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Do Investors Respond to Corporate Sustainability Communication? Evidence from an Event Study in the European Chemicals Industry (2020–2023)

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Abstract

Although sustainability communication is considered a potential value driver, its impact on share prices in energy- and emissions-intensive industries has rarely been empirically proven. This thesis examines this issue by analysing 4,690 press releases from 20 companies in the STOXX Europe 600 Chemicals index between 2020 and 2023 using an event study approach. Abnormal returns (ARs) were calculated at the firm level within a ±5 trading day window**.** Individual stock performance was benchmarked against both the industry index (STOXX Europe 600 Chemicals) and the broader market (STOXX Europe 600). Cumulative abnormal returns (CARs) were used as the primary indicator.

The analysis revealed a significant average CAR of approximately +0.16 percentage points ($\mathbf{p < 0.01}$) of the 20 companies in the European chemical industry. However, macro factors have a significantly stronger influence on share price performance; movements in the overall market account for almost 90% of the variance in stock returns, while changes in gas prices provide only a minor additional impetus. Membership in the Dow Jones Sustainability Index (DJSI) and the FTSE4Good Index has no independent effect on share prices, and textual characteristics, such as length, readability, sentiment, and thematic categories, also remain statistically insignificant.

This thesis provides the first evidence in the European chemical sector that investors consider ESG (Environmental, Social, and Governance) news. However, its impact is substantially outweighed in the short term by broader market conditions. In theory, this study extends signalling theory to operational ESG communication. However, in practice, it shows investor relations and sustainability managers that concrete sustainability measures alone are insufficient to overcome dominant market factors in the short term.

For Elena and Frieda

List of abbreviations

AR(s)	Abnormal Return(s)
BIS	Borsa Istanbul Sustainability Index
BLUE	Best Linear Unbiased Estimators
CAR(s)	Cumulative Abnormal Return(s)
CAAR(s)	Cumulative Average Abnormal Return(s)
CSR	Corporate Social Responsibility
CSRD	Corporate Sustainability Reporting Directive
DER	Debt/Equity Ratio
DJSI	Dow Jones Sustainability Index
ECFA	Economic Cooperation Framework Agreement
ECHA	European Chemicals Agency
EGD	European Green Deal
EMH	Efficient Market Hypothesis
EPS	Earnings Per Share
ESG	Environmental, Social, Governance
ETS	Emissions Trading System
FTSE4Good	Financial Times Stock Exchange For Good
Gas	Gas Prices
GDP	Gross Domestic Product
GLS	Generalised Least Squares
GSSSB	Green, Social, Sustainability And Sustainability-Linked Bonds
IC	Intellectual Capital
ICB	Industry Classification Benchmark
ICB	Industry Classification Benchmark
IED	Industrial Emissions Directive
Inflate	Inflation Rate
Intrate	Interest Rate
Market_cap	Market Capitalisation
NLP	Natural Language Processing
OLS	Ordinary Least Squares
P/E ratio or pe_ratio	Price/Earnings Ratio
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
ROA	Return On Assets
ROE	Return On Equity
RQ	Research Question
SASB	Sustainability Accounting Standards Board
SD	Standard Deviation
SDFR	Sustainable Finance Disclosure Regulation
SDG	Sustainable Development Goal(s)
SLO	Social Licence To Operate
SMOG	Simple Measure Of Gobbledygook
SPERCs	Specific Environmental Release Categories
TBL	Triple Bottom Line
UN	United Nations

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Content

1. Introduction

Sustainability has become a prominent topic in science, corporate practices, and capital markets. With initiatives such as the European Green Deal, the EU Taxonomy, and the Corporate Sustainability Reporting Directive (CSRD), the integration of environmental and social factors is now a core aspect of corporate governance and decision-making processes (Bongardt and Torres, 2022; Jurić et al., 2023). According to projections from S&P Global Ratings, the global issuance volume of labelled sustainable bonds (green, social, sustainability, and sustainability-linked bonds, known as GSSSB) is expected to grow to between $0.95 and $1.05 trillion by 2024, accounting for around 14% of the total global bond market (Cochelin et al., 2024). This segment, worth almost a trillion dollars, underscores that sustainable investment products are no longer a niche phenomenon and confirms the capital market's strong receptivity to credible ESG signals. Thus, companies are facing increased scrutiny regarding their ESG performance and the way they communicate it (Dupont and Torney, 2021; Jurić et al., 2023).

Although meta-analyses confirm a robust, long-term link between high ESG scores and firm value (Haque and Ntim, 2022; Liang et al., 2020), the short-term share price effects of individual sustainability press releases remain largely unexplored. Only a limited number of recent studies combine automated text analysis with an event study framework (e.g., Dorfleitner and Zhang, 2024; Nicolas et al., 2024), and there is still little evidence that web-based press releases on sustainability issues should be considered issuer-driven communication.

In particular, the intersection between 1. short-term abnormal returns following such press releases, 2. the moderating role of an existing ESG reputation, and 3. specific textual characteristics has not yet been investigated for European chemical companies, despite their high exposure to sustainability regulations and stakeholder scrutiny. The present thesis addresses this methodological and industry-specific gap (Sections 1.1.1-1.1.3). This gap is developed in Section 1.2.1 and translated into objectives and research questions in Sections 1.2.2 and 1.2.3, prior to outlining the methodological approach in Chapter 3.

This research gap also resonates with the author's practical observation in corporate communication at a chemical company, which motivated this thesis. Sustainability communication is increasingly expected from companies, including those in the chemical industry, but at the same time, it remains unclear which types of information are actually

perceived as relevant to decision-making by capital market participants in the short term. In particular, the thesis aims to examine the credibility of sustainability signals and the conditions under which investors recognisably respond to them. By combining an event study methodology with quantitative text analysis, the aim is to go beyond normative assumptions about ESG and to obtain an empirically grounded explanation of how sustainability-related press releases are translated into observable market reactions within an emission-intensive, highly regulated industrial context.

In accordance with the general classification set out in this preliminary Section 1, Section 1.1 delineates the scope of the thesis. The text situates sustainability communication within the interplay of regulation, capital-market logic, and industry-specific conditions. It explains why the European chemical industry is particularly well-suited as a focus.

Building on this, Section 1.2 specifies the central research gap, derives the scientific and practical objectives from it and positions the expected contribution of the thesis in the context of the existing literature. Finally, Section 1.3 provides a concise synopsis of the dissertation's overall structure, elucidating the sequential progression of the literature review, methodology, results chapter and discussion sections, which are methodically integrated to form a cohesive whole.

1.1. Sustainability, Regulation And The European Chemical Industry

The central importance of sustainability communication in Europe stems from two interrelated developments. Firstly, the EU has gradually transitioned sustainability disclosures into a more standardised, verifiable and comparable disclosure system. Secondly, capital market actors are increasingly utilising this information for risk assessment and capital allocation purposes.

This thesis focuses on the period 2020–2023, during which sustainability reporting in the EU has undergone a transition, moving from a predominance of voluntary corporate social responsibility (CSR) narratives to the establishment of a disclosure architecture driven by market forces. In this context, the European chemical industry offers a particularly pertinent example, combining significant economic importance with a high level of sustainability and intensive regulatory scrutiny.

As outlined in Section 1.1.1, the political milestones and regulatory impulses that directly shape the observation period are summarised. Section 1.1.2 establishes the European chemical industry as the focus sector and methodologically derives the single-industry approach. Building on this, Section 1.1.3 provides a detailed exposition of the operationalisation of sustainability in corporate practice and the rationale for utilising sustainability-related press releases as a suitable event format for examining short-term capital market reactions.

1.1.1. Historical Milestones And Policy Frameworks For Sustainability

The following milestones are indicative of the regulatory developments that have had a particularly strong impact on expectations regarding sustainability disclosure, its comparability, and capital market relevance in the EU during 2020–2023.

Before examining the milestones in the context of this thesis, a concise derivation of the topic of sustainability is provided. The roots of sustainability date back to 1713. This year, von Carlowitz stated that humans could not use more wood than a forest could produce to sustain the forest in the long term (Von Carlowitz, 1713). The author focused on the sustainable management of forestry resources. The publication of the Brundtland Report in 1987 broadened the use of sustainability (Brundtland, 1987; Gerasimova, 2017; Marinova, 2025). It has prompted industries to consider the long-term implications of their actions regarding the environment, society, and economy, encouraging them to develop strategies that balance profit-making with social responsibility and environmental stewardship (Frecè and Harder,

2018). It therefore provides an important basis for further milestones relevant to the period from 2020 to 2023.

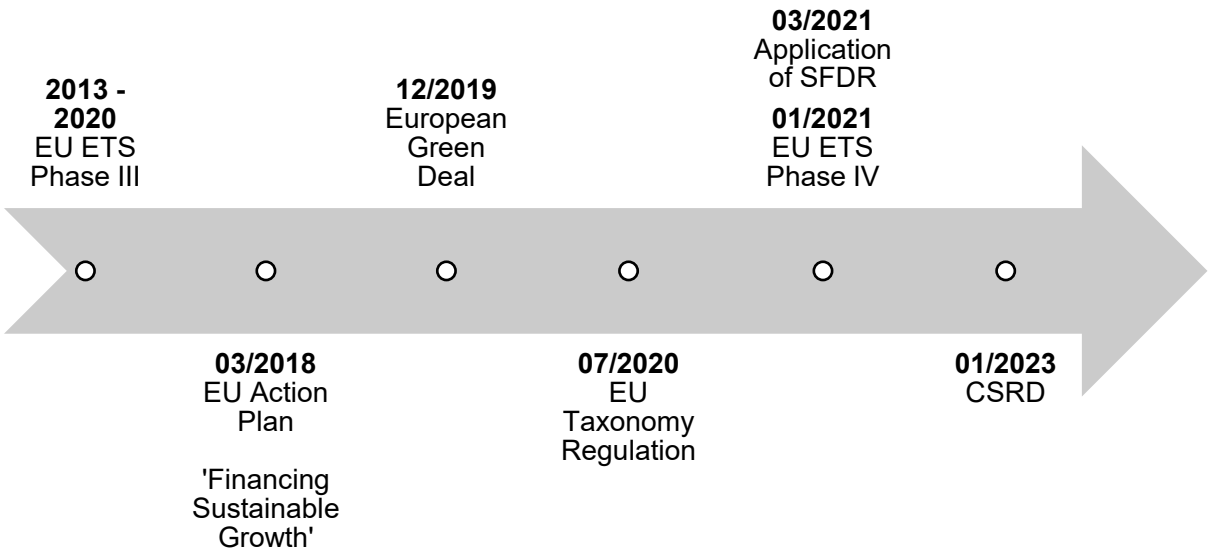

Figure 1: Timeline Of Sustainability Milestones In The Context Of This Thesis

The EU Emissions Trading System (ETS) was established in 2005, in response to the EU's commitment to reduce emissions as outlined in the Kyoto Protocol. The implementation of a market for CO_2 allowances was identified as the most cost-effective and politically feasible approach to achieve this objective across all member countries (Convery and Redmond, 2007; Ellerman et al., 2016; Ellerman and Buchner, 2007; Sato et al., 2022). For companies, this means they have been obligated to retain CO_2 certificates for their emissions since 2005. The quantity of emissions is directly proportional to the financial penalty incurred (Bayer and Aklin, 2020; Dechezleprêtre et al., 2018; Teixidó et al., 2019). The issue of environmental pollution has become a significant concern, given the well-documented correlation between CO2 emissions and their associated costs. Consequently, this issue has emerged as a direct cost factor and a business risk (Amri et al., 2020; Bayer and Aklin, 2020; Dechezleprêtre et al., 2018; Teixidó et al., 2019). Consequently, this may lead investors to direct greater attention to CO_2 values. Investors are interested in this because poor CO_2 values indicate future costs, while favourable CO_2 plans suggest reduced risk and enhanced upside potential (Amri et al., 2020; Bayer and Aklin, 2020; Dechezleprêtre et al., 2018; Guo et al., 2020). This effect can therefore be amplified for particularly energy-intensive industries, such as the chemical industry. The relevance of CO_2 extends beyond the scope of sustainability reports, encompassing the financial aspects of corporate entities (Amri et al., 2020; Marin et al., 2018). The EU ETS was implemented in clearly defined multi-year phases (Phase I: 2005-2007, Phase II: 2008-2012, Phase III: 2013-2020 and Phase IV: 2021-2030), with each phase

