climate protection organisation for companies that enables companies and financial institutions worldwide to do their part to combat the climate crisis and was established in 2015. The initiative develops standards, tools and guidelines that enable companies to set greenhouse gas emission reduction targets that meet the requirements needed to keep global warming below catastrophic levels and achieve net zero by 2050 at the latest. It serves as a central element in enabling companies to harmonise their climate targets with the requirements of the Paris Climate Agreement and have their reduction plans validated[1]. So far, over 10,000 companies (as of Feb 2025) worldwide have been validated. The targets are considered 'science-based' if they are in line with what is necessary according to the latest climate science to achieve the goals of the Paris Agreement - limiting global warming to 1.5 °C above pre-industrial levels.[2]

The SBTi is a non-profit organisation with a subsidiary providing target validation services. Partners of the initiative are the Carbon Disclosure Project (CDP), United Nations Global Compact, the We Mean Business Coalition, the World Resources Institute (WRI) and the Worldwide Fund for Nature (WWF).[3]

The Science Based Targets Initiative (SBTi) sets clear criteria for setting climate targets to help companies and financial institutions reduce their emissions in line with climate science. The targets are based on three main categories: 1.5°C targets, well-below 2°C targets and 2°C

[1] SBTi Standard Operating Procedure (SOP) for Development of SBTi Standards, Version 1.0, December 2023
[2] https://sciencebasedtargets.org/net-zero
[3] SBTi Standard Operating Procedure (SOP) for Development of SBTi Standards, Version 1.0, December 2023

targets, with the most ambitious targets aiming to limit global warming to 1.5°C. Companies must focus on short and long-term reduction targets, taking into account all emission scopes (Scopes 1, 2 and 3). In addition, there are sector-specific standards, e.g. for cement, agriculture and forestry or financial institutions, which define specific requirements depending on the industry sector. All targets must be scientifically sound, verifiable and aligned with existing regulatory requirements to ensure credible and transparent emission reductions.[4]

2.2. Climate Change on Firm Level

This subchapter examines the impact of climate change at the firm level from multiple perspectives.

It is structured around three core thematic areas: First, it analyses the extent to which individual firms are exposed to climate-related risks and the potential financial consequences that may result (Exposure and Downside Risk). The focus then shifts to the role of investors, whose growing consideration of climate-related risks increasingly influences investment decisions and corporate behaviour. Finally, the chapter investigates the effectiveness of voluntary corporate climate commitments, such as those made under the Science Based Targets initiative (SBTi) or the Carbon Disclosure Project (CDP). Empirical evidence suggests that while transparency is rewarded by capital markets, the mere existence of voluntary pledges is often not associated with measurable progress or favourable market valuation.

2.2.1. Exposure und Downside risk

In recent years, firm-level climate-related risks have gained considerable academic and practical relevance. The central focus of the literature lies in examining the extent to which companies are financially exposed to physical, regulatory, or technological climate risks, and the resulting downside risks stemming from such exposure. A particularly insightful contribution to this area is provided by Sautner et al. (2023), who analyze firm-level climate change exposure using earnings call transcripts. Their findings reveal a pronounced heterogeneity in both the perception and salience of climate risks among corporate managers. Remarkably, such differences persist even within the same industry, indicating that climate risk exposure is highly firm-specific. Firms with higher exposure tend to invest significantly less in research and development and are more likely to experience employment losses.

Ilhan et al. (2024) further show that companies with higher carbon intensity are associated with lower price-to-earnings (P/E) ratios and more pessimistic analyst forecasts regarding future

[4] SBTi Standard Operating Procedure (SOP) for Development of SBTi Standards, Version 1.0, December 2023

profitability. These findings suggest that capital markets partially price in climate-related risks, which manifests as valuation discounts for high-emission firms.

A key mechanism for mitigating climate-related risks is transparency. Aldy et al. (2024) demonstrate that companies which voluntarily disclose their emissions, particularly Scope 1 and Scope 2, through platforms such as the Carbon Disclosure Project (CDP) benefit from valuation premiums. However, the same study finds that the mere existence of climate commitments, such as targets reported through SBTi or CDP, has little to no measurable impact on firm valuation. One plausible explanation for this observation is that investors have become increasingly sceptical of potential greenwashing. Consequently, they attribute greater value to detailed, quantitative disclosures on emission intensity and related metrics than to qualitative or aspirational climate pledges.

In sum, recent research underscores the financial materiality of corporate climate risk exposure. The literature provides growing evidence that capital markets reflect firms' climate risks through both valuation discounts and increased downside risk. Voluntary climate disclosures are rewarded by markets, but only when they are perceived as credible, data-driven, and transparent.

2.2.2. Investor perspective

The role of investors in shaping corporate responses to climate change has also undergone a notable transformation. In a comprehensive survey conducted by Krueger, Sautner, and Starks (2020), institutional investors were asked about their integration of climate risks into investment processes. The findings reveal that investors already consider regulatory climate risks as financially material. Preferred instruments for addressing such risks include engagement, such as shareholder dialogue and resolutions and risk management strategies. Notably, divestment is not seen as an effective or commonly used approach. According to the authors, investors' ESG motivations are driven by both financial and non-financial considerations, including reputational concerns, moral responsibility, and long-term risk assessment.

Complementing this, Bolton and Kacperczyk (2020) present empirical evidence that carbon-intensive firms tend to deliver higher returns. They attribute this to a so-called "carbon premium," whereby investors demand higher expected returns in exchange for exposure to climate-related risks. However, this premium is not universally captured, as many institutional investors actively avoid high-emission firms, particularly in emission-sensitive industries.

In a follow-up study, Bolton and Kacperczyk (2023) examine the impact of carbon disclosure on firms' cost of capital. Their analysis shows that companies which voluntarily report Scope 1 and Scope 2 emissions benefit from significantly lower capital costs. This indicates that capital markets reward credible transparency regarding climate-related information.

Further, Krueger et al. (2024) find that mandatory ESG disclosure requirements lead to a significant improvement in stock liquidity. These effects are especially pronounced when disclosure is mandated and enforced by governmental authorities. Moreover, the positive impact is stronger for firms that previously exhibited weak ESG transparency and operate in markets with high investor demand for ESG information. The authors base their findings on a large-scale analysis of 17,860 firms across 65 countries.

Further support for the financial relevance of investor engagement is provided by Hoepner et al. (2021), who show that sustainability-focused shareholder engagement reduces downside volatility at the firm level. This effect is particularly strong for carbon-intensive firms, suggesting that investors target those companies where climate-related financial risks are most acute. Thus, engagement serves not only as a moral or reputational signal but also as a tool to enhance firms' risk-adjusted performance.

Another interesting finding is how retail investors perceive this issue: Choi, Gao, and Jiang (2020) show that investor behaviour is also shaped by experiential triggers: during abnormally warm months, retail investors, unlike institutional investors, reduce their holdings in carbon-intensive firms, leading to underperformance of such stocks. This reaction is driven less by changes in fundamentals and more by increased public attention to climate change, as proxied by Google search volume. The authors demonstrate that local weather anomalies can act as salient cues that heighten climate awareness, influencing belief formation and market behavior even in the absence of new information

2.2.3. Firm Commitments

A central element of corporate climate strategy for many firms has been the voluntary commitment to reduce greenhouse gas emissions through initiatives such as the Science Based Targets initiative (SBTi) and the Carbon Disclosure Project (CDP). These programs offer formalized frameworks for setting emission reduction goals. The adoption of such voluntary climate targets accelerated notably after the 2015 Paris Agreement, which triggered a wave of corporate pledges, most prominently through CDP and increasingly through SBTi. According to Aldy et al. (2024), approximately one-quarter of large U.S. corporations now disclose carbon reduction goals via CDP. However, only about 4% of the firms analysed had received SBTi

validation, which is considered more stringent due to its requirement for clearly defined decarbonization pathways.

A central issue associated with such commitments is their highly variable quality and lack of compliance. In their study Behind Schedule, Aldy et al. (2024) show that, assuming linear progress, 56% of companies fall short of their self-declared reduction trajectories. Over the decade from 2010 to 2020, the average deviation from announced targets was approximately six percentage points. The authors attribute this shortfall to overambitious target-setting, a lack of regulatory enforcement mechanisms, and exogenous shocks such as energy crises. Despite these widespread failures, capital markets do not appear to penalize firms. On the contrary, in some cases, companies have even been rewarded for relaxing their climate ambitions. For instance, BP scaled back its emissions targets in 2023 and experienced positive stock price reactions in response (Aldy et al., 2024).

Bolton and Kacperczyk (2023), in their study Firm Commitments, examine firm-level characteristics that predict the likelihood of voluntary climate pledges. They find that companies with already low carbon intensity, strong governance structures, and a high share of ESG-oriented investors are significantly more likely to adopt CDP or SBTi commitments. This suggests a selection effect: firms with limited decarbonization capacity may strategically avoid committing, which raises the concern that observed benefits (e.g., lower emissions) may be driven more by firm selection than by the commitment itself.

In a related empirical analysis, Aldy et al. (2024) examine whether such commitments are associated with firm valuation, using price-to-earnings (P/E) ratios as a proxy. They find that neither SBTi nor CDP pledges are significantly correlated with higher valuations. This stands in stark contrast to the valuation effects of carbon disclosure, where credible transparency, especially regarding Scope 1 and 2 emissions, is associated with a reduction in valuation discounts. The authors argue that capital markets have become increasingly skeptical of voluntary pledges and instead respond primarily to measurable progress or mandatory regulatory changes.

In the Behind Schedule study, Aldy et al. (2024) further analyze which sectors are most prone to missing their climate targets. Communication services, information technology, and materials show the largest deviations, while utilities tend to stay closer to their projected reduction paths. At the firm level, high Scope 3 emissions and rapid revenue growth are associated with a greater likelihood of falling short. In contrast, firms with longer-term targets

(e.g., 2050) tend to perform better—possibly because they adopt more realistic and gradual decarbonization pathways.

Overall, the literature suggests that while voluntary climate commitments have proliferated in recent years, they are not necessarily reliable indicators of credible climate strategy. Empirical evidence indicates that many firms fail to meet their own targets, and capital markets rarely penalize such underperformance. The effectiveness of climate commitments depends heavily on their supporting structures: transparency, interim milestones, and external accountability. In the absence of these elements, the risk of greenwashing remains high.

2.3. Financial Risk and Hedging Strategies

While much of the literature on climate-related financial risk focuses on firms' exposure and investor responses, a growing body of research highlights the role of financial shocks and hedging mechanisms in shaping firm outcomes and market behaviour. This chapter examines how exogenous events, such as oil price volatility and climate news, transmit into corporate financial risk, and how firms and investors can mitigate these effects through disclosure practices and asset-based hedging strategies. It is structured around three core dimensions: the financial impact of oil price shocks, the role of environmental disclosure as a moderating mechanism, and the construction of climate hedge portfolios in financial markets.

2.3.1. Oil Price Shocks and Corporate Financial Risk

Sun (2025) analyzes the heterogeneous effects of oil price shocks on corporate financial risk by decomposing oil price volatility into supply, demand, and risk shocks. Using a large panel of Chinese listed firms, the study finds that oil shocks—particularly supply-driven—significantly increase firms' financial distress, as measured by the Altman Z-score and KZ index. The effect is especially pronounced in privately owned firms and energy-intensive industries, which tend to face tighter financing constraints and are more exposed to energy input cost fluctuations. Moreover, these shocks operate through two primary mechanisms: increasing financing constraints and amplifying agency conflicts due to heightened uncertainty. The findings underscore the importance of differentiating between types of oil shocks when assessing their economic impact.

2.3.2. Environmental Disclosure as a Moderating Mechanism

A central finding of the study by Sun (2025) is the risk-mitigating role of environmental disclosure. Firms that disclose emissions targets, environmental activities, or participate in voluntary reporting schemes (e.g., CSR reports, CDP, ESG ratings) show significantly lower

sensitivity to oil price shocks. These disclosures reduce information asymmetries, improve access to capital, and signal long-term risk management capabilities to investors. The moderating effect is particularly strong for firms with historically limited transparency or in regions with weak regulatory enforcement. Additional robustness tests confirm that both qualitative reporting and third-party ESG scores (e.g., Sustainalytics, MSCI) contribute to reducing exposure to energy-related financial shocks, though variations exist depending on the disclosure type and data provider.