involving the tightening of the cap, the improvement of allocation rules and the expansion of the scope. Over time, there has been a marked shift towards enhanced effectiveness in reducing emissions, coupled with a pronounced shift towards a more market-oriented approach, particularly evident from Phase III onwards (Bordignon and Gamannossi degl'Innocenti, 2023; Ellerman et al., 2016; Joltreau and Sommerfeld, 2019; Teixidó et al., 2019). In the context of this work, only Phases III and IV are relevant, with the transition taking place from 2020 to 2021, meaning that 25% of the period under consideration is Phase III and 75% is Phase IV. This will also be the subject of the 'Limitations And Future Research' Chapter of this thesis in Section 5.4.1. Consequently, the operationalisation of climate and emissions risk will be aligned with capital market requirements prior to 2020. The subsequent phase will entail integrating the financial market and disclosure architecture.

Launched in March 2018, the EU Action Plan on Financing Sustainable Growth aims to redirect capital flows towards sustainable activities by creating a clear legal framework (Jenei et al., 2024; Sancak, 2023). Within this agenda, the EU taxonomy (valid since 12 July 2020) assumes the role of a common reference framework (definition of what is environmentally sustainable) (Gortsos, 2020; Jenei et al., 2024; Sancak, 2023). Thus, the EU taxonomy serves as the core instrument for capital allocation (Sancak, 2023; Viñes Fiestas, 2023). The SFDR (start of application 10 March 2021) translates this reference framework into harmonised market transparency by prescribing entity- and product-level disclosures on the financial market side (including sustainability risks/PAIs) and categorising products via Articles 6/8/9 (Bengo et al., 2022; Distefano et al., 2025; Hummel and Jobst, 2024). This renders the action plan the regulatory hub from which the subsequent disclosure logic of taxonomy and SFDR can be directly derived (Busch et al., 2021; Hummel and Jobst, 2024). From this point onwards, sustainability can be compared and reported to investors, which is precisely the prerequisite for capital-market-relevant signal effects relevant to this thesis.

Another milestone that significantly impacted European sustainability efforts and thus this thesis is the European Green Deal (EGD). The EGD, introduced by the European Commission under the leadership of Ursula von der Leyen in December 2019, represents a comprehensive and ambitious strategy to foster the European Union's transition towards a climate-neutral economy. This initiative outlines a roadmap to achieve significant reductions in carbon emissions, aiming at reaching climate neutrality by 2050 (Sikora, 2021). The EGD encompasses various policy measures and targets aimed at addressing climate change, promoting sustainability, and guiding the EU towards a more environmentally friendly and economically resilient future (Wolf et al., 2021). In the context of this thesis, the EGD can be conceptualised as a comprehensive regulatory and growth framework that coordinates climate

policy, industrial and financial measures. This has enabled the accelerated and more comprehensive introduction of climate-related EU regulations (Dupont et al., 2024; Sikora, 2021; Skjærseth, 2021).

In accordance with the European Green Deal, the EU Directive 2022/2464 (also known as CSRD) has been in force since January 2023. The objective of the directive is to modernise and consolidate the regulations on non-financial reporting (Baumüller and Grbenic, 2021; Odobaša and Marošević, 2023; Serdar Raković, 2025). In accordance with the recently issued directive, corporate entities are obligated to disclose information on sustainability risks, opportunities, strategies, targets, governance, and performance across the environment, social, and governance domains. This includes information on the value chain and greenhouse gas emissions in scopes 1 to 3 (Brans et al., 2024; Dunfjäll, 2025; Levchenko and Antonova, 2024). The CSRD is regarded as a significant catalyst for a shift from voluntary to mandatory reporting, with consequences for both transparency and costs, particularly for SMEs (Di Tullio et al., 2025; Levchenko and Antonova, 2024; Sharma, 2025). CSRD does not yet apply as a reporting requirement in this thesis's observation period, but it is classified as a regulatory impetus relevant to this thesis. It can be assumed that CSRD will raise expectations for data quality and comparability in advance and shift perceptions of sustainability information towards capital-market-relevant disclosure.

When considered collectively, these milestones signify the transition to a disclosure architecture that is increasingly standardised, verifiable and explicitly geared towards utilisation by capital market participants. This finding suggests that sustainability-related disclosures may be more likely to convey economically relevant signals, particularly in industries with significant external environmental impacts and considerable regulatory exposure. In light of the aforementioned context, the subsequent section elucidates the rationale for the European chemical industry's provision of a coherent framework for this thesis, covering both its content and methodology.

1.1.2. The European Chemical Industry As Focal Sector

The European chemical industry is often described as the industrial spine of the economy due to value added, trade integration and systemic role in value chains. The dual relevance of the sector, with macroeconomic importance on the one hand and sustainability externalities on the other, makes it a particularly insightful environment for examining how capital markets process sustainability communication.

The chemical sector is the fourth-largest industry in the EU and the second-largest chemical producer worldwide (Rinke Dias De Souza et al., 2024). Within the EU's NACE classification[1], basic chemicals and pharmaceuticals alone account for approximately 45% and 30% of the sector's added value in Europe, respectively, underscoring its contribution to industrial value added (Mobarakeh and Kienberger, 2025). In absolute terms, the sector's gross value added is substantial, e.g., around €165 billion in 2023. Regarding total economic value added, this is approximately 0.96% of EU GDP in 2023 (The European Chemical Industry Council, n.d.). Given that GDP is derived from gross value added, plus taxes on products minus subsidies, the ratio should be interpreted as an approximate indicator of macroeconomic size rather than a precise accounting identity. This share must be interpreted in the context of an intermediate industry, as a significant portion of the value added enabled by chemical products is realised in downstream industries (e.g. automotive, construction, agriculture, consumer goods) and reported there in statistics.

The production of goods in this sector serves as the foundation for the export of plastics, fertilisers, and intermediate products, which in turn are utilised in a diverse array of downstream manufacturing, agricultural, and food activities (Carmona-Martínez et al., 2024). The trade integration is further evidenced by extra-EU27 flows of goods within the manufacturing sector: in 2024, chemicals accounted for exports of €227 billion and imports of €180 billion, for a total trade volume of €407 billion (Figure 2).

[1] The NACE classification is a standard system utilised by the European Union for the uniform and comparable categorisation of all economic and industrial activities in the Member States (Vidali et al., 2024).

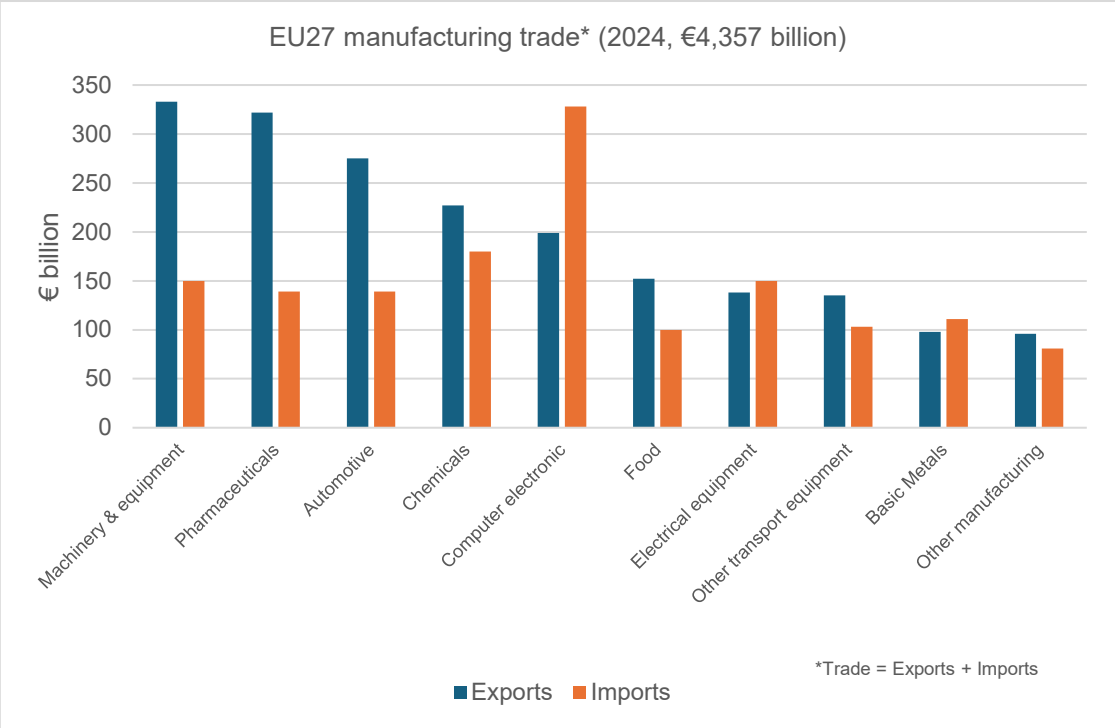

Figure 2: Extra-EU27 manufacturing trade by sector, 2024 (€bn) (The European Chemical Industry Council, 2025a)

In 2023, the European chemical industry employed approximately 1.2 million people (see Figure 4). Germany has been identified as the country with the highest number of employees in the chemical industry, with approximately 393,000 employees in 2023 (VCI - Verband der Chemischen Industrie, 2024).

While the focus of more recent studies has shifted away from employment figures, the emphasis has been placed on the sector's highly skilled workforce and its central importance for innovation and research and development in energy-intensive industries (Carmona-Martínez et al., 2024; Mobarakeh and Kienberger, 2025; Rinke Dias De Souza et al., 2024). With a turnover of €635 billion and around 31,000 companies in 2025 - most of which are SMEs - the chemical sector is deeply embedded in Europe's industrial fabric and promotes jobs and innovation across the continent (The European Chemical Industry Council, 2025b).

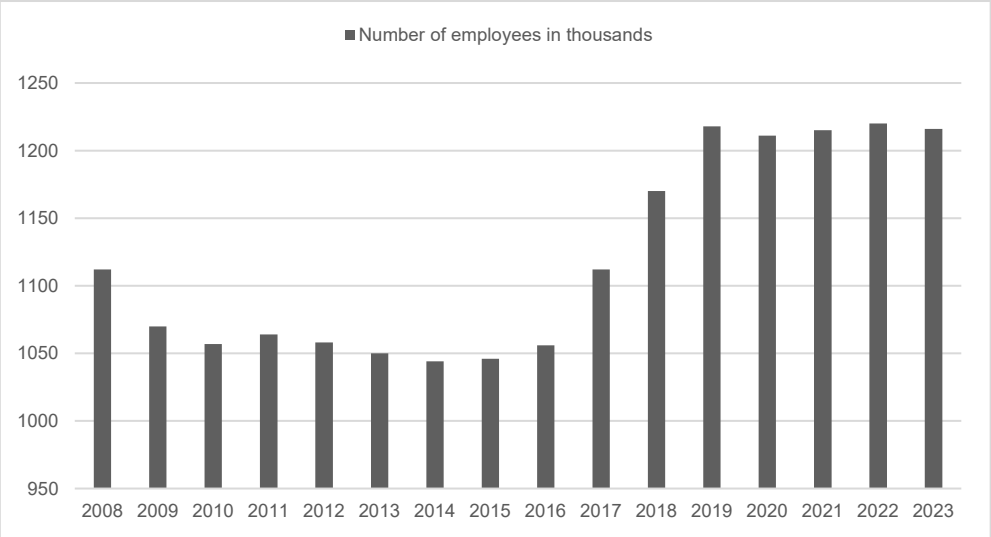

Figure 3: Employment in the EU-27 chemical industry, 2008–2023 (VCI - Verband der Chemischen Industrie, 2024)

In addition to its economic importance, the sector is of significance for sustainability on account of its energy and emissions profile. This industry is responsible for approximately 5-6.5% of global greenhouse gas emissions. This makes the chemical industry the largest emitter in the industrial sector (Bauer et al., 2023; Gabrielli et al., 2023; Isella and Manca, 2022; Meng et al., 2023). Despite the European chemical industry's significant contribution to CO2-related environmental pollution, the sector is also demonstrating clear decoupling: production has increased, while emissions, energy consumption, and waste have decreased (Barnosell and Pozo, 2024; Glavič et al., 2023). The combination of economic significance and considerable transition potential means that investors are paying increasing attention to credible sustainability information, especially when regulation and carbon pricing affect cost structures and risk premiums.

However, the external sustainability impacts of the chemical industry are not limited to emissions generated directly in production facilities. A significant portion of these impacts also arises from the environmental burdens embedded in chemical products throughout the value chain. In the context of life cycle assessment, this is frequently referred to as ‘cradle-to-gate’ (An et al., 2022; Häussling Löwgren et al., 2025; Moutousidi and Kookos, 2021; Tamoor et al., 2022). The production process entails monitoring emissions and resource consumption, from the extraction of raw materials through preliminary products, transportation, manufacturing processes, and culminating in the product's release from the factory. This perspective elucidates that a substantial proportion of the climate impact materialises prior to the utilisation and disposal phase, thereby precluding the possibility of explanation solely by operational Scope 1 and Scope 2 – both terms will be separately defined in 2.1.3 - emissions (Häussling

Löwgren et al., 2025; Moutousidi and Kookos, 2021). This is pivotal to the European reporting logic because it emphasises the necessity of value chain-related disclosure and, concomitantly, establishes the link to double materiality: From a financial perspective, chemical companies are impacted by sustainability risks, including, but not limited to, CO_2 prices, regulation, and transformation costs (i.e., financial materiality). Conversely, these entities also exert a substantial influence on the environment and society through their production and products (i.e., impact materiality) (Baumüller and Sopp, 2022; Nielsen, 2023; Velikov, 2025).

Stakeholders and regulatory authorities are critically monitoring this development in product-related environmental and social impacts. Accordingly, the chemical industry is subject to increasing scrutiny from stakeholders, including consumers, investors, regulatory bodies, and communities, regarding its sustainability practices (Hyršlová et al., 2017). In the context of high-impact industries, the concept of ‘Social Licence to Operate’ (SLO) has been a subject of considerable discussion. This term refers to the ongoing social acceptance that firms must maintain to continue operating in ways that meet societal expectations (Dare et al., 2014; Vanclay and Hanna, 2019). In practice, SLO debates emphasise transparent stakeholder engagement and continuous disclosure of impacts and mitigation measures (Cesar, 2019; Wilburn and Wilburn, 2011). In this thesis, the term 'stakeholders' is employed in a broad sense, encompassing capital market actors, notably investors (Góes et al., 2023; Dagestani et al., 2024).

In summary, these characteristics serve to reinforce the plausibility of capital markets responding to companies' sustainability communications. In a sector where transition costs, carbon exposure and regulatory risks play an important role, investors have strong incentives to adjust their short-term expectations regarding future cash flows, risk premiums and strategic credibility when new sustainability information is published. Consequently, sustainability-related press releases can serve as signals for operational risk management, transition strategy, and compliance readiness, particularly amid heightened disclosure requirements and assurance expectations across the EU regulatory system, as outlined in Section 1.1.1. This finding suggests that sustainability-related disclosures may be more likely to convey economically relevant signals, particularly in industries with significant external environmental impacts and considerable regulatory exposure. In light of the aforementioned context, the subsequent section elucidates the rationale for the European chemical industry's provision of a coherent framework for this thesis, covering both its content and methodology.

This sector’s characteristics substantiate a single-industry focus. A cross-sector design would introduce considerable structural heterogeneity (e.g. in business models, emission intensity,

regulatory exposure and baseline disclosure) into the analysis, thereby complicating the interpretation of short-term capital market reactions to sustainability press releases. This heterogeneity is particularly pronounced in the context of sustainability, because identical ESG information can have very different implications for cost structures, transformation paths, and risk premiums across industries (Barroso Del Toro et al., 2022b; Capelle-Blancard and Petit, 2019).

Conversely, a single-industry design within the European chemical industry offers a more comparable risk logic: companies are similarly affected by energy and raw material-related input dependencies and by EU frameworks such as CO_2 pricing, transformation and disclosure regimes, so that sustainability information can be processed on a more common economic basis (Barnosell and Pozo, 2024; Glavič et al., 2023; Lopez et al., 2024; Nabera et al., 2023; Thormann et al., 2023). This approach mitigates the likelihood that observed abnormal returns are predominantly attributable to sectoral structural disparities rather than the informational effect of the respective press release signal (Barroso Del Toro et al., 2022b; Capelle-Blancard and Petit, 2019; Duong et al., 2021; Mateska et al., 2023).

Finally, sectoral restriction improves the identification of effects in the event study setting. Since ESG news effects vary greatly empirically by industry and emission intensity, restricting the analysis to a highly material sector reduces cross-industry noise and increases the likelihood that short-term reactions can be plausibly attributed to the sustainability event (Barroso Del Toro et al., 2022a, 2022b; Mateska et al., 2023; Pandey et al., 2024). The selection of listed chemical companies from the STOXX Europe 600 universe (Section 1.2) aims to provide a transparent, investable, and data-robust population that consistently reflects the capital-market-oriented focus of the thesis. This industry focus responds directly to the methodological concern that multi-industry event studies may conflate sustainability signals with sector-specific baseline differences in carbon intensity, regulatory exposure and disclosure norms, thereby weakening causal attribution in short-horizon market reactions.

The European chemical industry has been established as a highly material and methodologically coherent framework for capital market-related analyses. The subsequent section will focus on sustainability at the company level. Section 1.1.3 demonstrates the operationalisation of sustainability in corporate practice and the linkage between sustainability performance and corporate performance, both in theory and in empirical evidence.

1.1.3. Sustainability In Business Practice And Corporate Performance

Drawing on the regulatory milestones outlined in Section 1.1.1 and the sectoral context examined in Section 1.1.2, the concept of sustainability in the EU during the 2020–2023 period is increasingly understood as a domain relevant to management and governance, rather than as a voluntary CSR narrative. In practical terms, the interplay between price-based climate policy (EU ETS) and disclosure-based governance (including the taxonomy, SFDR, and the CSRD impetus) is helping to make sustainability information along the value chain more operational, standardised, and verifiable. This indicates that financial materiality and impact dimensions along the value chain are systematically integrated into the decision-making and disclosure processes.

From a regulatory perspective, this development is bundled by the EGD as an overarching transformation framework. Operationally, two mechanisms work in a complementary manner: First, the EU ETS translates emissions into direct cost and risk signals via a price, thereby influencing investment and transformation decisions (Colmer et al., 2025; Hoffmann, 2007; Teixidó et al., 2019). Secondly, the EU disclosure architecture (in particular CSRD, taxonomy and SFDR) increases the standardisation, verifiability and comparability of sustainability information along the supply and value chain (Fragidis and Papafloratos, 2025; Hummel and Jobst, 2024; Nipper et al., 2025). This makes sustainability operationalisable, verifiable and marketable – shifting it from CSR rhetoric to a data-based control and reporting metric.

In the context of day-to-day business operations, this phenomenon leads to heightened operationalisation. Emissions and energy indicators are integrated into management systems. At the same time, programmes aimed at transformation (e.g. efficiency enhancement, electrification, utilisation of alternative raw materials, and the adoption of circular processes) necessitate investment and the establishment of governance structures (Chiu et al., 2012; Nilsson et al., 2021; Payer et al., 2024; Poplavets et al., 2024). Concurrently, value chain-related information is increasingly playing a significant role. Sustainability is therefore not merely a guiding principle, but a factor relevant to control and decision-making in the interplay between production, financing and risk management (Abdel-Basset and Mohamed, 2020; Ngo et al., 2024; Stindt, 2017).

This anchoring is economically relevant because sustainability information can influence expectations about future cash flows (cost and investment paths), risk premiums (transition, regulatory and reputational risks) and strategic credibility (Gangi et al., 2020; Höck et al., 2020; Jia and Li, 2022; Scholtens and Van'T Klooster, 2019). A temporal dimension must be

acknowledged: whilst reports are published periodically, new information is frequently released to the market via ad hoc communication formats, such as press releases (Bozanic and Thevenot, 2015; Guillamon-Saorin and Sousa, 2014). This is particularly relevant in an environment characterised by mounting auditing and comparability requirements (Dai et al., 2025; De Luca et al., 2024; Minnis and Shroff, 2017). Consequently, sustainability press releases can serve as a means of communicating short-term, visible signals about strategy, progress, risk management, and compliance readiness.

The crucial question, therefore, is whether the disclosed sustainability information is economically material. Regulation is instrumental in translating sustainability into measurable key performance indicators. Consequently, the related information becomes communicable, comparable and evaluable for investors (Balp and Strampelli, 2022; Chiu, 2022; Nielsen, 2023; Zetzsche and Anker-Sørensen, 2022). In this context, sustainability press releases provide an empirically tractable setting for examining short-horizon market reactions to new firm-issued information.

This logic is built upon in Section 1.2, where the research gap, objectives, and research questions are consolidated.

1.2. Research Gap, Objectives And Contribution

This chapter builds on the regulatory and sectoral framework outlined in Section 1.1 and specifies the central research question of this thesis. To address this objective, the present thesis first clarifies the specific research gap and formulates a focused problem statement (Section 1.2.1). This is followed by the presentation of the scientific and practical objectives and the expected contribution to knowledge of this thesis (Section 1.2.2). Finally, the research questions are formulated, and the research framework, including the sample and the basic operationalisation logic, is described in a manner that consistently leads to the empirical analysis (Section 1.2.3).

1.2.1. Research Gap

Despite the growing significance of sustainability information in capital markets, there is insufficient evidence to show whether company-issued sustainability press releases cause short-term price changes, particularly in the European chemical sector. While meta-analyses suggest a stable correlation between sustainability performance or ESG ratings and company value over time, it is much less clear whether individual sustainability announcements issued by companies trigger short-term price reactions, especially when they are communicated in ad hoc formats such as press releases (Bancu, 2024).