2.3.3. Hedging Climate Risk through Financial Markets

Engle et al. (2020) propose a dynamic hedging strategy for climate-related financial risks by constructing portfolios that track innovations in climate news. Using textual analysis of media sources, the authors build climate news indices—both general and sentiment-based—and use a mimicking portfolio approach to identify stocks that respond positively to negative climate news. These hedge portfolios, constructed based on ESG characteristics (notably from Sustainalytics), are industry-balanced and outperform ETF-based strategies (e.g., clean vs. fossil energy tilts) in both in-sample and out-of-sample tests. The results suggest that investors can hedge long-term climate exposure by systematically overweighting stocks with lower climate sensitivity and stronger ESG performance. Additionally, these strategies reinforce the role of capital markets in pricing climate risks and rewarding credible environmental practices.

2.4 Firm characteristics

Based on existing research, key determinants have been identified that significantly influence the likelihood of companies setting climate-related targets. Both company-specific and industry-specific characteristics are considered crucial drivers of corporate sustainability engagement in the academic literature. These insights serve as the foundation for selecting the firm-level variables that were incorporated in the first part of this study. The following sections provide a differentiated overview of these influencing factors.

2.4.1. Company-specific factors include

A) Company size: larger companies are more inclined to set climate reduction targets due to their higher public requirements (Reverte, 2009; Gamerschlag et al. 2011). B) Financial restrictions: Companies with low financial reserves or high leverage may be less inclined to set ambitious targets (Jensen & Meckling 1976 C) Profitability: Companies with higher profitability have greater resources for sustainable corporate steps and are more willing to publicise climate targets (Ng & Koh, 1994; Pirsch et al., 2007)

2.4.2. Industry-specific factors

A) Industry profile: Companies from emission-intensive industries (e.g. energy, materials, utilities) are under greater public and regulatory pressure and are more inclined to set climate targets (Cowen et al., 1987, Reverte, 2009). B) Country-specific factors: Companies from countries with more restrictive regulatory frameworks and environmental regulations have a stronger focus on sustainability (van der Laan Smith et al. 2005).

3. Development of Hypotheses

This chapter formulates the core hypotheses that guide the empirical investigation of this thesis. Based on the theoretical foundations and prior research reviewed in Chapter 2, the study develops two central hypotheses—one focusing on the determinants of SBTi validation, and the other addressing the capital market response to SBTi-validated firms during periods of systematic oil price shocks. These hypotheses are informed by a combination of signalling theory, stakeholder theory, and institutional theory, all of which suggest that voluntary climate commitments can serve as strategic tools for differentiation, risk signalling, and legitimacy-building in financial markets.

The first research dimension concerns the question of why some firms pursue SBTi validation while others do not, even when operating under similar environmental, regulatory, and sectoral conditions. SBTi validation is a voluntary yet highly standardized commitment to science-based emission reduction targets. As such, it requires not only a willingness to be held accountable but also the operational and financial capacity to meet specific decarbonization benchmarks. Previous literature indicates that firm characteristics such as size, profitability, ESG performance, and emission intensity influence the likelihood of voluntarily adopting climate pledges. Larger firms, for example, are often more exposed to public and investor scrutiny and tend to have more resources for strategic climate management. Higher ESG scores reflect a pre-existing commitment to sustainability, while profitability indicates the availability of internal funds to support emissions reduction programs. Emission intensity, particularly in Scope 1 and Scope 3 categories, can either motivate firms to commit to reductions or, conversely, disincentivize participation due to the high cost or complexity of decarbonization.

In line with these considerations, the first hypothesis is defined as follows:

H1: Firms with stronger ESG performance, higher profitability and larger size are more likely to obtain SBTi validation.

This hypothesis assumes that firms with stronger sustainability performance and financial capacity are more likely to formalize their commitments through SBTi. The inclusion of Scope 3 emission categories acknowledges the growing importance of value chain emissions in the assessment of climate risk and investor perception. Conversely, high downstream emissions may indicate a more carbon-intensive product portfolio, which could reduce the likelihood of successful SBTi validation, either due to reputational risk or technological barriers to emission reductions.

The second hypothesis addresses the capital market implications of SBTi validation. While the economic rationale behind climate commitments is often framed in terms of long-term risk mitigation, investors may also respond to such actions in the short term—especially in periods of heightened market sensitivity. Systematic oil price shocks provide a natural experiment to test how investors perceive firms' structural exposure to fossil energy. According to signalling theory, firms that communicate credible and externally validated sustainability strategies may be seen as less vulnerable to transition risks and more aligned with the expected shift toward a low-carbon economy. If SBTi validation is interpreted as such a signal, capital markets may respond less negatively—or potentially not at all—during periods of fossil energy price volatility.

Hence, the second hypothesis is stated as:

H2: SBTi-validated firms exhibit significantly weaker abnormal stock price reactions to systematic oil price shocks compared to non-validated counterparts.

This hypothesis will be tested using an event study methodology, focusing on abnormal returns over a [-3, +3] day window around the dates of identified oil price shocks. The analysis compares the performance of SBTi-validated firms to that of matched non-validated firms within both the U.S. and European subsamples. A paired t-test is applied to evaluate the statistical significance of return differences, controlling for size, sector, and geography through nearest-neighbor matching.

In formulating these hypotheses, the thesis aims to contribute to two strands of literature: first, the determinants of voluntary sustainability commitments in corporate strategy; and second, the financial materiality of such commitments under real-world market conditions. In both cases, SBTi validation serves as a concrete and standardized proxy for a firm's climate ambition and risk posture, enabling a structured and comparative analysis.

The following chapters will operationalize these hypotheses through a detailed description of the dataset (Chapter 4), methodological approach (Chapter 5), and empirical results (Chapter 6 and 7), before returning to these guiding assumptions in the final discussion and conclusion.

4 Data

This chapter outlines the data foundation for the empirical analyses conducted in this study. It describes the process of defining and selecting the relevant company universe and provides a detailed account of the data sources, filtering criteria, and matching procedures used to construct the final dataset. The focus lies on creating a robust and representative sample of U.S. and European firms that allows for meaningful investigation into the determinants of SBTi validation. Particular attention is paid to the integration of financial, environmental, and market-based variables that jointly capture firms' operational performance, sustainability profile, and risk characteristics. By combining structured firm-level data with publicly disclosed SBTi target information, this chapter establishes the empirical basis for the prediction and comparative analyses that follow.

4.1 Data collection and sample selection – Determinant analysis of SBTi validation

For the first part of the research—namely, the prediction exercise aimed at explaining SBTi validation based on specifically selected firm characteristics—the entire available dataset of companies from the United States and European countries (hereafter jointly referred to as "Europe") was extracted from the Refinitiv database and consolidated into a single dataset.

The overall universe of publicly listed companies in Refinitiv comprises approximately 67,400 entities. For the purposes of this study, only firms were considered that reported both a revenue and a market capitalization greater than zero in the most recent fiscal year, and for which data on the following firm characteristics were available:

- Gross Profit Margin (%)
- EBITDA Margin (%)
- EBIT Margin (%)
- Operating Margin (%)
- Net Debt to Total Capital
- ESG Score (Refinitiv)
- Scope 1, 2, and 3 Estimated Total Emissions
- Scope 1 Emissions to Revenue
- Scope 2 Emissions to Revenue

- Scope 3 Upstream Emissions to Revenue
- Scope 3 Downstream Emissions to Revenue
- Total Return over 3 Months
- Total Return over 6 Months
- Weekly Sharpe Ratio over 2 Years
- Five-Year Beta
- 60-Day Volatility
- 90-Day Volatility
- 120-Day Volatility
- Weekly Alpha over 2 Years

The resulting subset of firms from the U.S. and Europe with complete data on these characteristics comprises 3,281 companies. Within this dataset, companies that have received SBTi validation for their climate targets were identified and marked with a binary (dummy) variable (1 = validated reduction targets via SBTi, hereafter referred to as "SBTi-validated").

Information on which companies have obtained SBTi validation was sourced from the SBTi's publicly available "Companies Taking Action" database. This resource lists all currently validated companies, including details such as ISIN (if available), LEI, the status of near-term targets (categorized as "targets set," "committed," "removed," or blank), the classification of near-term targets (e.g., "1.5°C," "1.5°C / 2°C," "1.5°C / well below 2°C," "2°C," "well below 2°C," etc.), target years, long-term target status and classification, net-zero commitment and corresponding target year, organization type (Company, Financial Institution, Small or Medium Enterprise), location, region, sector, announcement date, and target description.

Matching was conducted between the Refinitiv dataset and the SBTi dataset using available ISINs. If a company in the Refinitiv dataset appeared in the SBTi database with a minimum designation of "near-term target set" or "committed," a value of 1 was assigned to the corresponding dummy variable.

4.2 Data collection and sample selection – capital markets reaction on systematic oil shocks

For the second phase of the research, a subset of firms from the existing dataset was identified—specifically, those companies that had received validation from the Science Based Targets initiative (SBTi) no later than January 1st, 2022. These SBTi-validated firms served as the treatment group for the empirical analysis. To construct a suitable control group, a nearest neighbour matching procedure was implemented using Python. This method matched each validated firm with a non-validated counterpart based on relevant firm characteristics, ensuring comparability between the two groups and mitigating potential selection bias.

Following the identification of both the treatment and control firms, historical stock price data for all selected companies were retrieved from Refinitiv Datastream. This data collection provided the basis for conducting the subsequent event study.

In order to calculate the expected returns for each firm, Fama-French Five Factor model data were obtained for the corresponding time period. Specifically, model factors for both the United States and Europe were downloaded, aligned with the geographic focus of the sampled firms. These factors were used to adjust for market-wide influences and isolate the potential impact of SBTi validation on stock performance.

The event window for the study spans from January 3rd, 2022, to December 31st, 2024, covering a period of three full calendar years. This time frame was chosen to capture both short-term and medium-term market responses following SBTi validation, allowing for a robust analysis of any persistent valuation effects associated with corporate climate commitments.

5. Exploratory Data Analysis

The dataset comprises a total of 3,281 companies, of which 2,358 are based in the United States and 923 in Europe. Interestingly, the number of companies with an SBTi (Science-Based Targets initiative) validation is nearly identical across regions—334 in the U.S. and 323 in Europe.

Based on GICS industry classifications, the dataset includes firms from 73 distinct industries. The industries with the highest proportion of SBTi-validated companies include Containers & Packaging, Tobacco, Household Products, Construction Materials, Textiles, Apparel & Luxury Goods, Air Freight & Logistics, IT Services, Transportation Infrastructure, Beverages, and Office REITs. Conversely, industries with the lowest representation of SBTi-validated firms are Hotel & Resort REITs, Consumer Finance, Biotechnology, Energy Equipment & Services,

Oil, Gas & Consumable Fuels, Diversified Consumer Services, Gas Utilities, Insurance, Mortgage Real Estate Investment, and Water Utilities.

Top 10 highest share of SBTi Validations		Top 10 lowest share of SBTi Validations	
Containers & Packaging	67%	Hotel & Resort REITs	7%
Tobacco	60%	Consumer Finance	6%
Household Products	58%	Biotechnology	4%
Construction Materials	50%	Energy Equipment & Services	4%
Textiles, Apparel & Luxury Goods	47%	Oil, Gas & Consumable Fuels	1%
Air Freight & Logistics	42%	Diversified Consumer Services	0%
IT Services	40%	Gas Utilities	0%
Transportation Infrastructure	38%	Insurance	0%
Beverages	38%	Mortgage Real Estate Investment	0%
Office REITs	36%	Water Utilities	0%

Table 1: Share of SBTi Validation per Industry in the data set

The dataset comprises a carefully selected set of financial, environmental, and market-based variables designed to capture a firm's operational performance, sustainability profile, and market dynamics. Financial ratios such as Gross Profit Margin, EBITDA Margin, and Net Debt to Total Capital are included to reflect a company's profitability and capital structure, which are essential indicators of financial health and risk. To account for corporate sustainability, the dataset incorporates Scope 1, 2, and 3 emissions intensities (normalized by revenue) and the Refinitiv ESG Score, offering both quantitative and qualitative assessments of a firm's environmental impact and governance practices. These variables are central to evaluating firms' climate strategies and alignment with science-based targets. Finally, market-based measures such as total returns, 5-year beta, and 90-day volatility are used to capture investor perception, risk, and stock price behaviour over time. These metrics provide insight into how sustainability performance may be reflected in capital market outcomes.

The combination of these variable types allows for a holistic analysis of the relationship between financial performance, environmental responsibility, and market valuation.

Variable	Definition	Source
Company Market Cap	Total market value of all share classes, based on the latest closing prices and most widely reported share types	Refinitiv
Revenue to Market Cap	Total consolidated company revenue, applicable across all industries in Relation to Company Market Cap	Refinitiv
Gross Profit Margin - %	Gross profit as a percentage of total revenue; relevant for industrial, property, investment trust, and financial firms.	Refinitiv
EBITDA Margin - %	EBITDA as a percentage of total revenue; applicable to all industries.	Refinitiv
EBIT Margin - %	EBIT as a percentage of total revenue; applicable to all industries.	Refinitiv
Net Debt to Total Capital	Net debt divided by total capital; a leverage measure valid for all industries.	Refinitiv
ESG Score	Refinitiv ESG Score is an overall company score based on the self-reported information in E, S & G pillars.	Refinitiv
Scope1&2 EstTotal	Combined Scope 1 and 2 emissions in tonnes, normalized by revenues (in million USD).	Refinitiv
Scope1 / Revenues	Direct emissions (Scope 1) in tonnes, normalized by revenues (in million USD).	Refinitiv
Scope2 / Revenues	Indirect emissions from energy use (Scope 2) in tonnes, normalized by revenues (in million USD).	Refinitiv
Scope3US / Revenues	Upstream Scope 3 emissions in tonnes, normalized by revenues (in million USD).	Refinitiv
Scope3DS / Revenues	Downstream Scope 3 emissions in tonnes, normalized by revenues (in million USD).	Refinitiv
TotalReturn3Mo	Cumulative return over the past 3 months, including price changes and dividends.	Refinitiv
TotalReturn6Mo	Cumulative return over the past 6 months, including price changes and dividends.	Refinitiv
BetaFiveYear	Measure of stock price volatility relative to the market over a 5-year period using monthly returns.	Refinitiv
Volatility90D	Annualized standard deviation of daily log returns over the past 90 trading days; indicates short-term price risk.	Refinitiv

Table 2: Firm-specific characteristics for OLS regression

A summary of the dataset comprising both U.S. and European firms is presented below. To minimize the distorting influence of outliers, the data were winsorized at the 10th and 90th percentiles. This ensures that the statistical interpretation remains robust. Despite this adjustment, certain variables, such as Scope emissions and market capitalization, still exhibit substantial dispersion. Profitability measures such as EBITDA and EBIT margins lie in the moderate positive range, though negative minimum values indicate the presence of loss-making firms. Furthermore, variables related to capital markets such as volatility and total return display considerable variability, as is typically observed in financial data.

	count	mean	std	min	25%	50% (median)	75%	max
Company Market Cap	3281.0	6687975610.737	9709035617.716	123635379.7	449907182.064	1876458497.13	7816068026.8	30384739000.0
Revenue to Market Cap	3281.0	1.232	1.339	0.12	0.261	0.655	1.665	4.334
Gross Profit Margin - %	3281.0	45.42	23.345	13.771	25.405	41.788	63.886	85.357
EBITDA Margin - %	3281.0	14.147	16.828	-18.452	5.649	13.967	25.427	41.429
EBIT Margin - %	3281.0	6.941	15.787	-27.023	1.396	8.379	17.403	29.456
Net Debt to Total Capital	3281.0	0.168	0.383	-0.528	-0.099	0.239	0.465	0.698
ESG Score	3281.0	47.106	19.4	18.242	29.837	46.64	64.717	75.999
Scope1&2&3EstTotal	3281.0	2894484.682	4761477.66	13075.633	74728.272	486759.687	2909191.398	14707047.0
Scope1 / Revenues	3281.0	32.657	56.501	0.764	2.64	7.676	21.51	180.326
Scope2 / Revenues	3281.0	22.413	22.277	1.991	5.912	13.984	29.011	73.019
Scope3US / Revenues	3281.0	163.706	127.883	30.146	61.278	124.302	231.266	427.879
Scope3DS / Revenues	3281.0	378.058	517.564	3.234	24.496	123.503	465.676	1581.647
TotalReturn3Mo	3281.0	-1.897	15.309	-24.906	-13.829	-2.939	8.37	25.201
TotalReturn6Mo	3281.0	2.462	21.936	-31.21	-14.69	1.732	17.445	40.606
BetaFiveYear	3281.0	1.064	0.442	0.394	0.702	1.054	1.389	1.788
Volatility90D	3281.0	50.602	21.331	25.498	32.747	45.28	64.46	91.778

Table 3: Descriptive statistics total data set

When examining the summary statistics for non-SBTi-validated firms, it becomes evident that these companies are substantially smaller than the overall sample, with an average market capitalization of USD 3.86 billion. In terms of profitability and ESG performance, their mean values also fall below the global average. Interestingly, the emissions intensity (Scope 1 to Scope 3 per unit of revenue) appears to be comparatively lower. However, this group exhibits the highest average volatility across all segments, at 53.8%.

	count	mean	std	min	25%	50% (median)	75%	max
Company Market Cap	2624.0	3855433177.313	5185281045.96	93047359.6	336059001.058	1294307089.755	4928465088.004	16209811410.08
Revenue to Market Cap	2624.0	1.253	1.38	0.116	0.265	0.663	1.669	4.473
Gross Profit Margin - %	2624.0	45.762	24.477	13.164	24.88	41.698	64.709	88.451
EBITDA Margin - %	2624.0	10.543	22.314	-39.569	4.045	12.784	24.321	41.807
EBIT Margin - %	2624.0	3.223	21.665	-48.035	-0.627	7.447	16.773	29.326
Net Debt to Total Capital	2624.0	0.145	0.415	-0.6	-0.145	0.221	0.471	0.717
ESG Score	2624.0	41.91	17.58	16.575	26.651	41.326	56.733	69.314
Scope1&2&3EstTotal	2624.0	1829515.397	2989434.27	8979.419	49673.862	331629.827	1854527.614	9360853.751
Scope1 / Revenues	2624.0	34.925	60.287	1.039	3.441	7.838	21.55	191.199
Scope2 / Revenues	2624.0	23.032	22.265	2.175	6.72	14.624	29.257	73.438
Scope3US / Revenues	2624.0	150.35	111.879	29.968	60.714	119.691	199.213	380.15
Scope3DS / Revenues	2624.0	400.696	551.841	3.086	24.375	131.852	483.679	1687.39
TotalReturn3Mo	2624.0	-1.597	16.441	-26.526	-14.29	-2.578	9.82	27.35
TotalReturn6Mo	2624.0	2.493	23.468	-33.65	-15.477	1.951	18.175	43.088
BetaFiveYear	2624.0	1.073	0.468	0.367	0.689	1.059	1.415	1.851
Volatility90D	2624.0	53.804	23.235	26.095	34.798	47.708	69.156	98.77

Table 4: Descriptive statistics non-validated companies

In contrast, SBTi-validated firms show a markedly higher average market capitalization of USD 24.1 billion, exceeding both the overall and non-validated groups. Their financial performance is also superior, with EBITDA and EBIT margins averaging 19.8% and 13.2%, respectively, alongside a notably elevated ESG score of 67.5. These firms demonstrate a higher emissions intensity, yet simultaneously report the lowest average volatility, at just 39.6%.

	count	mean	std	min	25%	50% (median)	75%	max
Company Market Cap	657.0	24101155193.835	31288513419.95	689135247.148	2364766058.7	8896099957.643	31287924143.01	97896697500.0
Revenue to Market Cap	657.0	1.146	1.179	0.132	0.246	0.627	1.644	3.754
Gross Profit Margin - %	657.0	44.736	19.776	17.289	27.66	42.093	61.751	75.757
EBITDA Margin - %	657.0	19.794	11.086	5.438	10.459	17.758	28.406	39.981
EBIT Margin - %	657.0	13.159	8.942	1.655	5.535	11.808	19.135	29.715
Net Debt to Total Capital	657.0	0.246	0.263	-0.231	0.08	0.284	0.445	0.613
ESG Score	657.0	67.474	12.346	45.516	58.494	69.679	78.186	83.346
Scope1&2&3EstTotal	657.0	9469986.447	14392745.281	105718.112	439084.19	2295500.0	11843608.508	45190324.363
Scope1 / Revenues	657.0	22.538	37.052	0.389	1.358	6.01	21.275	119.445
Scope2 / Revenues	657.0	19.81	21.861	1.439	3.904	10.561	25.277	69.888
Scope3US / Revenues	657.0	219.69	181.481	30.438	63.029	158.977	336.408	578.009
Scope3DS / Revenues	657.0	298.854	396.611	4.41	24.933	101.832	409.4	1208.834
TotalReturn3Mo	657.0	-3.168	11.391	-20.049	-12.47	-3.839	5.052	16.477
TotalReturn6Mo	657.0	2.062	16.238	-22.247	-10.433	0.756	15.323	28.878
BetaFiveYear	657.0	1.04	0.361	0.485	0.744	1.046	1.321	1.614
Volatility90D	657.0	39.595	12.987	23.581	28.643	36.889	48.637	63.818

Table 5: Descriptive statistics validated companies

In sum, SBTi-validated companies tend to be larger, more profitable, and exhibit stronger ESG performance, albeit with greater emissions intensity across Scopes 1 to 3. Their lower volatility may suggest a more stable market profile, despite offering similar capital market returns.

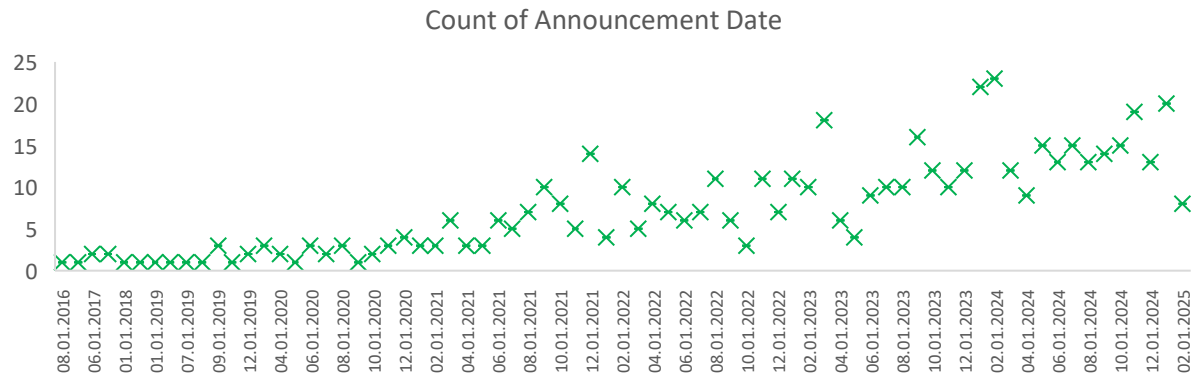

Figure 1: Number of SBTi Validations per date

The time series of Science Based Targets initiative (SBTi) validations reveals a notable surge beginning in mid to late 2021. This increase can be attributed to several key developments in the initiative's governance, methodology, and operational structure.

A major driver was the publication of the Net-Zero Standard in October 2021, which offered the first globally consistent framework for setting corporate net-zero targets aligned with the 1.5°C goal. By clarifying expectations and providing methodological guidance, the standard encouraged broader corporate participation (Science Based Targets initiative, 2021a).