The existing research has addressed short-term financial market reactions to ESG information selectively, often based on external news sources or aggregated ESG measures (Capelle-Blancard and Petit, 2019; Dorfleitner and Zhang, 2024; Khan et al., 2024). Consequently, they rarely capture issuer-controlled message design and credibility cues that are central to signalling processes (Nicolas et al., 2024). Furthermore, the available literature focuses only to a limited extent on company-issued sustainability press releases as an independent signal type (Boungou and Dufau, 2025). For the European chemical sector – which offers a particularly plausible context for short-term reactions due to its high material sustainability relevance and regulatory exposure – this evidence base is currently insufficient (Sun et al., 2024; Ujaczki and Backmann, 2026).

This combination yields the central research gap in this work: There is a lack of empirically reliable classification of whether and how capital markets behave in the short term concerning sustainability press releases from European chemical companies, and to what extent the

reaction is systematically influenced by the ESG reputation of the sender and by the release's content and linguistic characteristics.

1.2.2. Objectives and Contribution

In light of the research gap previously delineated, this thesis intends to achieve two interrelated objectives. Firstly, the scientific objective is to model sustainability press releases as short-term information signals within the framework of signal theory, and to empirically test whether their value-relevance in the European chemical sector is measurable. This thesis particularly investigates whether an existing ESG reputation, operationalised, for instance, via sustainability index memberships, functions as an anchor of credibility and whether it amplifies or attenuates the market reaction.

Secondly, the work aims to provide practical consequences for investor relations, sustainability and communications managers. The objective of this thesis is to provide reliable evidence on the conditions under which sustainability messages are relevant. Furthermore, the thesis attempts to ascertain which communicative characteristics (e.g., topic focus, tone, comprehensibility, length) are associated with stronger or weaker reactions.

This thesis's contributions can be summarised as follows: firstly, its focus on company-issued sustainability press releases as a particular event category; secondly, the combination of an event study design with quantitative text analysis to explain heterogeneous reactions; and thirdly, the provision of clearly defined sectoral and regional evidence for the European chemical sector during the 2020–2023 period.

1.2.3. Research Questions

The previously delineated research gap yields three research questions that structure the empirical analysis.

RQ1: How do sustainability-related press releases affect the share prices of companies in the STOXX Europe 600 Chemicals Index in the short term?

The rationale underpinning RQ1 is to ascertain the fundamental value relevance of sustainability information in the short term, and to examine whether sustainability press releases can be interpreted as capital market-effective events in the 2020–2023 observation period.

RQ2: Does the market reaction to sustainability-related press releases differ between companies with additional presence in sustainability indices and companies without such an ESG reputation?

The rationale of RQ2 underlying this approach is to operationalise the credibility and reputation dimensions. The question examined whether an external reputation anchor would reinforce the signal effect (e.g., higher credibility) or whether expectations would already be anticipated, thereby muting the reaction.

RQ3: How are the content and linguistic characteristics of sustainability-related press releases (e.g. topic focus, sentiment, readability, text length) related to short-term share price reactions?

The rationale for this RQ3 is to extend the purview of the pure event effect by incorporating an explanatory perspective. It is acknowledged that not all announcements possess equivalent characteristics, and the analysis seeks to ascertain whether the observed heterogeneity in abnormal returns is associated with quantifiable text characteristics.

The empirical sample comprises all chemical companies that were continuously represented in the STOXX Europe 600 Chemicals Index during 2020 and 2023. It offers a transparent, investable and industry-consistent selection of listed companies with available daily price data and publicly accessible press releases.

Methodologically, the thesis combines an event study with a short event window of 11 days around the press release publication date and a quantitative content analysis of the press release texts. The short-term market reaction is operationalised via cumulative abnormal returns; differences in responses are explained by reputation characteristics (including sustainability index membership) and textual characteristics. The subsequent sections of the chapter delineate this operationalisation and derive the research objectives and the thesis's contribution from it.

1.3. Thesis Structure

The derivation thus far explains the intricate relationships between European legislation and sustainability, as well as the tension between corporate practices in the European chemical industry and the investors of the companies represented in the STOXX Europe 600 Chemicals Index. Consequently, this chapter will briefly present the structure of this thesis.

Chapter 2 commences with an examination of the theoretical foundations upon which this thesis is based, in the form of a literature review. To address the research questions defined in 1.2, the role of investors in the selected corporate context is analysed, followed by an examination of the influence of sustainability criteria on investors in chemical companies. Ultimately, the treatise culminates in an exhaustive examination of sustainability indices and ratings.

Afterwards, Chapter 3 outlines the methodological framework of the thesis. It therefore introduces the philosophical stance and theoretical underpinnings, and describes the research design, data basis, and event study procedures. It also addresses potential methodological limitations.

Then, the presentation of the empirical results and their analysis in Chapter 4 follows. These include a diagnostic analysis of the data and the statistical assumptions, followed by the findings from the event study and regression models, presented in the descriptive results and in the regression analysis results.

Chapter 5 discusses the key findings in light of the existing literature, derives practical and theoretical implications, and provides critical reflections and future research directions. The last Chapter 6 concludes the thesis by summarising the study's core insights and contributions.

The subsequent chapter, Chapter 2, is dedicated to the theoretical underpinnings and delves into the assumptions underlying this thesis.

2. Literature Review

Considering the tension between sustainability in the European chemical industry, as discussed in Chapter 1, this chapter presents a literature review. This literature review provides an in-depth examination of the current state of scientific knowledge relevant to the thesis. This includes, first of all, investors as a relevant stakeholder group and their market reactions (2.2). The literature review then addresses corporate web-based press releases and communication patterns in Section 2.3. This is important insofar as this communication medium will be used to examine investor behaviour. The summary (2.4) outlines the research gaps, based on the insights from Sections 2.2 and 2.3, and how this thesis can help to close them and make a relevant contribution to both practical and theoretical knowledge.

However, the first step is to understand investors and their market reactions better.

2.1. Carbon Disclosure Its Impact on Equity Valuation

In this section, drawing on the findings of Chapter 1, an overview of the extant literature is provided, with a focus on the correlation between CO_2 emissions and stock valuation. The discussion addresses the rationale behind companies disclosing information on CO_2 emissions (2.1.1), the manner in which markets evaluate such disclosures (2.1.2), and the impact of emissions and CO_2 prices on valuation (2.1.3). This scientific framework provides an economic rationale for treating companies' sustainability-related communications as potentially value-relevant signals that can trigger short-term market reactions, especially in CO_2-intensive industries such as the chemical industry.

2.1.1. Determinants Of Carbon Disclosure

As discussed in Section 1.1, regulatory pressure on companies in the European chemical industry has increased during the observation period from 2020 to 2023. Studies show that disclosure of carbon information is more likely among firms operating in regulated environments or with a significant institutional investor presence (Cohen et al., 2023; Hakim et al., 2025; Zhou et al., 2025). Additionally, firms with greater capital market exposure are more likely to disclose carbon information with a view to attracting investment and maintaining their legitimacy, as is evidenced by the fact that those listed on major exchanges or operating in

competitive industries are more likely to do so (Choi and Luo, 2021; He and Zeng, 2025; Velte et al., 2020; W. Xu et al., 2024). However, voluntary disclosure, which has become increasingly rare in recent years due to the increasing obligatory nature of EU regulations, is frequently motivated by efforts to reduce information asymmetries, enhance reputation and manage external financing pressures (Cohen et al., 2023; Hakim et al., 2025; Ma et al., 2023; Zhou et al., 2025).

2.1.2. Impact Of Carbon Disclosure On Equity Valuations

The discourse surrounding carbon disclosure has become increasingly prevalent in academic literature, with an increasing number of studies attributing its significance to its role in providing valuable capital market information, particularly in industries with high carbon intensity. Empirical evidence has repeatedly demonstrated that voluntary carbon disclosure is associated with positive valuation outcomes, including higher company values. Moreover, the impact of such disclosure has been observed to extend beyond the level of emission, suggesting a broader and more significant influence on financial markets (He and Zeng, 2025; Sun et al., 2022).

The primary explanatory mechanisms that have been repeatedly posited include reduced information asymmetries, a lower equity risk premium, lower financing barriers, and enhanced investment efficiency (Bui et al., 2020; He and Zeng, 2025). Nevertheless, it is noteworthy that the evidence is not entirely positive. In certain circumstances, disclosure can also be viewed neutrally or negatively. For example, disclosure can be viewed negatively if it primarily reveals ‘bad news’ (e.g. very high emissions without a credible path to reduction) or if markets interpret disclosure as mere compliance (Hewagama et al., 2025). Regulatory frameworks also impact valuation logic. Under mandatory reporting, standardisation can diminish the negative emissions valuation relationship because investors are less likely to reflexively ‘over-discount’ emissions figures (Baboukardos, 2017). At the same time, mandates demonstrate that premiums can undergo a shift between (former) voluntary disclosers and non-disclosers (Matthews et al., 2025).

Two distinctions must be highlighted for this thesis: firstly, the impact on value depends heavily on the quality and strategic relevance of the information (e.g. granular, forward-looking, linked to concrete actions) (Huang et al., 2025). Secondly, it is pertinent to consider the alignment between disclosure and actual performance, since consistency generates a valuation advantage, while inconsistent signals may undermine trust (H. Yan et al., 2020). If market

transparency is rewarded only when it is both credible and material, the next step is to clarify which emission dimensions are systematically related to company valuation, a topic examined in the next section.

2.1.3. Emissions And Equity Valuations

A recent body of literature has identified a correlation between higher emissions or emission intensities and lower firm valuations, as well as a reduced value relevance of conventional performance indicators. The specific impact of emissions on firm value depends on the scope of the emissions. In Europe, in particular, a stronger valuation sensitivity to directly controllable operational emissions (Scope 1) has been observed, while correlations between Scope 2 and 3 are sometimes weaker or less consistent (Perdichizzi et al., 2024).

In this context, the different emission scopes are shortly defined. Scope 1 covers direct greenhouse gas emissions from sources owned or controlled by the company (e.g. process-related CO_2 from chemical reactions) (Phillpotts et al., 2025; Rodríguez-Jiménez et al., 2023; Sharma and Sharma, 2025). Conversely, Scope 2 accounts for indirect emissions from the generation of purchased energy, including electricity, steam, heating, and cooling, which are frequently utilised by chemical companies (Jett et al., 2025; Phillpotts et al., 2025; Rodríguez-Jiménez et al., 2023). Scope 3, in turn, includes all other indirect emissions across the supply chain, both upstream and downstream of the organisation (e.g. upstream emissions from raw materials such as precursors and intermediate chemicals) (Irwin and Shenoy, 2023; Phillpotts et al., 2025; Rodríguez-Jiménez et al., 2023).

In the context of the EU ETS, it has been posited that the relationship between emissions and valuation may be non-linear. At low to medium emissions levels, emissions may initially serve as an indicator of output or profitability. However, at higher exposure levels, a discount is likely to be attributed to anticipated regulatory and transition risks (Basse Mama and Mandaroux, 2022). Furthermore, the findings for ETS companies indicate a potential correlation between reduced emission intensity and better financial performance (Flori et al., 2024). In the Science Based Targets initiative (SBTi) context, reductions in Scope 1 and 2 emissions are associated with financial benefits, while the significance of Scope 3 emissions in this regard remains less evident (Kayser et al., 2026).