In parallel, the SBTi made the 1.5°C ambition level mandatory for all targets submitted after July 2022. This shift likely accelerated submissions in the months prior to the policy's full implementation (Science Based Targets initiative, 2021b). Moreover, the streamlined SME pathway, introduced in 2020 and increasingly adopted in 2021, significantly reduced entry barriers for small and medium-sized enterprises, further contributing to the rise in validated targets (Science Based Targets initiative, 2021a). Finally, the SBTi undertook substantial capacity-building efforts in 2021, including staff expansion and process optimization, enabling faster and higher-volume validations (Science Based Targets initiative, 2021a).

6 Methodology

This chapter outlines the two-step empirical strategy employed in the thesis. The first part investigates firm-level determinants of SBTi validation using logistic regression. A set of 16 independent variables—covering financial performance, emissions intensity, ESG scores, and risk metrics—was used to predict the likelihood of a firm receiving SBTi validation. To ensure robustness, the data was winsorized, and multicollinearity was addressed through VIF analysis. A second regression model incorporated fixed effects for country (USA vs. Europe) and industry to assess context-specific effects.

In the second part, an event study was conducted to examine whether SBTi-validated firms respond differently to systematic oil price shocks than comparable non-validated firms. The analysis focused on companies that had been SBTi-validated as of January 1, 2022, resulting in 110 firms (61 U.S., 49 Europe). Oil shocks were defined as Brent crude daily returns in the 95th percentile (±3.92%). Four portfolios (SBTi and matched non-SBTi for each region) were constructed using nearest neighbor matching based on size, industry, and country. Abnormal returns were estimated using the Fama-French 5-Factor model over a [-3, +3] event window. Paired t-tests were used to assess the statistical significance of return differences between groups.

6.1 Methodological approach - Determinant analysis of the SBTi validation

In the first part of this study, an Ordinary Least Squares (OLS) regression was conducted to investigate whether selected firm-level characteristics can predict or explain the likelihood of a company being validated by the Science-Based Targets initiative (SBTi). The dependent variable was a binary indicator representing SBTi validation (1 = validated, 0 = not validated).

A total of 16 explanatory variables were selected from four distinct categories: financial performance metrics, market return indicators, sustainability and emissions data, and risk-related measures. To address the influence of extreme values, all independent variables were winsorized at the 10th and 90th percentiles. Prior to estimation, multicollinearity was assessed using a Variance Inflation Factor (VIF) analysis, and variables with excessively high collinearity were removed to ensure model robustness.

The financial performance indicators included profitability measures (Revenue to Market Cap, Gross Profit Margin, EBITDA Margin, EBIT Margin), capital structure (Net Debt to Total Capital), and valuation (Company Market Cap). Market return variables comprised Total Return over 3 and 6 months. Sustainability-related variables included the ESG Score

(Refinitiv), estimated total emissions (Scope 1, 2, and 3), and revenue-normalized emissions metrics: Scope 1 / Revenue, Scope 2 / Revenue, Scope 3 Upstream / Revenue, and Scope 3 Downstream / Revenue. Risk was captured via Beta (5-Year) and 90-day stock price volatility.

The regression model was specified as follows:

$$\begin{aligned}SBTi_i = {} & \beta_0 + \beta_1 \cdot \text{Company Market Cap}_i + \beta_2 \cdot \text{Revenue to Market Cap}_i + \beta_3 \cdot \text{Gross Profit Margin}_i \\ & + \beta_4 \cdot \text{EBITDA Margin}_i + \beta_5 \cdot \text{EBIT Margin}_i + \beta_6 \cdot \text{Net Debt to Total Capital}_i + \beta_7 \cdot \text{ESG Score}_i \\ & + \beta_8 \cdot \text{Scope1\&2\&3 Est. Total}_i + \beta_9 \cdot \text{Scope1 / Revenue}_i + \beta_{10} \cdot \text{Scope2 / Revenue}_i \\ & + \beta_{11} \cdot \text{Scope3 Upstream / Revenue}_i + \beta_{12} \cdot \text{Scope3 Downstream / Revenue}_i \\ & + \beta_{13} \cdot \text{Total Return 3Mo}_i + \beta_{14} \cdot \text{Total Return 6Mo}_i + \beta_{15} \cdot \text{Beta (5Y)} \\ & + \beta_{16} \cdot \text{Volatility 90D}_i +\end{aligned}$$

In a subsequent section, the OLS regression model is re-estimated with the inclusion of two fixed effects—"Country" and "Industry"—in order to more precisely examine whether certain firm-specific characteristics exhibit heterogeneous effects on SBTi validation, contingent upon either the industry in which a firm operates or the geographic location of its headquarters. Given that this research aims to provide a comparative perspective between the United States and Europe as aggregate entities, the variable "Country of Headquarters" is dichotomized into USA and Europe for the purposes of this regression. Consequently, all European firms are consolidated under the term *Europe*. In a subsequent analytical step, the two regions—USA and Europe—are examined independently to explore industry-level differences within each geographical domain.

The regression model was specified as follows:

$$\begin{aligned}SBTi_i = {} & \beta_0 + \beta_1 \cdot \text{Company Market Cap}_i + \beta_2 \cdot \text{Revenue to Market Cap}_i + \beta_3 \cdot \text{Gross Profit Margin}_i \\ & + \beta_4 \cdot \text{EBITDA Margin}_i + \beta_5 \cdot \text{EBIT Margin}_i + \beta_6 \cdot \text{Net Debt to Total Capital}_i + \beta_7 \cdot \text{ESG Score}_i \\ & + \beta_8 \cdot \text{Scope1\&2\&3 Est. Total}_i + \beta_9 \cdot \text{Scope1 / Revenue}_i + \beta_{10} \cdot \text{Scope2 / Revenue}_i \\ & + \beta_{11} \cdot \text{Scope3 Upstream / Revenue}_i + \beta_{12} \cdot \text{Scope3 Downstream / Revenue}_i \\ & + \beta_{13} \cdot \text{Total Return 3Mo}_i + \beta_{14} \cdot \text{Total Return 6Mo}_i + \beta_{15} \cdot \text{Beta (5Y)}_i \\ & + \beta_{16} \cdot \text{Volatility 90D}_i + \varepsilon_i\end{aligned}$$

6.2. Methodological approach – Capital market reactions during systematic oil price shocks

The second part of this research aims to investigate whether companies validated by the Science Based Targets initiative (SBTi) exhibit a significantly different response to systematic oil price shocks compared to their non-SBTi-validated counterparts. For this purpose, firms that have held SBTi validation since at least January 1, 2022, were selected. This process yielded a total of 110 companies, with 61 based in the United States and 49 in Europe. The decision to only use companies with a SBTi Validation since at least January 1, 2022 was based on the amount of companies in the period before.

To identify systematic oil shocks during the observation period, closing prices of the CMCI Brent USD ETC were employed. A "shock" was defined as a daily return of the Brent Crude Oil Index in the 95th percentile, corresponding to positive or negative daily returns of 3.92%. Within the examined timeframe, a total of 40 systematic oil shocks were identified, comprising 26 negative and 14 positive shocks.

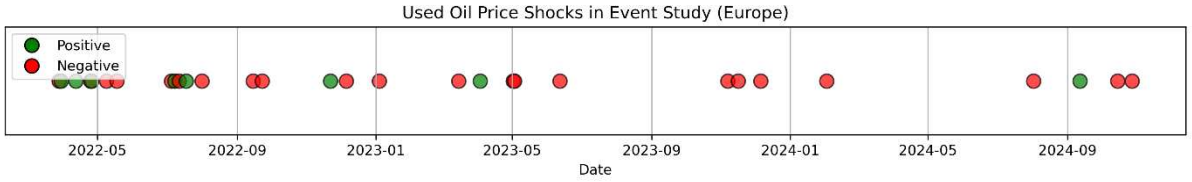

Figure 2: Used Oil Price Shocks in Event Study

In the next step, the returns of four portfolios were calculated: Portfolio (a) Europe SBTi, consisting of SBTi-validated companies headquartered in Europe that have held a validated target since at least January 1, 2022; (b) USA SBTi, comprising SBTi-validated companies headquartered in the United States, also validated since at least January 1, 2022; (c) Europe non-SBTi counterpart, including companies with similar firm characteristics to those in the Europe SBTi portfolio but without SBTi validation; and (d) USA non-SBTi counterpart, consisting of firms with similar characteristics to the USA SBTi portfolio, likewise without SBTi validation. The counterpart portfolios were identified using nearest neighbour matching based on company market capitalization, GICS industry classification, and country of headquarters.

All portfolio returns were calculated on an equal-weighted basis. Separate event studies were then conducted for the European and U.S. portfolios. Cumulative abnormal returns (CARs) were computed using the Fama–French five-factor model within a 7-day event window [-3,

+3]. Following the CAR calculation, a comparative analysis between the SBTi and non-SBTi portfolios was performed. Statistical significance of the results was tested using a paired t-test.

7. Results

Chapter 7 presents the empirical results and is divided into two parts. The first section examines the firm-level determinants of SBTi validation using logistic regression. The analysis finds that companies with higher ESG scores, greater profitability (EBITDA margin), and larger market capitalization are significantly more likely to be validated. Regional and industry effects are also relevant: European firms and those in service- and tech-oriented sectors exhibit higher validation rates. Emission metrics show mixed effects—upstream Scope 3 emissions correlate positively, while downstream and Scope 1 emissions show a negative association with validation. The second section assesses capital market reactions to systematic oil price shocks. In Europe, SBTi-validated firms experienced significantly weaker negative reactions to both positive and negative shocks compared to non-validated peers. For U.S. firms, the trend was similar, though not statistically significant. These findings suggest that SBTi validation may be linked to greater short-term resilience in the face of fossil fuel-related market volatility.

7.1. Determinant analysis of the SBTi validation

The regression results revealed several statistically significant predictors ($p < 0.05$) of SBTi validation status. These include Company Market Cap, Revenue to Market Cap, EBITDA Margin, ESG Score, Scope 1 / Revenue, Scope 3 Upstream / Revenue, Scope 3 Downstream / Revenue, and Volatility (90 days).

The findings suggest that larger companies are more likely to pursue SBTi validation. Firms with higher revenues relative to their market valuation also show a greater likelihood of validation. Operational profitability, as indicated by EBITDA margin, is positively associated with SBTi participation.

Unsurprisingly, the ESG Score emerged as the strongest and most significant predictor—firms with higher ESG performance scores are substantially more likely to be validated.

Interestingly, Scope 3 upstream emissions relative to revenue are positively associated with SBTi validation. This may reflect improved transparency or upstream engagement by more ESG-focused firms. In contrast, Scope 3 downstream emissions have a negative effect, suggesting that firms with carbon-intensive product use (e.g., in transportation or fossil-based end-use sectors) are less likely to be validated. Likewise, firms with high Scope 1 emissions per unit of revenue exhibit a significantly lower probability of validation. Finally, firms with

higher short-term stock volatility (90-day) tend to be less engaged in SBTi validation, possibly reflecting greater market uncertainty or instability.

Several variables demonstrated marginal significance ($0.05 < p < 0.10$), including Gross Profit Margin, Scope 1+2+3 Estimated Total Emissions, and Total Return over 6 months. These results suggest that higher gross profitability may increase the likelihood of validation, and larger emitters (in total) may show slightly higher validation rates—possibly due to their visibility or public pressure. Meanwhile, firms with stronger recent stock performance may be less inclined to pursue validation in the short term.

Variables found to be statistically insignificant ($p > 0.10$) include Net Debt to Total Capital, Scope 2 / Revenue, Total Return over 3 months, and Beta (5-Year). These findings imply that a firm's capital structure, Scope 2 emissions intensity, short-term market returns, and systemic risk exposure are not meaningfully associated with SBTi validation status.

Turning to the results of the fixed effects in the regression model, the following insights emerge: firms headquartered in the United States exhibit a statistically significant negative association with SBTi validation ($p < 0.001$, coefficient = –0.1369), indicating that U.S.-based firms are considerably less likely to be validated by the SBTi compared to their European counterparts. Moreover, several industries display statistically significant positive effects on SBTi validation. Among these, the most pronounced positive coefficients are observed in the Containers & Packaging sector (+0.5711), Textiles, Apparel & Luxury Goods (+0.3690), IT Services (+0.3632), and Software (+0.2402). Additional industries showing significantly positive associations include Household Products, Media, and Real Estate Investment Trusts (REITs)

Variable	Coefficient	t - stat
const	-0.3117	-4.9501
Company Market Cap	0.0000	9.4668
Revenue to Market Cap	0.0035	0.5772
Gross Profit Margin - %	0.0005	1.4369
EBITDA Margin - %	0.0006	0.4660
EBIT Margin - %	-0.0011	-0.8437
Net Debt to Total Capital	-0.0079	-0.4026
ESG Score	0.0058	14.1582
Scope 1&2&3EstTotal	0.0000	3.4462
Scope 1 / Revenues	-0.0005	-2.8497
Scope 3 / Revenues	-0.0004	-1.2148
Scope 3 US / Revenues	0.0003	4.1435
Scope 3 DS / Revenues	-0.0000	-0.9482
TotalReturn3Mo	0.0000	0.0336
TotalReturn6Mo	-0.0002	-0.5049
BetaFiveYear	0.0215	1.3882
Volatility90D	0.0001	0.1866
Containers & Packaging	0.5711	6.5850
Household Products	0.4406	4.0597
IT Services	0.3632	5.3502
Life Sciences Tools & Services	0.3369	4.9056
Media	0.2813	4.2956
Office REITs	0.3632	4.0824
Professional Services	0.3246	5.0486
Software	0.2402	4.0600
Textile, Apparel & Luxury Goods	0.3690	5.3718

Table 6: OLS regression results (USA)

In the next stage of the prediction exercise, industries are analysed separately for the United States and Europe in order to assess which firm-level characteristics most strongly predict the likelihood of SBTi validation within each regional context. A comparison of the respective regression outputs reveals that the ESG Score (USA: coefficient = 0.0046, $p < 0.001$; Europe: coefficient = 0.0084, $p < 0.001$), Company Market Capitalization (USA and Europe: coefficient ≈ 0, $p < 0.001$), and Scope 3 Upstream Emissions relative to Revenue (USA: coefficient = 0.0004, $p < 0.001$; Europe: coefficient = 0.0004, $p = 0.0037$) emerge as the most robust and consistent predictors across both regions.

Notable differences between the two models pertain to operating margin variables: while in the U.S. neither EBITDA nor EBIT margin exhibit a statistically significant association with validation status, in the European sample EBITDA margin shows a positive effect (coefficient

= 0.0068, p = 0.0284), whereas EBIT margin is negatively associated (coefficient = –0.0082, p = 0.0354).

Regarding industry fixed effects, the IT Services sector is positively and significantly associated with SBTi validation in both regions, though the effect is strongest in the U.S. (coefficient = 0.4437, $p < 0.001$). Similarly, Containers & Packaging and Office REITs exhibit strong and significant positive effects in both samples, while Software—like IT Services—shows a particularly strong effect in the U.S. context. In contrast, Multi-Utilities is significant only in Europe, whereas Food Products and Household Products are significant only in the U.S.

Finally, a number of traditional financial indicators—including Net Debt to Total Capital, Volatility, Total Return (3 or 6 Months), as well as Scope 1, Scope 2, and Scope 3 Downstream Emissions—do not exhibit significant effects in either regional model.

Variable	Coefficient	t - stat
const	-0.4854	-3.0870
Company Market Cap	0.0000	2.4107
Revenue to Market Cap	-0.0043	-0.3654
Gross Profit Margin - %	0.0006	0.6925
EBITDA Margin - %	0.0068	2.1960
EBIT Margin - %	-0.0082	-2.1077
Net Debt to Total Capital	-0.0343	-0.5455
ESG Score	0.0084	8.2787
Scope 1&2&3EstTotal	0.0000	2.4924
Scope 1 / Revenues	-0.0005	-1.4552
Scope 3 / Revenues	-0.0012	-1.6381
Scope 3 US / Revenues	0.0004	2.9132
Scope 3 DS / Revenues	-0.0000	-0.9990
TotalReturn3Mo	-0.0016	-0.8612
TotalReturn6Mo	0.0004	0.2431
BetaFiveYear	0.0525	1.2784
Volatility90D	0.0006	0.4728
Air Freight & Logistics	0.5293	3.0469
Containers & Packaging	0.6692	3.3893
Entertainment	0.3769	2.1513
IT-Services	0.2958	2.0337
Multi-Utilities	0.4728	2.4979
Office REITs	0.4843	1.9695
Professional Services	0.3701	2.2562
Retail REITs	0.4100	2.0824
Specialty Retails	0.3401	2.2308

Table 7: Regression analysis results Europe (including industry-fixed effects)

Variable	Coefficient	t - stat
const	-0.4102	-6.4976
Company Market Cap	0.0000	11.2677
Revenue to Market Cap	0.0109	1.3721
Gross Profit Margin - %	0.0005	1.4683
EBITDA Margin - %	-0.0010	-0.8107
EBIT Margin - %	0.0007	0.5637
Net Debt to Total Capital	0.0074	0.3934
ESG Score	0.0046	10.4706
Scope 1&2&3EstTotal	0.0000	1.4945
Scope 1 / Revenues	-0.0001	-0.3819
Scope 3 / Revenues	-0.0006	-1.6614
Scope 3 US / Revenues	0.0004	3.6087
Scope 3 DS / Revenues	0.0000	1.0633
TotalReturn3Mo	0.0002	0.3291
TotalReturn6Mo	-0.0002	-0.6446
BetaFiveYear	0.0090	0.5794
Volatility90D	-0.0003	-0.7989
Containers & Packaging	0.5438	5.9754
Food Products	0.3089	4.4143
Household Products	0.4568	4.4901
IT Services	0.4437	5.8556
Life Sciences Tools & Services	0.4050	5.8336
Media	0.2962	4.3068
Office REITs	0.3705	4.2368
Semiconductors	0.2629	4.1616
Software	0.2824	4.6846

Table 8: Regression analysis results USA (including industry-fixed effects)

7.2. Capital market reactions during systematic oil price shocks

This section examines whether SBTi-validated firms respond differently to systematic oil price shocks compared to their non-validated counterparts. Using an event study approach with matched portfolios and the Fama-French 5-factor model, the analysis compares cumulative abnormal returns around extreme oil price movements. Results are presented separately for Europe and the United States to identify potential regional differences.

7.2.1. Capital market results Europe

The results show that SBTi-validated firms respond significantly differently to both negative and positive oil price shocks compared to their non-validated counterparts. In the case of negative shocks, the average cumulative abnormal return (CAR) of the SBTi portfolios was

−1.05%, whereas the non-SBTi portfolios experienced a mean loss of −1.29%. The resulting difference of +0.24 percentage points in favour of the SBTi group is statistically significant (p = 0.045). A similar pattern is observed for positive shocks: the CAR of the SBTi group was approximately zero (−0.01%), while the non-SBTi group recorded an average return of −0.35%, resulting in a difference of +0.34 percentage points, which is also statistically significant (p = 0.045).

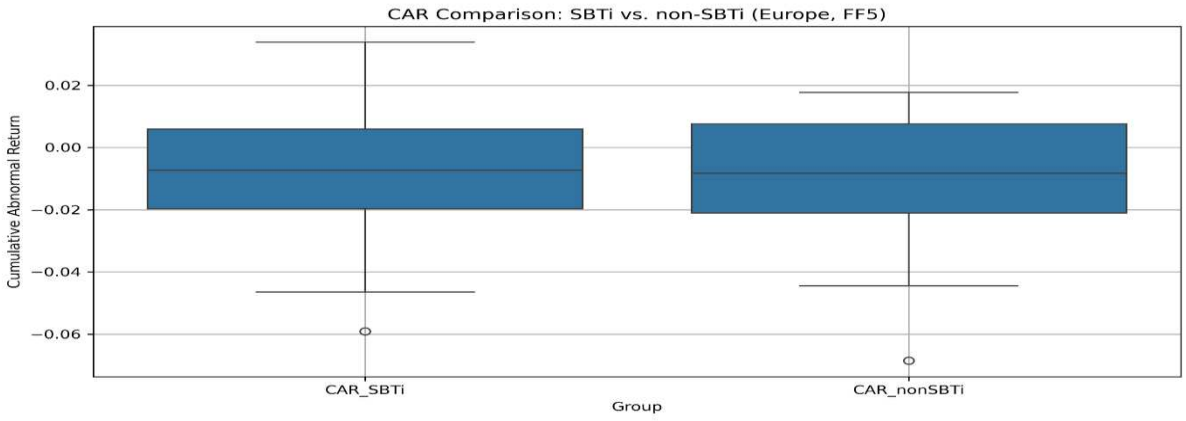

Figure 3: CAR comparison SBTi vs non-SBTi (Europe, Fama French 5 Factor)

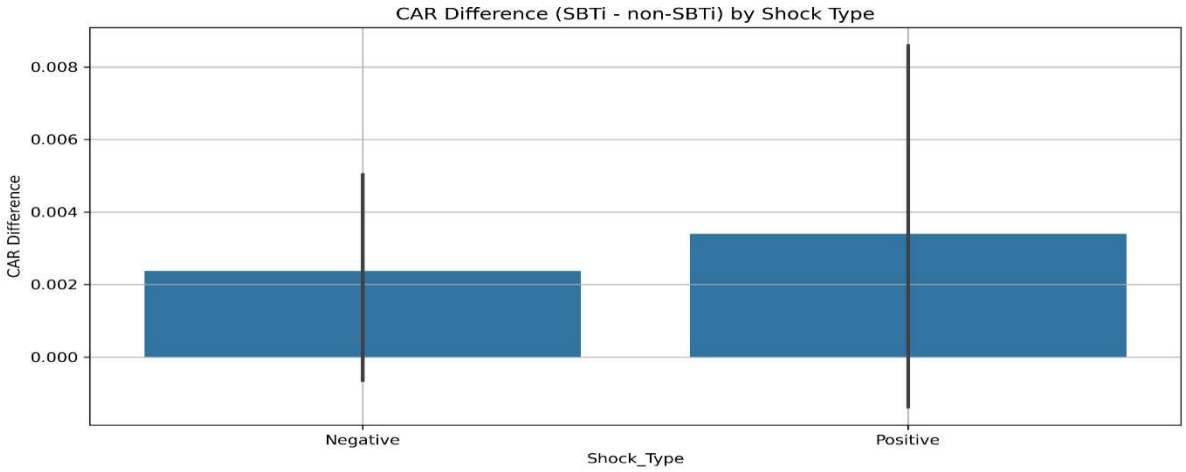

Figure 4: CAR Difference SBTi vs non-SBTi (by shock type, Europe, Fama French 5 Factor)

The t-test results thus indicate that SBTi-validated companies exhibit a significantly weaker market reaction to oil price shocks—regardless of whether these shocks were positive or negative. This may be explained by the fact that SBTi firms are potentially less embedded in fossil-based value chains, and therefore less sensitive to short-term oil price fluctuations. The findings support the hypothesis that climate-related corporate commitments may not only offer

long-term reputational advantages but also promote short-term risk resilience in the face of macroeconomic energy shocks.

Summary Table (1/2): Mean CARs by Shock Type (Europe, FF5 Model)

Shock Type	Mean CAR (SBTi)	Mean CAR (non-SBTi)	Mean CAR Diff
Negative	-0.0105	-0.0129	0.0024
Positive	-0.0001	-0.0035	0.0034

Table 9: Summary Table (1/2): Mean CARs by Shock Type (Europe, Fama French 5 Factor)

Summary Table (2/2): Test Statistics (Europe, FF5 Model)

Shock Type	N Events	T-Statistic	P-Value
Negative	22	2.0973	0.0448
Positive	8	2.0973	0.0448

Table 10: Summary Table (2/2): Test statistics (Europe, Fama French 5 Factor)

7.2.1. Capital market results USA

The results for the U.S. market indicate that SBTi-validated firms tend to exhibit smaller abnormal returns in response to both negative and positive oil price shocks compared to their non-validated counterparts—albeit without statistical significance. In the case of negative shocks, the average cumulative abnormal return (CAR) for SBTi portfolios was −0.91%, whereas the non-SBTi portfolios experienced an average loss of −1.06%. The resulting difference of +0.15 percentage points in favor of the SBTi group is not statistically significant ($p = 0.257$). A similar pattern emerges in the context of positive shocks: the average CAR for the SBTi group amounted to −0.13%, while the non-SBTi group recorded an average return of −0.36%, resulting in a difference of +0.23 percentage points, which is likewise not statistically

significant(p=0.257).