These findings in the relevant literature support the assumption that emissions-related information and, consequently, sustainability-related press releases are generally relevant to

a company's value and, subsequently, to its success. However, the mechanism by which emission risk is translated into company valuation remains unclear. This will be examined in the next section with an economic focus.

2.1.4. Carbon Prices and Equity Valuations

From an economic perspective, the pricing of emissions exposure as transition risk can be explained through two channels. Firstly, it is necessary to consider the influence of carbon prices on expected cash flows. This is achieved by translating emissions into direct costs, investment requirements and potential stranded asset risks (Colmer et al., 2025; Fragkos et al., 2021; Riedl, 2021; Varga et al., 2022). Secondly, transition risk can also be reflected in a higher risk premium or discount rate. Studies discuss emissions-related valuation discounts as a carbon risk premium (Bolton et al., 2022) and present evidence-based approaches for pricing transition risk in financial markets in Europe (Broccardo et al., 2024; Bua et al., 2024) and in credit risk signals (Costola and Vozian, 2025).

The strength of these effects is systematically heterogeneous and is influenced by a range of factors. These include the ETS environment (Basse Mama and Mandaroux, 2022; Choi and Luo, 2021), sector and energy intensity (Bekun et al., 2021; Danish et al., 2020; Fragkos et al., 2021), and policy credibility, which can be reflected in carbon price signals (Sitarz et al., 2024).

When this valuation mechanism is taken into account, CO_2 prices (especially EU ETS) are translated into expected costs or risk premiums through emissions exposure, which can also influence share prices in the short term. This provides an economic foundation for examining sustainability press releases in the EU chemical industry as potentially price-relevant signals.

In summary, the present section demonstrates the significance of sustainability-related, including CO_2-related, information for share prices. Companies disclose emissions data under regulatory and capital market pressures, and markets evaluate this information based on its quality and credibility. Emissions are translated into expected costs or risk premiums using the CO2 price (e.g., the EU ETS). Building on this, Section 2.2 focuses on the investor side and examines how investors process ESG information, what valuation logic they use, and why market reactions can be heterogeneous.

2.2. Investors And Market Reactions

As this thesis aims at analysing the abnormal reactions of the stock market to corporate sustainability communications from an investor's perspective, this section explores the role of investors in advancing corporate sustainability.

This section first outlines how sustainability considerations are incorporated into investment processes. It begins by outlining the general role of investors in shaping corporate strategies and influencing sustainability-related behaviour (2.2.1). The subsequent subsection then discusses how ESG criteria are incorporated into investment assessments, and their influence on financial decision-making (2.2.2). Finally, it addresses the relevance of sustainability indices and ratings, focusing on their role in evaluating company performance and signalling credibility to the capital market (2.2.3).

The ensuing discourse is founded on the distinction between the regional preferences for using 'share price' and 'stock price'. The term ‘stock price’ is more commonly used in American English when referring to a publicly traded company's equity price. Research and financial literature from the US typically utilise the term ‘stock price’ (Hendijani Zadeh, 2023; Keinonen, 2019; Kubik et al., 2005; Smajlbegovic, 2019). The term ‘share price’ is more frequently used in British English and countries influenced by British financial terminology, such as the UK, India, and other Commonwealth nations (Bissoondeeal, 2021; Bissoondeeal and Tsiaras, 2023; Ferretti et al., 2024; Miyano and Kaizoji, 2017). Given that the companies examined in the chemical industry are primarily located in Europe, particularly the United Kingdom, and that the thesis is written at the University of Worcester, based in the United Kingdom, the term 'share price' will be used consistently throughout this thesis.

2.2.1. Role And Impact Of Investors In A Corporate Context

As mentioned in Section 1.1.2, the chemical industry has many stakeholders. One important group is the investors of the respective companies (Hyršlová et al., 2017). Aside from sustainability, investors are significant to companies because they provide capital essential for operations, expansion, and innovation (Al-Qadasi, 2024). This financial support is crucial for companies in the manufacturing sector to maintain competitiveness and long-term sustainability (Chen et al., 2022). Institutional investors, in particular, also significantly shape organisational governance structures and decision-making processes (Lin et al., 2017).

Companies that align their objectives with investor expectations for profitability and value creation are more likely to attract investment and achieve long-term success (Latif et al., 2022).

When discussing value creation and long-term success, it is also essential to promote sustainability. Long-term institutional investors aim to maximise the value of their investments by encouraging companies to adopt strategies that enhance financial performance and promote sustainable growth (Chen et al., 2022). Research indicates that investors interested in sustainable investing commonly implement strategies such as negative screening, positive screening, norms-based screening, ESG integration, and sustainability-themed investing (Cunha et al., 2020).

- Negative Screening: This exclusion criterion applies to companies or sectors that demonstrate non-compliance with predefined ESG standards (Amel-Zadeh and Serafeim, 2018; Bertelli and Torricelli, 2024).

- Positive Screening: The process of selecting companies or assets with the strongest ESG performance within a given sector or market involves a strategic focus on entities that demonstrate a leadership position in sustainability practices (Bertelli and Torricelli, 2024; Cappucci, 2017; Єльнікова, 2020).

- Norms-based Screening: Investment decisions are made based on their alignment with international norms and standards, such as the UN Global Compact or OECD Guidelines. This approach is particularly prevalent in Europe (Єльнікова, 2020).

- ESG integration: The incorporation of ESG factors into traditional financial analysis and investment decisions is a systematic process that considers how ESG risks and opportunities influence long-term performance (Cappucci, 2017; Sciarelli et al., 2021).

- Sustainability-themed investing: This investment strategy focuses on investments in specific sustainability themes, including renewable energy, clean technology, and health and nutrition. The portfolios in question are designed to identify companies or projects that have been determined to make a direct contribution to sustainable development (Sciarelli et al., 2021; Єльнікова, 2020).

Having briefly discussed the role of investors in a corporate context, the following section focuses on the development of sustainability and ESG criteria in the investment sector as a whole.

2.2.2. Impact Of ESG Criteria In The Investment Sector

The evolution of ESG as an investment criterion has gained significant momentum in recent years, as both individual and institutional investors increasingly recognise the relevance of environmental, social, and governance factors in financial decision-making (Beunza and Ferraro, 2019; Boschee, 2023; Gunawan et al., 2023). As outlined in Section 1.1, a comprehensive set of measures within the European Union's sustainability initiatives has accelerated this process and has positively impacted the relevant body of literature (Daugaard, 2020; Nguyen, 2025; Zairis et al., 2024).

Numerous studies have provided empirical evidence that strong ESG performance can positively impact financial performance (Zhao et al., 2018). These authors, for example, also found that companies with strong ESG performance tend to demonstrate improved financial performance, which is crucial information for investors, company management, decision-makers, and industry regulators (Zhao et al., 2018). This positive correlation between ESG performance and financial performance has been observed across various sectors, including the healthcare industry (Pinheiro et al., 2023), an industry closely linked to the chemical industry due to its heavy reliance on chemical products and the associated occupational and environmental risks (McDiarmid, 2006; Virji et al., 2022). Section 1.1.3 provides a broader discussion of the underlying business case for sustainability and its implications for corporate practice.

Research further indicates that ESG performance can significantly mitigate financial risks during crises, such as the COVID-19 pandemic (Broadstock et al., 2021). They highlighted that ESG performance can reduce financial risk during crises, underscoring the importance of ESG considerations in enhancing resilience and sustainability amid economic challenges (Broadstock et al., 2021). Moreover, the influence of ESG performance on financial performance has been examined in specific contexts, such as the energy sector, where better ESG performance has been associated with improved financial outcomes (Pinheiro et al., 2023). Moreover, good ESG performance can improve financing conditions by lowering capital costs and easing constraints (Chen, 2024). This suggests that companies prioritising ESG considerations may enjoy improved access to financing and reduced capital costs, thereby enhancing financial performance. Additionally, a positive relationship between ESG performance and financial performance has been observed in various regions, including China (H. Liu et al., 2022).

The impact of ESG performance on financial performance extends beyond specific industries to a broader range of companies. Shobhwani (2023) demonstrated that strong corporate ESG performance enhances financial performance, as measured by accounting and market-based metrics. This indicates that companies that integrate ESG considerations into their operations and decision-making processes are likely to achieve superior financial results compared to those that neglect ESG factors.

Furthermore, the disclosure of ESG performance has been linked to value generation in the financial industry. Gholami, Sands and Rahman (2022) highlighted a positive relationship between corporate ESG performance disclosure and financial performance in the financial sector, emphasising the significance of transparency and accountability in ESG practices. This suggests that companies effectively communicating their ESG efforts to stakeholders may experience enhanced financial performance due to increased stakeholder support and trust.

In addition to directly impacting financial performance, ESG performance has been linked to other financial metrics, including firm valuations. Almeyda and Darmansya (2019) identified a significant and positive relationship between ESG factors and firms' valuations, indicating that companies with higher ESG scores tend to perform better. This highlights the broader implications of ESG considerations on various aspects of corporate performance and valuation.

Nevertheless, several scientific studies have identified a moderate or even negative correlation between ESG and financial performance. For instance, some studies conducted by Indian and Western European companies have demonstrated a consistent negative correlation between ESG (primarily Environmental and Governance) and financial performance metrics such as Return on Equity (ROE) and Return on Assets (ROA) (Bahadır and Akarsu, 2024; Giannopoulos et al., 2022; Rao et al., 2023; Zahid et al., 2022). This finding supports the notion that ESG investments can increase business costs and reduce short-term profitability. However, these results must be critically scrutinised.

The mentioned study by Rao et al. (2023), which was conducted among Indian companies in the Nifty 50 stock index, cannot be directly compared with this thesis, which focuses on European chemical companies. Furthermore, the other sources mentioned have moderating effects: For Zahid et al. (2022), the negative effect of ESG on financial performance is more pronounced in companies audited by high-quality (Big Four) firms. According to the study by Bahadir and Akarsu (2024), a better information environment can mitigate the negative impact of ESG on profitability. In companies with high asset turnover, ESG does not harm profitability.

Overall, the body of research on the impact of ESG performance on corporate financial performance reveals a high degree of positive correlation, indicating that companies prioritising environmental, social, and governance factors tend to achieve better financial outcomes. These findings underscore the pivotal role of ESG performance in shaping corporate success and fostering stakeholder trust.

Given this established link between ESG performance and financial success, it is pertinent to explore how the measurement and reporting of ESG factors through sustainability indices and ratings influence investor perceptions and behaviours. The following Section 2.2.3 will examine the sustainability indices and ratings used to assess ESG performance. It will analyse their impact on investor decision-making processes and explore their effectiveness as tools for conveying ESG information to the investment community. By understanding the significance of sustainability indices, this thesis can gain deeper insights into shaping investor perceptions and behaviour, ultimately influencing investment strategies and market outcomes.

2.2.3. Sustainability Indices And Ratings

This section will explore the role of sustainability indices and ratings in the investment landscape. These tools have become increasingly crucial for assessing corporate ESG performance and guiding investor decisions (Paranita et al., 2025; Wang, 2025; Zhang and Chang, 2024; Zumente and Lāce, 2021). By examining the various sustainability indices and ratings used to evaluate companies, this thesis aims to understand their impact on investor perceptions and behaviour. This section will analyse whether the presence of these indices serves as an effective mechanism for communicating ESG performance and how they influence investment strategies and market outcomes.