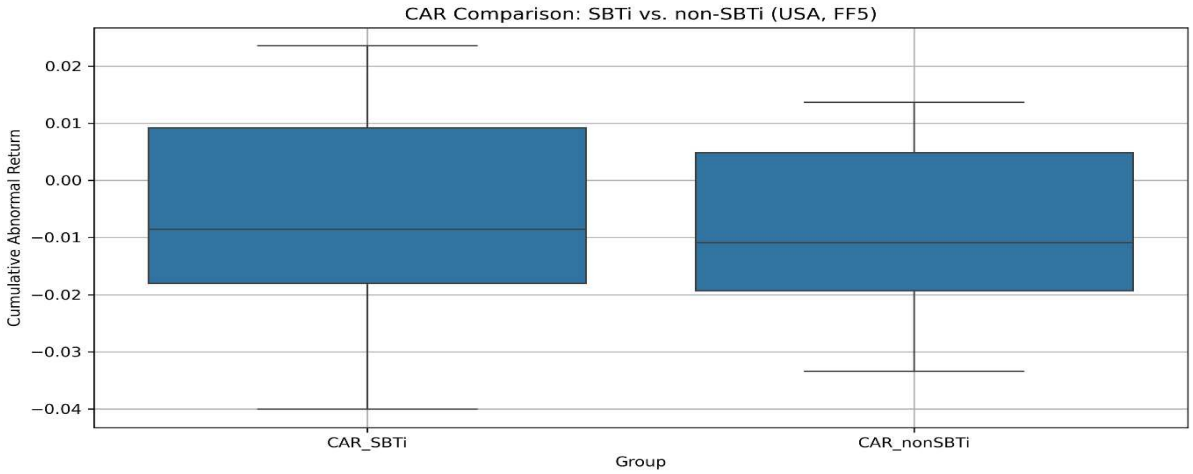

Figure 5: CAR comparison SBTi vs non-SBTi (USA, Fama French 5 Factor)

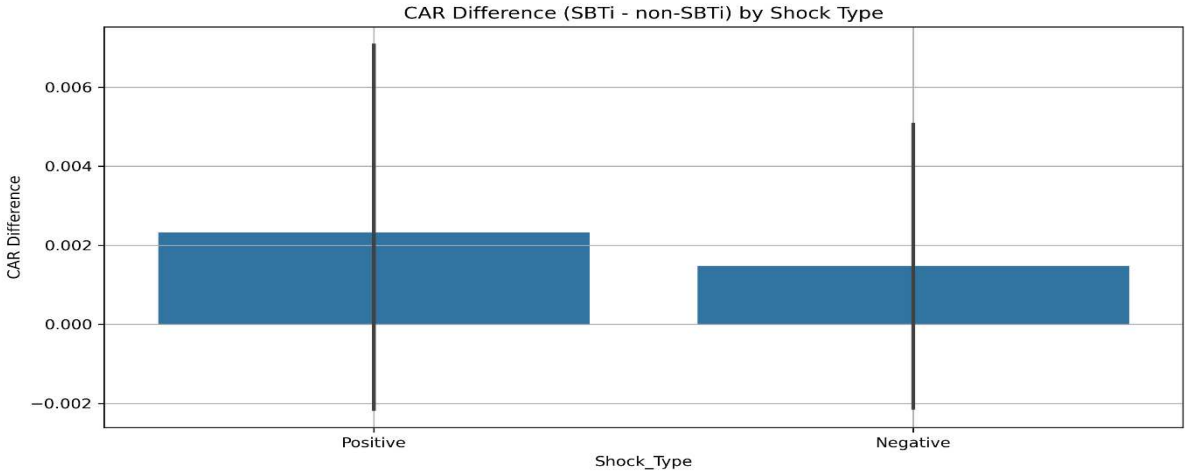

Figure 6: CAR Difference SBTi vs non-SBTi (USA, Fama French 5 Factor)

These results suggest a consistently weaker market reaction of SBTi-validated firms to oil price shocks—regardless of the direction of the shock. Although the observed differences are not statistically significant in this case, they lend support to the notion that climate-related corporate commitments may be associated with a degree of risk resilience to macroeconomic energy shocks. One potential explanation is that SBTi-validated firms are structurally less dependent on fossil-based value chains, and therefore fluctuations in oil prices are less strongly reflected in their stock prices.

Summary Table (1/2): Mean CARs by Shock Type (USA, FF5 Model)

Shock Type	Mean CAR (SBTi)	Mean CAR (non-SBTi)	Mean CAR Diff
Negative	-0.0091	-0.0106	0.0015
Positive	-0.0013	-0.0036	0.0023

Table 11: Summary Table (1/2): Mean CARs by Shock Type (USA, Fama French 5 Factor)

Summary Table (2/2): Test Statistics (Europe, FF5 Model)

Shock Type	N Events	T-Statistic	P-Value
Negative	21	1.1563	0.2573
Positive	8	1.1563	0.2573

Table 12: Summary Table (1/2): Test statistics (USA, Fama French 5 Factor)

8. Conclusion

This chapter revisits the research objectives and research questions outlined in the introduction, reflects on the limitations of the study, formulates key takeaways, and proposes potential avenues for further research.

This thesis set out to examine both the strategic determinants and capital market implications of SBTi certification, focusing on listed companies from the United States and Europe. Two central research questions guided the analysis:

1. Which firm-specific characteristics explain why certain companies pursue SBTi validation?
2. Do capital markets react differently to systematic oil price shocks depending on a firm's SBTi certification status?

Using a large dataset of over 3,200 firms for the first part of the study, and 110 SBTi-validated firms alongside a matched sample of non-validated counterparts for the second part, this research provides novel insights at the intersection of climate strategy and capital market behavior.

The logistic regression analysis reveals that firms with higher ESG scores, stronger profitability, and larger market capitalization show a significantly higher probability of obtaining SBTi certification. A second OLS regression with country and industry fixed effects further confirmed the role of these contextual factors: European firms and those from service- and technology-oriented industries are more likely to pursue validation. Notably, higher upstream Scope 3 emissions intensities correlate positively with validation, while downstream emissions exhibit a negative association—possibly reflecting the importance of perceived controllability and visibility of climate-related activities.

The second part of the research, examining capital market reactions to systematic oil price shocks, shows that SBTi-validated firms in Europe experience significantly smaller abnormal stock returns compared to non-validated firms—both for positive and negative shocks. This indicates a potential resilience of climate-committed firms to fossil price volatility. While a similar trend is observable in the U.S. sample, these results did not reach statistical significance. Nevertheless, the findings suggest that SBTi-validated firms may be structurally less exposed to fossil value chains, potentially benefitting from more credible ESG signalling and favourable investor perception in times of market stress.

Despite these contributions, the study also acknowledges several important limitations. The analysis of firm characteristics was based on a filtered sample of 3,281 companies, all of which had available data on Scope 1–3 emissions and Refinitiv ESG scores. One could argue that this introduces a selection bias toward firms already demonstrating stronger sustainability ambition or disclosure practices. As such, the sample may not be fully representative of the broader U.S. and European markets. Furthermore, the regression relied on firm characteristics from the most recent fiscal year, without differentiating by the year of SBTi validation, which may limit the temporal accuracy of the findings.

The second part of the study, event analysis of capital market reactions, was based on a smaller sample due to the requirement that companies had to be SBTi-validated by January 1, 2022. Previous years lacked sufficient validation cases. Additionally, the event window of three years may be considered short, and market reactions to sustainability announcements are often context-dependent and heterogeneous in interpretation. The credibility of non-regulatory climate pledges also varies widely and is subject to sectoral, regional, and implementation-specific factors, issues already addressed in the theoretical framework.

Despite these limitations, this study contributes to empirical sustainability research by investigating how climate-related corporate strategies may influence short-term market dynamics. Future research could expand on this by incorporating more granular target classifications (e.g., short- vs. long-term targets), alternative exogenous shocks, and longer event windows. Additional studies could also explore other regional dynamics, as this study focused primarily on U.S. and European firms. Moreover, the role of regulatory environments, investor composition, or policy-driven events may serve as meaningful variables for further exploration.

In conclusion, the findings suggest that science-based climate targets are not merely symbolic declarations or marketing tools, but are rooted in tangible firm characteristics and may, under the right conditions, have an influence on capital market reactions. SBTi certification can serve as a credible signal of climate commitment, but only if accompanied by transparent communication, operational follow-through, and measurable progress.

Decleration

I acknowledge the use of Artificial Intelligence, specifically the language model ChatGPT (OpenAI, last Version in August 2025) to improve the text quality and reduce the word count. The AI tool was employed for language refinement, including improving clarity. All content was reviewed and edited to ensure accuracy and obedience to academic standards.

References

Aldy, Joseph E., Patrick Bolton, Zachery M. Halem, and Marcin T. Kacperczyk.

Behind schedule: The corporate effort to fulfill climate obligations. SSRN Electronic Journal, 2024.

Aldy, Joseph E., Patrick Bolton, Zachery M. Halem, and Marcin T. Kacperczyk.

Show & tell: An analysis of corporate climate messaging and its financial impacts. SSRN Electronic Journal, 2024.

Bolton, Patrick, and Marcin T. Kacperczyk.

Carbon disclosure and the cost of capital. Journal of Finance, 78(6):3677–3754, 2023.

Bolton, Patrick, and Marcin T. Kacperczyk.

Do investors care about carbon risk? Journal of Financial Economics, 142(2):517–549, 2021.

Bolton, Patrick, and Marcin T. Kacperczyk.

Firm commitments. SSRN Electronic Journal, 2021.

Engle, Robert, Stefano Giglio, Bryan Kelly, Heebum Lee, and Johannes Stroebel.

Hedging climate change news. The Review of Financial Studies, 33(3):1184–1216, 2020.

Gamerschlag, Ramin, Klaus Möller, und Frank Verbeeten.

Determinants of voluntary CSR disclosure: Empirical evidence from Germany. Review of Managerial Science, 5(2–3):233–262, 2011.

Hoepner, Andreas G., Ioannis Oikonomou, Zacharias Sautner, Laura T. Starks, and Xiao Y. Zhou.

ESG shareholder engagement and downside risk. Review of Financial Studies, 36(3):1243–1289, 2023.

Ilhan, Ehsan, Philipp Krueger, Zacharias Sautner, and Laura T. Starks.

Climate risk disclosure and institutional investors. Review of Accounting Studies, 29(2):511–545, 2024.

Ilhan, Ehsan, Zacharias Sautner, and Grigory Vilkov.

Climate risk and institutional investors. The Review of Financial Studies, 34(6):3026–3071, 2021.

Jensen, Michael C., und William H. Meckling.

Theory of the firm: Managerial behavior, agency costs and ownership structure. Journal of Financial Economics, 3(4):305–360, 1976.

Jin, Xianjin, Yi Liu, and Weijia Sun.

Attention to global warming and the stock market. Journal of Financial Economics, 149(1):150–175, 2023.

Kacperczyk, Marcin, and Amit Seru.

Fund manager use of public information: New evidence on managerial skills. The Journal of Finance, 62(2):485–528, 2007.

Krueger, Philipp, Zacharias Sautner, and Laura T. Starks.

The importance of climate risks for institutional investors. Review of Financial Studies, 34(3):1067–1111, 2021.

Pirsch, Julie, Shruti Gupta, und Stacy Landreth Grau.

A framework for understanding corporate social responsibility programs as a continuum: An exploratory study. Journal of Business Ethics, 70(2):125–140, 2007.

Reverte, Carmelo.

Determinants of corporate social responsibility disclosure ratings by Spanish listed firms. Journal of Business Ethics, 88(2):351–366, 2009.

Sautner, Zacharias, Laurence van Lent, Grigory Vilkov, and Ruishen Zhang.

Firm-level climate change exposure. The Journal of Finance, 78(3):1449–1503, 2023.

Sautner, Zacharias, Laurence van Lent, Grigory Vilkov, and Ruishen Zhang.

Pricing climate change exposure. SSRN Electronic Journal, 2022.

Smith, Joyce van der Laan, Ajay Adhikari, und Rasoul H. Tondkar.

Exploring differences in social disclosures internationally: A stakeholder perspective. Journal of Accounting and Public Policy, 24(2):123–151, 2005.

Sun, W.

Disentangling oil price shocks and corporate financial risk: The moderating role of environmental disclosure. Journal of Economics and Public Finance, 11(2):24–54, 2025.

Appendix

Top 10 highest share of SBTi Validations		Top 10 lowest share of SBTi Validations	
Containers & Packaging	67%	Hotel & Resort REITs	7%
Tobacco	60%	Consumer Finance	6%
Household Products	58%	Biotechnology	4%
Construction Materials	50%	Energy Equipment & Services	4%
Textiles, Apparel & Luxury Goods	47%	Oil, Gas & Consumable Fuels	1%
Air Freight & Logistics	42%	Diversified Consumer Services	0%
IT Services	40%	Gas Utilities	0%
Transportation Infrastructure	38%	Insurance	0%
Beverages	38%	Mortgage Real Estate Investment	0%
Office REITs	36%	Water Utilities	0%

Table 1: Share of SBTi Validation per Industry in the data set

Variable	Definition	Source
Company Market Cap	Total market value of all share classes, based on the latest closing prices and most widely reported share types	Refinitiv
Revenue to Market Cap	Total consolidated company revenue, applicable across all industries in Relation to Company Market Cap	Refinitiv
Gross Profit Margin - %	Gross profit as a percentage of total revenue; relevant for industrial, property, investment trust, and financial firms.	Refinitiv
EBITDA Margin - %	EBITDA as a percentage of total revenue; applicable to all industries.	Refinitiv
EBIT Margin - %	EBIT as a percentage of total revenue; applicable to all industries.	Refinitiv
Net Debt to Total Capital	Net debt divided by total capital; a leverage measure valid for all industries.	Refinitiv
ESG Score	Refinitiv ESG Score is an overall company score based on the self-reported information in E, S & G pillars.	Refinitiv
Scope1&2 EstTotal	Combined Scope 1 and 2 emissions in tonnes, normalized by revenues (in million USD).	Refinitiv
Scope1 / Revenues	Direct emissions (Scope 1) in tonnes, normalized by revenues (in million USD).	Refinitiv
Scope2 / Revenues	Indirect emissions from energy use (Scope 2) in tonnes, normalized by revenues (in million USD).	Refinitiv
Scope3US / Revenues	Upstream Scope 3 emissions in tonnes, normalized by revenues (in million USD).	Refinitiv
Scope3DS / Revenues	Downstream Scope 3 emissions in tonnes, normalized by revenues (in million USD).	Refinitiv
TotalReturn3Mo	Cumulative return over the past 3 months, including price changes and dividends.	Refinitiv
TotalReturn6Mo	Cumulative return over the past 6 months, including price changes and dividends.	Refinitiv
BetaFiveYear	Measure of stock price volatility relative to the market over a 5-year period using monthly returns.	Refinitiv
Volatility90D	Annualized standard deviation of daily log returns over the past 90 trading days; indicates short-term price risk.	Refinitiv

Table 2: Firm-specific characteristics for OLS regression

	count	mean	std	min	25%	50% (median)	75%	max
Company Market Cap	3281.0	6687975610.737	9709035617.716	123635379.7	449907182.064	1876458497.13	7816068026.8	30384739000.0
Revenue to Market Cap	3281.0	1.232	1.339	0.12	0.261	0.655	1.665	4.334
Gross Profit Margin - %	3281.0	45.42	23.345	13.771	25.405	41.788	63.886	85.357
EBITDA Margin - %	3281.0	14.147	16.828	-18.452	5.649	13.967	25.427	41.429
EBIT Margin - %	3281.0	6.941	15.787	-27.023	1.396	8.379	17.403	29.456
Net Debt to Total Capital	3281.0	0.168	0.383	-0.528	-0.099	0.239	0.465	0.698
ESG Score	3281.0	47.106	19.4	18.242	29.837	46.64	64.717	75.999
Scope1&2&3EstTotal	3281.0	2894484.682	4761477.66	13075.633	74728.272	486759.687	2909191.398	14707047.0
Scope1 / Revenues	3281.0	32.657	56.501	0.764	2.64	7.676	21.51	180.326
Scope2 / Revenues	3281.0	22.413	22.277	1.991	5.912	13.984	29.011	73.019
Scope3US / Revenues	3281.0	163.706	127.883	30.146	61.278	124.302	231.266	427.879
Scope3DS / Revenues	3281.0	378.058	517.564	3.234	24.496	123.503	465.676	1581.647
TotalReturn3Mo	3281.0	-1.897	15.309	-24.906	-13.829	-2.939	8.37	25.201
TotalReturn6Mo	3281.0	2.462	21.936	-31.21	-14.69	1.732	17.445	40.606
BetaFiveYear	3281.0	1.064	0.442	0.394	0.702	1.054	1.389	1.788
Volatility90D	3281.0	50.602	21.331	25.498	32.747	45.28	64.46	91.778

Table 3: Descriptive statistics total data set

	count	mean	std	min	25%	50% (median)	75%	max
Company Market Cap	2624.0	3855433177.313	5185281045.96	93047359.6	336059001.058	1294307089.755	4928465088.004	16209811410.08
Revenue to Market Cap	2624.0	1.253	1.38	0.116	0.265	0.663	1.669	4.473
Gross Profit Margin - %	2624.0	45.762	24.477	13.164	24.88	41.698	64.709	88.451
EBITDA Margin - %	2624.0	10.543	22.314	-39.569	4.045	12.784	24.321	41.807
EBIT Margin - %	2624.0	3.223	21.665	-48.035	-0.627	7.447	16.773	29.326
Net Debt to Total Capital	2624.0	0.145	0.415	-0.6	-0.145	0.221	0.471	0.717
ESG Score	2624.0	41.91	17.58	16.575	26.651	41.326	56.733	69.314
Scope1&2&3EstTotal	2624.0	1829515.397	2989434.27	8979.419	49673.862	331629.827	1854527.614	9360853.751
Scope1 / Revenues	2624.0	34.925	60.287	1.039	3.441	7.838	21.55	191.199
Scope2 / Revenues	2624.0	23.032	22.265	2.175	6.72	14.624	29.257	73.438
Scope3US / Revenues	2624.0	150.35	111.879	29.968	60.714	119.691	199.213	380.15
Scope3DS / Revenues	2624.0	400.696	551.841	3.086	24.375	131.852	483.679	1687.39
TotalReturn3Mo	2624.0	-1.597	16.441	-26.526	-14.29	-2.578	9.82	27.35
TotalReturn6Mo	2624.0	2.493	23.468	-33.65	-15.477	1.951	18.175	43.088
BetaFiveYear	2624.0	1.073	0.468	0.367	0.689	1.059	1.415	1.851
Volatility90D	2624.0	53.804	23.235	26.095	34.798	47.708	69.156	98.77

Table 4: Descriptive statistics non-validated companies

	count	mean	std	min	25%	50% (median)	75%	max
Company Market Cap	657.0	24101155193.835	31288513419.95	689135247.148	2364766058.7	8896099957.643	31287924143.01	97896697500.0
Revenue to Market Cap	657.0	1.146	1.179	0.132	0.246	0.627	1.644	3.754
Gross Profit Margin - %	657.0	44.736	19.776	17.289	27.66	42.093	61.751	75.757
EBITDA Margin - %	657.0	19.794	11.086	5.438	10.459	17.758	28.406	39.981
EBIT Margin - %	657.0	13.159	8.942	1.655	5.535	11.808	19.135	29.715
Net Debt to Total Capital	657.0	0.246	0.263	-0.231	0.08	0.284	0.445	0.613
ESG Score	657.0	67.474	12.346	45.516	58.494	69.679	78.186	83.346
Scope1&2&3EstTotal	657.0	9469986.447	14392745.281	105718.112	439084.19	2295500.0	11843608.508	45190324.363
Scope1 / Revenues	657.0	22.538	37.052	0.389	1.358	6.01	21.275	119.445
Scope2 / Revenues	657.0	19.81	21.861	1.439	3.904	10.561	25.277	69.888
Scope3US / Revenues	657.0	219.69	181.481	30.438	63.029	158.977	336.408	578.009
Scope3DS / Revenues	657.0	298.854	396.611	4.41	24.933	101.832	409.4	1208.834
TotalReturn3Mo	657.0	-3.168	11.391	-20.049	-12.47	-3.839	5.052	16.477
TotalReturn6Mo	657.0	2.062	16.238	-22.247	-10.433	0.756	15.323	28.878
BetaFiveYear	657.0	1.04	0.361	0.485	0.744	1.046	1.321	1.614
Volatility90D	657.0	39.595	12.987	23.581	28.643	36.889	48.637	63.818

Table 5: Descriptive statistics validated companies

Variable	Coefficient	t - stat
const	-0.3117	-4.9501
Company Market Cap	0.0000	9.4668
Revenue to Market Cap	0.0035	0.5772
Gross Profit Margin - %	0.0005	1.4369
EBITDA Margin - %	0.0006	0.4660
EBIT Margin - %	-0.0011	-0.8437
Net Debt to Total Capital	-0.0079	-0.4026
ESG Score	0.0058	14.1582
Scope 1&2&3EstTotal	0.0000	3.4462
Scope 1 / Revenues	-0.0005	-2.8497
Scope 3 / Revenues	-0.0004	-1.2148
Scope 3 US / Revenues	0.0003	4.1435
Scope 3 DS / Revenues	-0.0000	-0.9482
TotalReturn3Mo	0.0000	0.0336
TotalReturn6Mo	-0.0002	-0.5049
BetaFiveYear	0.0215	1.3882
Volatility90D	0.0001	0.1866
Containers & Packaging	0.5711	6.5850
Household Products	0.4406	4.0597
IT Services	0.3632	5.3502
Life Sciences Tools & Services	0.3369	4.9056
Media	0.2813	4.2956
Office REITs	0.3632	4.0824
Professional Services	0.3246	5.0486
Software	0.2402	4.0600
Textile, Apparel & Luxury Goods	0.3690	5.3718

Table 6: OLS regression results (USA)

Variable	Coefficient	t - stat
const	-0.4854	-3.0870
Company Market Cap	0.0000	2.4107
Revenue to Market Cap	-0.0043	-0.3654
Gross Profit Margin - %	0.0006	0.6925
EBITDA Margin - %	0.0068	2.1960
EBIT Margin - %	-0.0082	-2.1077
Net Debt to Total Capital	-0.0343	-0.5455
ESG Score	0.0084	8.2787
Scope 1&2&3EstTotal	0.0000	2.4924
Scope 1 / Revenues	-0.0005	-1.4552
Scope 3 / Revenues	-0.0012	-1.6381
Scope 3 US / Revenues	0.0004	2.9132
Scope 3 DS / Revenues	-0.0000	-0.9990
TotalReturn3Mo	-0.0016	-0.8612
TotalReturn6Mo	0.0004	0.2431
BetaFiveYear	0.0525	1.2784
Volatility90D	0.0006	0.4728
Air Freight & Logistics	0.5293	3.0469
Containers & Packaging	0.6692	3.3893
Entertainment	0.3769	2.1513
IT-Services	0.2958	2.0337
Multi-Utilities	0.4728	2.4979
Office REITs	0.4843	1.9695
Professional Services	0.3701	2.2562
Retail REITs	0.4100	2.0824
Specialty Retails	0.3401	2.2308

Table 7: Regression analysis results Europe (including industry-fixed effects)