First, the terms 'sustainability indices' and 'sustainability ratings’ in this context are intended to refer to tools for assessing companies' sustainability efforts from an external perspective.

Sustainability indices constitute composite benchmarks that systematically aggregate and rank organisations or financial assets based on their performance across a defined suite of sustainability criteria, with a particular emphasis on ESG dimensions. These indices serve a dual purpose: they facilitate the monitoring of sustainable investment performance and provide a framework for benchmarking investment portfolios against established standards (Bolognesi et al., 2024; Cunha et al., 2020; Jain et al., 2019; Vilas et al., 2021).

Sustainability ratings represent evaluative metrics or classifications assigned to specific entities, including corporations, investment funds, or projects, based on their performance regarding sustainability criteria (Berardi, 2012; Escrig-Olmedo et al., 2019; Popescu et al., 2021). Such ratings are generally rendered by specialised agencies and are derived from comprehensive analyses of ESG data, corporate disclosures, and, in certain instances, real-time analytical assessments (Abhayawansa and Tyagi, 2021; Hughes et al., 2021; Koellner et al., 2005).

On the one hand, sustainable indices are typically compiled using standardised methods and publicly available data, thereby increasing comparability and reliability across markets and time periods (Kwatra et al., 2020; Witulski and Dias, 2020). These indices summarise various sustainability criteria, offering a comprehensive overview of the sustainability performance of groups of companies or funds (Bolognesi et al., 2024; Jain et al., 2019; Vilas et al., 2022). Nevertheless, the aggregation process can sometimes mask poor performance in specific areas, and the reliability of the results can be influenced by methodological choices, such as indicator selection and weighting (Bolognesi et al., 2024; Vilas et al., 2022).

On the other hand, ratings often rely on self-reported or non-standardised data, leading to inconsistencies and potential bias. Practitioners have reported difficulties obtaining reliable information and have encountered methodological issues in risk assessment, which can compromise the reliability of ratings (Boiral et al., 2020). The reliability of ratings is occasionally upheld through the use of impression management strategies rather than the pursuit of objective rigour (Cesarone et al., 2023; Drempetic et al., 2020; Hughes et al., 2021; Widyawati, 2020). Concurrently, a paucity of convergence among diverse rating agencies is observed (Drempetic et al., 2020; Sorrosal-Forradellas et al., 2023).

Ratings can provide detailed insights into specific companies or projects; however, they may not be as reliable for broad comparisons due to the varying methodologies and data sources used (Drempetic et al., 2020).

Thus, sustainability indices provide a more dependable and uniform evaluation of large-scale data, thanks to their statistical validation and standardised methods, which are also used in this thesis. Although beneficial for detailed analysis, ratings often face significant challenges regarding data quality and methodological rigour, making their reliability more variable.

Some well-known sustainability indices in the stock market include the MSCI World Sustainable Development Index, the DJSI, and the FTSE4Good Index. These indices comprise companies that meet specific ESG criteria and are recognised for their sustainable business practices (Deng and Cheng, 2019). Studies have shown a positive correlation between a company's ESG indices and its stock market performance, indicating that inclusion in ESG indices can enhance an enterprise's market value growth (Deng and Cheng, 2019; Garcia-Blandon et al., 2024). Additionally, sustainability indices indicate corporate sustainability leadership, which can attract investors to align their investments with ESG principles (Garcia-Blandon et al., 2024). Including the DJSI North America resulted in ARs for 12-30 months after listing and increased institutional ownership, indicating superior share performance post-inclusion (Kang et al., 2020). Event studies typically focus on ARs to evaluate the association between share price movements and specific events within a defined time frame known as the event window (Suryani and Pertiwi, 2021). The ARs are crucial indicators of how the market reacts to corporate announcements, policy changes, or natural disasters (B. Liu et al., 2022).

An event study was conducted to examine the share price reactions of companies listed on the Borsa Istanbul Sustainability Index (BIS). During the 7-day event window, these companies achieved returns that were statistically significantly higher than expected based on standard market models (Çimen, 2019). Such ARs indicate a positive market reaction and, concomitantly, call into question the semi-strong form of the efficient market hypothesis (EMH), as they demonstrate that information regarding index inclusion was not fully and directly priced into the share price (Nanda and Wirakusuma, 2020; Sunardi et al., 2023). The EMH is a fundamental theory in finance that posits that financial markets efficiently reflect all available information about securities, making it impossible for investors to consistently achieve above-average returns (Santoso and Ikhsan, 2020). By assuming market efficiency, event studies can evaluate ARs around specific events and determine whether these returns are consistent with what would be expected in an efficient market (Sohail et al., 2017). More details about this scientific phenomenon will be discussed in the next section, with a continued focus on the insights provided by sustainability indices.

Another event study investigated the performance of companies listed in the same BIS Index during the COVID-19 crash. The study found that companies in the sustainability index experienced lower average losses than non-included companies, highlighting the protective effect of sustainability investments during financial crises (Tosun and Özgen, 2023). A study by Adamska and Dąbrowski (2021) examines investor reactions to companies' inclusion and exclusion from sustainability indices across six markets. It found that in riskier institutional

environments, investors responded more positively to company inclusions and more negatively to exclusions. This suggests that investors perceive inclusion in sustainability indices as a risk-reducing factor.

There is also scientific evidence that the firm's performance does not benefit from inclusion in ESG or sustainability indices. Both publications by Jain, Sharma, and Srivastava (2019) and Kurnoga, Šimurina, and Fučkan (2022) do not find a significant difference in performance between sustainability and traditional indices in most cases. These studies have focused on comparing ESG and traditional indices across various regions, such as Europe (Kurnoga et al., 2022) and developed markets as a whole (Jain et al., 2019). However, an analysis of this comparison at an industry-specific level is currently lacking. Firms operating in sensitive industries with high emissions tend to demonstrate high ESG indicators and disclose better performance (Cherkasova and Nenuzhenko, 2022). Research indicates that large-scale companies do not always have lower greenhouse gas emissions intensity than small-scale companies, but they may have higher ESG scores (Hu et al., 2024). Along these lines, it can be assumed that ESG performance may be higher in sensitive industries, such as the chemical industry (see Section 2.4). After all, companies in this industry typically operate at higher emission levels and have greater potential for savings. Consequently, companies in this industry that are included in sustainability indices could also enjoy better corporate performance.

It is the signalling theory (Connelly et al., 2011; Spence, 1978) that provides a central framework for understanding why sustainability communication may serve as a credible signal to capital markets. According to this theory, firms employ various signals to convey information to investors and stakeholders, thereby influencing their perceptions and decisions (Grinblatt and Hwang, 1989). In the realm of sustainability communication and particularly in the present case of sustainability indices, companies use signals to address the asymmetry between their actual sustainability commitments and investor perceptions (Bae et al., 2018; Moussa and Elmarzouky, 2024; Papoutsi and Sodhi, 2020). These signals convey both financial forecasts and sustained commitments to environmental and social objectives (Goliampolska, 2025; Landi et al., 2022; Taliento et al., 2019). Nevertheless, external factors such as market conditions, regulatory changes, and economic events can affect the effectiveness of these signals and shape how market participants interpret them (Choudhury et al., 2022). The credibility and reliability of such signals may be diminished by external noise, which influences their perceptions and subsequent actions (Yao et al., 2019). This issue is particularly noteworthy in the chemical industry, given its high exposure and cyclical nature, which presents methodological challenges in distinguishing pure signalling effects from background noise

(Forcadell et al., 2023; Papafloratos et al., 2023; Setälä et al., 2025). This challenge will be further examined in Section 3.4 (Methodology) and Section 5.4 (Discussion) of this thesis.

Building on the signal perspective outlined above, the following section focuses on sustainability-related web-based press releases and uses empirical data to examine whether such releases elicit unusual share price reactions in the current literature.

2.3. Corporate Web-Based Press Releases And Communication Patterns

Based on relevant literature, this section analyses how companies in the chemical industry use web-based press releases to communicate sustainability-related content. Both the content-related and textual characteristics of the publications are examined.

First, the role of web-based press releases is classified (Section 2.3.1), followed by a detailed examination of the influence of sustainability-related press releases on share prices (Section 2.3.2). Subsequently, the content-related and textual characteristics of press releases are outlined and examined to determine what the literature says about their influence on investor reactions and, consequently, on the share price (Section 2.3.3).

In the following course of this thesis, no distinction is made between web-based press releases and press releases; instead, the term is used synonymously, as web-based press releases generally retain the traditional structure and purpose of press releases, such as providing news, background information and quotes, similar to email or print versions (Tessuto, 2021; Yakhontova and Ivantsiv, 2021).

2.3.1. Role Of Web-Based Press Releases In Corporate Communication

Generally, press releases serve as a means for companies to manage their relationships with stakeholders, influence media coverage, and shape public perception (Catenaccio, 2022; Liu and Zhang, 2021). Compared to other forms of corporate communication, press releases provide a timely and direct means of reaching stakeholders and the public (Çataldaş, 2024; Fuoco et al., 2023; Scott, 2015). They are beneficial for agenda-building, influencing investors' decisions, and shaping public opinion (Guillamon-Saorin and Sousa, 2014; Schafraad et al., 2016). The content of press releases, which often includes positive news such as new product

launches, contributes to shaping a positive corporate image and building publicity capital (Yakhontova and Ivantsiv, 2021). Press releases are often structured to attract media coverage, which can significantly amplify the reach of the information being shared (Catenaccio, 2022). Companies' effective framing of narratives is pivotal in ensuring the resonance of their messages with journalists (Ettema, 2005; Saliba and Geltner, 2012; S. Wang et al., 2024). These professionals frequently use these documents as fundamental sources for writing news stories (Guillamon-Saorin et al., 2012). Media serve as essential intermediaries that disseminate accurate information in corporate press releases and generate new, relevant information for various parties (Rossmann et al., 2017; Tsileponis et al., 2020). Press releases also effectively reduce information asymmetry by disseminating news broadly through traditional disclosure methods (Bartov et al., 2018). They are still widely used for economically significant information compared to other communication forms, such as social media and corporate tweets (Al Guindy et al., 2024).

Unlike social media platforms like X, press releases are structured to provide detailed and formal information, making them more suitable for conveying complex messages and financial results (Bartov et al., 2018). The present thesis analyses the web-based original of each release; subsequent redistribution, whether via embedded links on X, e-mail lists or other third-party services, does not alter its structure and therefore lies outside the analytical scope. While firms increasingly use social media for specific announcements, press releases remain essential for conveying detailed, important information, such as financial results and significant corporate developments (Al Guindy et al., 2024). Moreover, press releases have a broader reach than other forms of communication, as they are often picked up by media outlets and included in news stories, thereby enabling the wider dissemination of the company's message (Brennan et al., 2008). Especially in this regard, they are not without limitations. Concerns about exaggerations, misrepresentations, spin and the omission of conflicts of interest have been highlighted, underscoring the importance of transparency, reliability, and accuracy in press releases (Choi and Feller, 2021; Grochala, 2019; Sumner et al., 2016; Yavchitz et al., 2012).

However, current press releases can influence the market reaction to corporate news, making them a valuable tool for companies to communicate with stakeholders and investors (Neuhierl et al., 2013). They are also valuable for strategically managing online investor audiences and influencing investor decision-making processes (Guillamon-Saorin and Martínez-López, 2013).