Variable	Coefficient	t - stat
const	-0.4102	-6.4976
Company Market Cap	0.0000	11.2677
Revenue to Market Cap	0.0109	1.3721
Gross Profit Margin - %	0.0005	1.4683
EBITDA Margin - %	-0.0010	-0.8107
EBIT Margin - %	0.0007	0.5637
Net Debt to Total Capital	0.0074	0.3934
ESG Score	0.0046	10.4706
Scope 1&2&3EstTotal	0.0000	1.4945
Scope 1 / Revenues	-0.0001	-0.3819
Scope 3 / Revenues	-0.0006	-1.6614
Scope 3 US / Revenues	0.0004	3.6087
Scope 3 DS / Revenues	0.0000	1.0633
TotalReturn3Mo	0.0002	0.3291
TotalReturn6Mo	-0.0002	-0.6446
BetaFiveYear	0.0090	0.5794
Volatility90D	-0.0003	-0.7989
Containers & Packaging	0.5438	5.9754
Food Products	0.3089	4.4143
Household Products	0.4568	4.4901
IT Services	0.4437	5.8556
Life Sciences Tools & Services	0.4050	5.8336
Media	0.2962	4.3068
Office REITs	0.3705	4.2368
Semiconductors	0.2629	4.1616
Software	0.2824	4.6846

Table 8: Regression analysis results USA (including industry-fixed effects)

Summary Table (1/2): Mean CARs by Shock Type (Europe, FF5 Model)

Shock Type	Mean CAR (SBTi)	Mean CAR (non-SBTi)	Mean CAR Diff
Negative	-0.0105	-0.0129	0.0024
Positive	-0.0001	-0.0035	0.0034

Table 9: Summary Table (1/2): Mean CARs by Shock Type (Europe, Fama French 5 Factor)

Summary Table (2/2): Test Statistics (Europe, FF5 Model)

Shock Type	N Events	T-Statistic	P-Value
Negative	22	2.0973	0.0448
Positive	8	2.0973	0.0448

Table 10: Summary Table (2/2): Test statistics (Europe, Fama French 5 Factor)

Summary Table (1/2): Mean CARs by Shock Type (USA, FF5 Model)

Shock Type	Mean CAR (SBTi)	Mean CAR (non-SBTi)	Mean CAR Diff
Negative	-0.0091	-0.0106	0.0015
Positive	-0.0013	-0.0036	0.0023

Table 11: Summary Table (1/2): Mean CARs by Shock Type (USA, Fama French 5 Factor)

Summary Table (2/2): Test Statistics (Europe, FF5 Model)

Shock Type	N Events	T-Statistic	P-Value
Negative	21	1.1563	0.2573
Positive	8	1.1563	0.2573

Table 12: Summary Table (1/2): Test statistics (USA, Fama French 5 Factor)

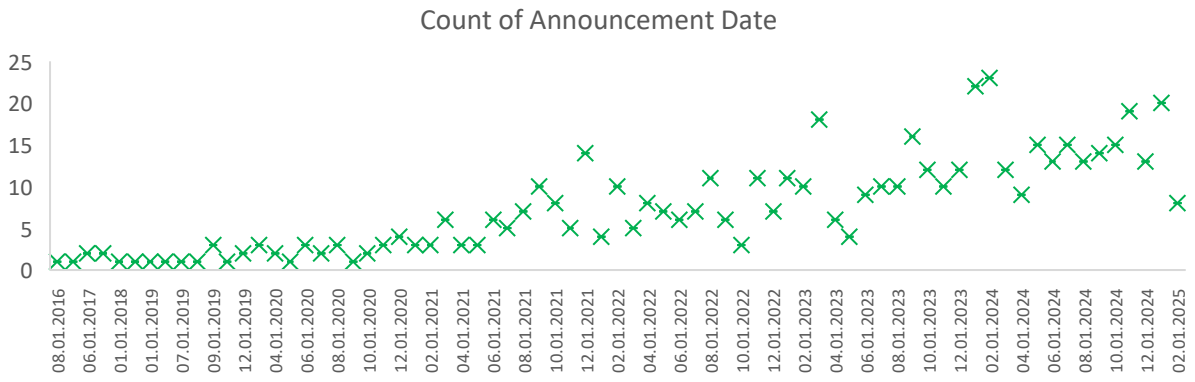

Figure 1: Number of SBTi Validations per date

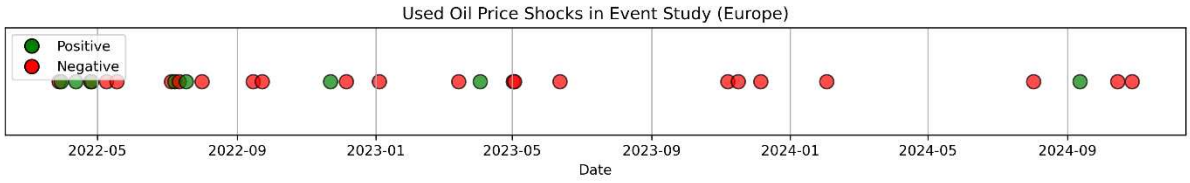

Figure 2: Used Oil Price Shocks in Event Study

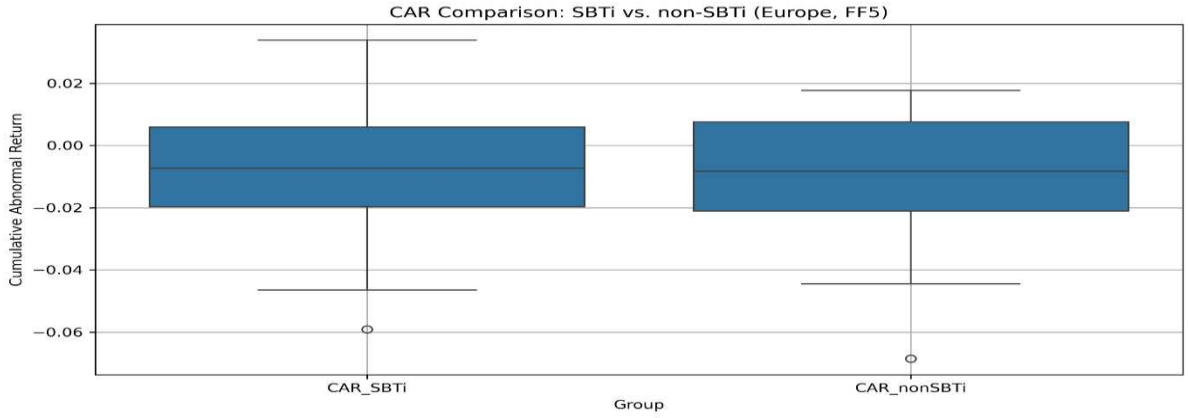

Figure 3: CAR comparison SBTi vs non-SBTi (Europe, Fama French 5 Factor)

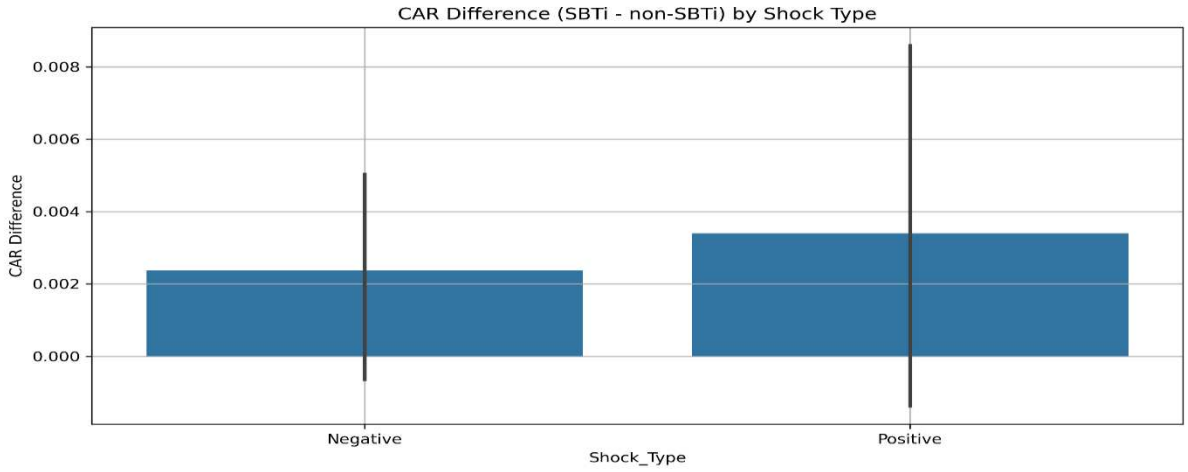

Figure 4: CAR Difference SBTi vs non-SBTi (by shock type, Europe, Fama French 5 Factor)

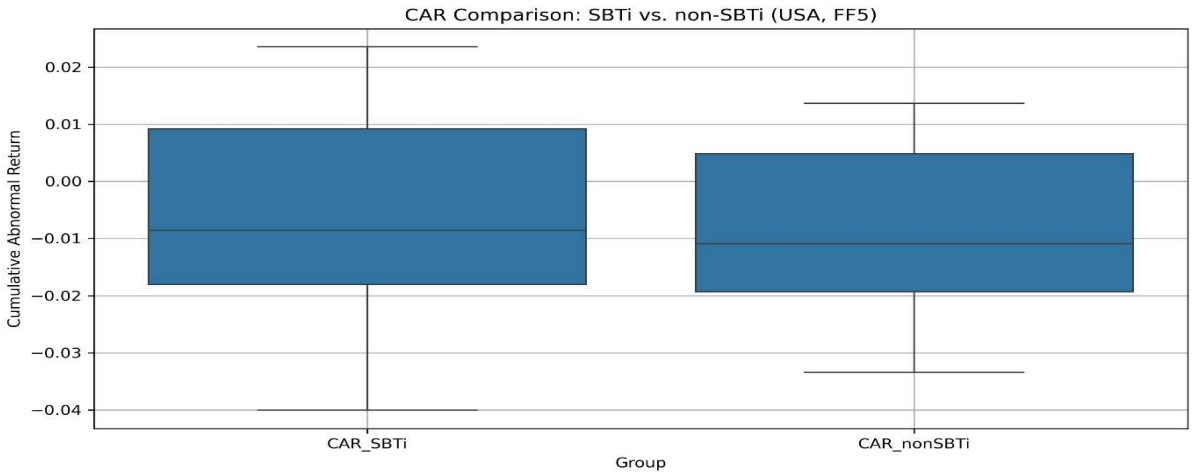

Figure 5: CAR comparison SBTi vs non-SBTi (USA, Fama French 5 Factor)

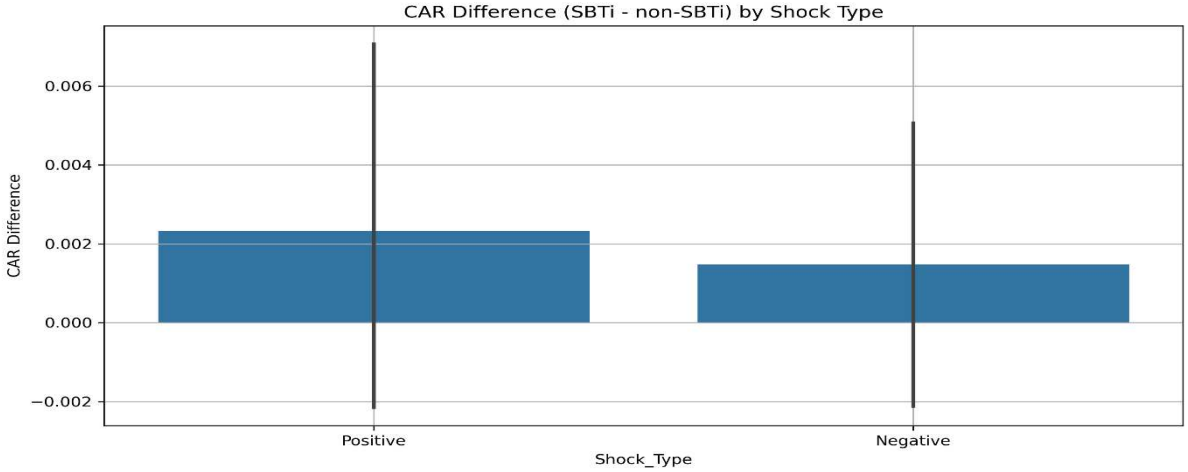

Figure 6: CAR Difference SBTi vs non-SBTi (USA, Fama French 5 Factor)