This section reveals the structural and strategic functions of press releases in corporate communications. Their influence is equally important to understand, particularly in financial markets. Therefore, the following section analyses the financial impact of press releases and their role in influencing investor behaviour and share price performance.

2.3.2. Impact Of Sustainability-Related Press Releases On Share Prices

As discussed in the last section, research indicates that press releases can influence investors' decisions. This section examines the phenomenon in the context of sustainability-related press releases, exploring their impact on capital markets and potential effects on corporate value.

A considerable body of research further emphasises the calming effect of corporate sustainability disclosures on share price fluctuations and the risk of market crashes. Hunjra, Mehmood, and Tayachi (2020) illustrate that weak internal controls and the tendency to withhold negative information can increase the likelihood of share price crashes. In contrast, strong CSR and governance practices help mitigate this risk. Similarly, Dai, Lu, and Qi (2019) demonstrate that high-quality sustainability-related disclosures can significantly reduce price instability, highlighting the importance of transparency and credibility in corporate communication.

From a broader market perspective, Grewal, Hauptmann, and Serafeim (2017) indicate that firms disclosing more sustainability information, particularly that deemed material by the Sustainability Accounting Standards Board (SASB), tend to demonstrate lower share price synchronicity. This finding suggests that sustainability-related signals contribute to more firm-specific price movements, likely due to enhanced investor confidence and differentiated risk assessments. Supporting this perspective, Pahlavan, Rostamy, and Darabi (2023) demonstrate that sustainability reporting enhances financial transparency, improves liquidity, and mitigates crash and liquidity risks. Additionally, Zhang, Djajadikerta, and Zhang (2018) bolster this argument by linking sustainability engagement to reduced stock return volatility in the Chinese market.

In addition to their stabilising effects, sustainability press releases can significantly influence investors´ decisions and share prices. Research has also shown that the content of corporate press releases can impact market responses and influence investors' decision-making processes (Guillamon-Saorin and Sousa, 2014; Henry, 2008). Gupta and Graubner (2019) examine various types of corporate news within the German market and confirm a measurable

impact of press releases on stock returns. Lee, Rasiah, and Lai (2020) expand upon this understanding by demonstrating how press freedom enhances market efficiency, allowing investors to interpret press releases more accurately.

A particularly noteworthy contribution comes from Neuhierl, Scherbina, and Schlusche (2013), who categorise firm-level press releases and evaluate their effects on share prices and the information environment. This approach closely aligns with the methodology of the present thesis. Their findings emphasise that sustainability-related communication is crucial in shaping capital market reactions.

Nevertheless, the influence of press releases on share prices is inconsistent and must be understood within a broader market context. Chin, Tzeng, and Yu (2012) suggest that external factors, such as macroeconomic trends or industry-specific regulations, can significantly impact capital market reactions. The research conducted on Taiwanese chemical shares in the aftermath of the Economic Cooperation Framework Agreement (ECFA) established between China and Taiwan in 2010, an agreement aimed at reducing tariffs, eliminating non-tariff trade barriers, and fostering economic cooperation and development (Hong and Yang, 2011), indicates that political events could supersede firm-level signals in shaping market outcomes. This underlines the need to differentiate between internal and external drivers of share price movements, a challenge that will be addressed later in the methodological framework (see Section 4.4) of this thesis.

Furthermore, not all investors interpret sustainability information in the same way. According to Hoffmann, Post, and Pennings (2015) and Laskin (2018), individual investment strategies and risk tolerance significantly influence how sustainability signals are perceived. While socially responsible investors tend to concentrate on firms with robust ESG performance, others may focus on traditional financial metrics (Ali, 2020; Guillamon-Saorin and Martínez-López, 2013). This diversity in perspectives further complicates the task of generalising the effects of press releases.

The way in which information is framed and conveyed plays a crucial role. The strategic application of non-GAAP (Generally Accepted Accounting Principles) measures, performance indicators outside the official financial reporting, in press releases can offer a more differentiated perspective on a company's financial status and sustainability efforts (Bhattacharya et al., 2007; Guggenmos et al., 2022; Guillamón-Saorín et al., 2017). These disclosures enable management to better align with market expectations, thereby potentially enhancing the signalling power of sustainability-related content.

Timing is also paramount for the impact of press releases on investor response. Research by Yan et al. (2020) and Rawson, Twedt, and Watkins (2023) reveals that well-timed announcements regarding sustainability achievements can elicit positive responses from investors. Furthermore, press releases must often balance long-term strategic positioning with short-term investors´ sentiment. Gong (2024) highlights how companies modify the tone of their communications in reaction to stock liquidity and pressures from transient investors, illustrating a dynamic feedback loop between communication strategy and market expectations.

In conclusion, sustainability-related press releases are essential for effectively communicating corporate responsibility and resilience. By shaping investor perceptions, these communications can stabilise market behaviour, influence share prices, and attract investors who prioritise ESG criteria. However, contextual factors, such as market conditions and investor diversity, must be taken into account when evaluating their actual impact.

Following a careful consideration of the findings from the literature review to this point, it is possible to formulate the following assumption:

H1
‘Sustainability-related press releases positively affect the share prices of companies listed in the STOXX 600 Europe Chemicals Index’

Against this backdrop, the present thesis aims to investigate empirically how sustainability-related press releases affect share prices in the European chemical sector. This leads to the following research question:

RQ1
‘How do sustainability-related press releases affect the share prices of companies listed in the STOXX 600 Europe Chemicals Index?’

These findings suggest that sustainability-related press releases serve to communicate responsibility and resilience, acting as a strategic tool to influence investor expectations and capital market behaviour.

At this juncture, the considerations and findings presented in Section 2.2.3 are revisited, as H1 permits the derivation of a subsequent hypothesis for this thesis. It is posited that signalling theory is explanatory in the context of this thesis and that sustainability indices can be understood as credible signals that companies use to transparently present their sustainability efforts. It is further assumed that this can reduce information asymmetries vis-à-vis the capital market. With this framework in mind, the present thesis seeks to ascertain whether and to what degree the responses of capital markets diverge when companies in the STOXX Europe 600 Chemicals Index deliberately accentuate their sustainability communication in the context of their inclusion in a sustainability index from 2020 to 2023.

H2

‘The share price reaction to sustainability-related press releases differs between companies that are additionally featured in sustainability indices and those that are’

Subject to the validity of this assumption, the subsequent research question is posited:

RQ2

‘Does the market reaction to sustainability-related press releases differ between companies additionally featured in sustainability indices?’

However, the previously discussed studies in this section tended to focus on the impact of the press releases, paying comparatively little attention to the communicative mechanisms, such as content-related or textual characteristics, through which this impact unfolds. The following section analyses the characteristic communication patterns in sustainability-related press releases from the chemical industry. The extent to which communicative design elements, such as topics, structure, readability, and sentiment, contribute to the observed effects on the capital market is analysed.

2.3.3. Content-Related And Textual Characteristics For Sustainability-Related Press Releases

Building on the previous findings, the impact of sustainability-related press releases on market reactions depends on what they communicate and how they communicate it. Structural and textual dimensions – such as text length, readability, sentiment and thematic focus – shape how media, stakeholders and investors process these messages. This section analyses these features to understand how content-related and textual characteristics in press releases influence investor response.

Text length is one of the most frequently studied structural features in this regard. Longer releases may contain more detailed information; however, they are commonly reduced to conform to the concise format favoured by news articles (Maat, 2007). Corporate press releases tend to be comparatively brief, typically between 300 and 800 words, a quality that aligns with the necessity for succinctness in communication targeted towards journalists who are often inundated with a high volume of tasks and information (Catenaccio, 2022). In a media landscape where information overload is commonplace, journalists must rely on press releases as primary sources for news stories. The brevity of such releases is essential in this regard (Schafraad et al., 2016). It is acknowledged that the brevity of press releases can facilitate a more expeditious comprehension of the subject matter. However, there is a concomitant risk that critical sustainability issues might be oversimplified (Adhariani and Du Toit, 2020).

Conversely, the length of sustainability reports directly affects their readability. It has been demonstrated that longer reports may offer a more comprehensive overview, but this can decrease readability, making it challenging for stakeholders to extract key information (Mnif and Kchaou, 2023). Sustainability reports often use technical jargon and complex language. These elements can potentially obfuscate the intended message, reducing their overall effectiveness (Adhariani and Du Toit, 2020). This aligns with studies showing that readability indices, such as the Flesch Reading Ease score, are often lower in sustainability reports than in other corporate disclosures (Adhariani and Du Toit, 2020; Nilipour et al., 2020). This finding suggests that sustainability reports are characterised by greater complexity, posing a more significant challenge for stakeholders to comprehend their content (Lin et al., 2023; Smeuninx et al., 2020). This inherent complexity can engender frustration among readers, which may, in turn, lead to adverse perceptions of the company's transparency and commitment to sustainability (Costantini and Costantini, 2022).

A positive text sentiment can counter this issue, which is another dimension, alongside the length and readability of press releases. Research has demonstrated that corporate press releases frequently employ considerable positive language, including positive quotations and headlines, which may enhance their appeal and perceived credibility (Rosenkranz and Pollach, 2016; Schafraad et al., 2016). This strategic use of language indicates a broader trend in which companies seek to frame their narratives in a positive light. The dissemination of positive press releases is an effective strategy for mitigating adverse perceptions arising from unfavourable events (Soroka, 2006; Velásquez et al., 2020). Furthermore, such communications have been shown to stimulate investor interest in significant transactions, including mergers and acquisitions (Schafraad et al., 2016). In addition to crisis communication and announcements about mergers and acquisitions, companies have also noted positive market responses to favourable sustainability-related news. Press releases highlighting key sustainability achievements or initiatives can effectively foster investor confidence, especially when strategically planned (Rawson et al., 2023; Z. Yan et al., 2020). Such strategic disclosure can also attract socially responsible investors who prioritise ESG criteria in their investment decisions, thereby further enhancing the relevance of sustainability communication (Filip et al., 2021).

In addition, maintaining a favourable tone in corporate communications has been demonstrated to facilitate agenda-building. This process extends beyond merely delivering information; it also encompasses shaping narrative congruency with the organisation's objectives (Park et al., 2019). The adoption of a positive tone is essential for managing corporate crises and shaping public perceptions, thereby reinforcing the dual purpose of press releases. That is to say, such communications serve to inform the public while also strengthening an organisation's identity (Ling, 2023). Especially in corporate crises, companies frequently issue statements that address unethical behaviour, outline corrective measures, and emphasise their commitment to ethical practices (Ozgun and Broekel, 2022).

Besides the question of how corporate press releases are communicated and their crisis management function, other frequent events can be categorised in a corporate context, where stakeholders, including investors, highly value transparency regarding the company's economic health, and financial performance remains a key topic of discussion (García-Sánchez et al., 2023; Jain, 2025; Tamimi and Sebastianelli, 2017). To this end, companies routinely issue press releases that detail financial information such as quarterly earnings, mergers, and acquisitions the company may be engaged in, and the latest strategic financial initiatives the company is implementing (Chen et al., 2025; Davis et al., 2011; Hu et al., 2022). These practices keep stakeholders informed and manage market perceptions (Sumner et al.,

2021). Presenting favourable financial results is paramount in achieving favourable media coverage (Schafraad and Zoonen, 2020). Another category for press releases is CSR projects. These press releases can also help shape a positive perception of the company, provided the claims are not undermined by contradictory actions (Khan and Sukhotu, 2020; S. Kim, 2019; Lee, 2016; Vogler and Eisenegger, 2021). A study has highlighted the growing emphasis on enhancing transparency and accountability in addressing the environmental and social impacts of modern economic practices (Li et al., 2019). Environmental sustainability is thus also important in the context of press releases. These types of press releases often highlight the adoption of sustainable business models, thereby demonstrating companies' commitment to aligning their operations with sustainability principles (Ritala et al., 2018). Such news typically covers measures to mitigate ecological impacts, including reducing carbon emissions and promoting sustainable energy sources (Gorski and Ranf, 2024). This category of press releases is crucial for this thesis and will be examined in further detail.

The following literature provides insights into the content of these sustainability-related corporate press releases. As demonstrated in one study, firms are increasingly integrating sustainable business models into their public discourse, reflecting a shift in corporate priorities (Ritala et al., 2018). Another study highlights how specific words and themes influence media coverage, emphasising the strategic nature of corporate agenda-building (Schafraad et al., 2016). The influence of language on public and media responses is also explored, highlighting how word choices shape the effectiveness of a press release. This concept can extend beyond health-related topics to sustainability messaging (Adams et al., 2019). Boumans (2018) emphasises the significance of framing in shaping media representation, highlighting the need for a sophisticated understanding of language in shaping perceptions. Another study examines the evolution of press release topics and formats, shedding light on their role in corporate identity and providing a comprehensive overview of the subject (Nursyahbani, 2021).

All these studies enhance the understanding of communication on sustainability, but they also reveal specific gaps. They employ either a broad or a targeted approach, involving different stakeholders, when encountering sustainability-related press releases. Under these circumstances, the research fails to provide any insights into which words or word groups are most effective for various stakeholders. Only some studies emphasise that aligning sustainability messaging with expectations regarding ESG issues is essential (Imperiale et al., 2023; Lokuwaduge and Heenetigala, 2017).

Furthermore, it is crucial to provide empirical evidence on the specific vocabulary that influences investor beliefs (Kräussl et al., 2024). Furthermore, another study highlights the

crucial role of credibility in shaping investors' perceptions of sustainability disclosures (Misiuda and Lachmann, 2022). Dambra et al. (2018) also highlight the use of voluntary disclosures to enhance visibility, a strategy employed in the context of sustainability communication. However, this specific application remains understudied. In a similar vein, ESG ratings have been linked to investors' risk perceptions, suggesting that, as previously mentioned, positive sustainability language may help mitigate financial concerns (Feng et al., 2022; Horn, 2023; Reber et al., 2022). However, the precise wording that elicits this effect remains to be fully elucidated (Landi et al., 2022). Meanwhile, research on corporate press releases suggests that maintaining an overall optimistic outlook can strengthen market confidence (Azimi et al., 2024; Hossain et al., 2024; Li et al., 2024; Rocciolo et al., 2017; C. Wang et al., 2024). However, further studies are required to ascertain which specific linguistic elements contribute most to this outcome (Zhang, 2024).

Existing studies frequently analyse the content of sustainability communication or its reception by different stakeholders. However, they rarely combine the two in a quantifiable and industry-specific way. Moreover, while some studies have analysed how readability, tone, and sentiment affect media coverage or stakeholder interpretation, the impact of these variables on the capital market has not yet been comprehensively examined in an integrated manner. This phenomenon is especially evident in sectors such as the chemical industry, where regulatory pressures, environmental scrutiny and the need to innovate converge.

Collectively, earlier studies indicate that textual and content-related traits may influence how investors respond to sustainability-related press releases. Nevertheless, the direction and extent of these impacts are inadequately substantiated in a combined, industry-specific context. This is why the following assumption can be made:

H3

‘Content-related and textual characteristics of sustainability-related press releases—specifically content, sentiment, readability and length—are associated with share price movements of companies in the STOXX 600 Europe’ Chemicals Index’

Accordingly, this thesis attempts to close this gap by investigating the following research question:

RQ3
'Do content, sentiment, readability and length of sustainability-related press releases coincide with share price movements of companies in the STOXX 600 Europe Chemicals Index'

This research question seeks to address the gaps in science as holistically as possible, without claiming to combine all dimensions. Based on the findings of this literature review, the following section concludes and identifies the most important cornerstones, including the research questions that inform the methodology design.

2.4. Summary

The primary purpose of conducting a literature review is to establish the current state of knowledge on a particular topic, laying the groundwork for further research (DeShon and Gillespie, 2005). In the context of this thesis, the most relevant scientific literature on the interrelationships among sustainability, communication, and finance is compiled. However, a persistent challenge with literature reviews, including this one, is the risk of bias in selecting and interpreting studies (Paez, 2017). Another limitation of literature reviews refers to the quality and reliability of the included studies (Daniel, 2022). This literature review includes some publications that are limited to specific industries and regions. This is also because the topics discussed in combination with sustainability, communication, and finance do not yet have a generally valid and established empirical basis. Initial approaches in this context began in the 2010s and 2020s, and more articles on this topic and related fields are expected to be published in the future. This is also why the dynamic nature of research fields challenges the currency and relevance of literature reviews (Mahood et al., 2013).

Nevertheless, established theories and approaches from various disciplines (e.g., signalling theory) can also be applied in this context. Based on these established theories, the following paragraphs present some significant findings from the literature review.

1. Literature suggests that sustainability-related press releases can positively impact share prices. This positive reaction is attributed to the growing importance of ESG

factors among investors, as they serve as indicators of long-term viability and reduced risk. Transparent and well-timed sustainability disclosures could further enhance investor confidence and result in favourable market responses. Some empirical studies suggest that companies with robust sustainability practices tend to perform better financially, reflecting positively on their share prices **(RQ1)**

2. There is further scientific evidence that market reactions to sustainability-related press releases can be more pronounced for companies included in sustainability indices. Inclusion in indices such as the DJSI or the FTSE4Good is perceived as a validation of a company's commitment to sustainability, which could reduce perceived investment risks and attract a broader base of socially responsible investors. Such companies may experience stronger positive market reactions than those not featured in such indices. **(RQ2)**

3. The literature review also examines the importance of specific content-related and textual characteristics, including language, sentiment, and readability, in press releases. Positive, clear, and transparent communication about sustainability achievements could significantly influence investor sentiment and share prices. Companies that are part of sustainability indices may benefit more from strategic communication efforts due to the higher expectations and scrutiny they face from investors. Effectively communicating sustainability initiatives reinforces the company's commitment to ESG principles, which, in turn, positively impacts share prices. **(RQ3)**

These findings suggest that press releases can serve as a key instrument for influencing capital market reactions, particularly when addressing sustainability issues. RQ1-3 derived from this have been developed and derived logically in the respective sub-chapters of the literature review:

- Section 2.3.2 presents an analysis of the general capital market effects of sustainability press releases. (RQ1)

- In Section 2.2.3, an analysis was conducted and, in Section 2.3.2, further extended to determine the extent to which membership in sustainability indices is associated with divergent market reactions. (RQ2)

- Finally, section 2.3.3 provided an analysis of the communicative characteristics of such press releases and their influence on investor reactions. (RQ3)

In the subsequent chapter, which is dedicated to discussing the methodology, these research questions are recalled at the beginning of Chapter 3. However, it should be noted that this re-examination does not adhere to the sequence in which they were initially derived. Conversely, the methodological implementation employs an analytical structure that commences with the most statistically controllable correlations and progressively advances towards the analysis of more complex interaction effects. This pragmatic sequence clarifies the analysis process and yields reliable results in a step-by-step manner.

3. Methodology

The previous literature review chapter revealed that the capital-market-relevant information content of sustainability press releases in the European chemical industry has been researched only to a limited extent thus far. Against this background, the present thesis pursues two overarching research objectives:

- First, the signalling theory is to be expanded by modelling sustainability-related press releases as short-term signals whose value relevance depends on the credibility of the sender, such as a reputation through sustainability index listing, and specific text characteristics.

- Second, it aims to generate practical knowledge for investor relations, sustainability, and communications managers to demonstrate under which communicative conditions sustainability-related messages are relevant to share prices, and how such signals impact share prices.

These objectives are specified in RQ1-3:

- (RQ 1) How do sustainability-related press releases affect the share prices of companies listed in the STOXX Europe 600 Chemicals Index?

- (RQ 2) Does the market reaction to sustainability-related press releases differ between companies additionally featured in sustainability indices?

- (RQ 3) Do content, sentiment, readability and length of sustainability-related press releases coincide with share price movements of companies in the STOXX Europe 600 Chemicals Index?

An event study design is chosen to answer these questions. Initially, Section 3.1 provides an explanation of the underlying research philosophy and theoretical framework. A justification of the chosen research design in Section 3.2 follows this. Building on this, Section 3.3 presents the data basis, from the selection of companies and press releases to the preparation of price data and the integration of relevant sustainability indices. Section 3.4 addresses the definition of event windows and control variables. In Section 3.5, the regression models are defined; in Section 3.6, the key methodological limitations are discussed, and measures are outlined to

minimise them. Finally, Section 3.7 provides a summary of the key methodological steps and clarifies their relevance to the research objectives.

However, the next section will first lay the methodological foundations, utilising the research philosophy and theoretical framework.

3.1. Research Philosophy And Theoretical Framework

This section outlines the research philosophy underpinning this doctoral thesis. Research philosophy is the belief that phenomena that have not yet been researched should be gathered, analysed, and used alongside relevant data (Bryman, 2016; Holden and Lynch, 2004). Generally, research philosophy is a broad field that concerns the development of knowledge and lays the foundation for high-quality research (Healy and Perry, 2000). A well-defined research philosophy is also crucial for selecting the research strategy in general and the data collection methods in particular (Dudovskiy, 2020). This includes three dimensions: ontology (what exists), epistemology (how we can know it), and axiology (which values are involved).

Ontology can be defined as the researcher's understanding of the reality of nature and the existence of phenomena (Devi Prasad Bhattarai, 2021). Consequently, it includes the researcher's beliefs about what exists, how it exists and how it can be understood from the researcher's perspective. Two philosophical assumptions about ontology are questioned in selecting the research philosophy for this doctoral thesis: positivism and realism.

Firstly, a positivist approach offers distinct advantages in examining the impact of sustainability-related communication on investors' response (Maletic et al., 2015). In positivism, a well-established and explored philosophy, empirical evidence and systematic methods are emphasised to establish the belief that knowledge is primarily derived from observable and measurable phenomena (Acton, 1951; Avis, 2003; Paré et al., 2016). In the context of sustainability communication's impact on investor response, this approach could ensure that findings are grounded in quantifiable metrics and verifiable data. A rigorous examination of causal relationships can be conducted by minimising the influence of subjective interpretations or biases. Moreover, positivist methodology is employed to create predictive models based on observable correlations, which are instrumental in guiding business strategies and policy decisions (Amardas Tuboalabo et al., 2024; Oloruntosin Tolulope and Oguanobi Ugochukwu, 2024; Patro, 2024; Vudugula et al., 2023).

Secondly, this thesis contemplates realism as an alternative ontological position. As a result of realism, phenomena can be observed empirically; however, underlying structures and mechanisms are not directly observable, yet they still influence outcomes (Kahn, 2020; Papineau, 1985). It is essential to understand the deeper mechanisms and contextual factors that mediate the relationship, in this thesis's case, between sustainability-related press releases and investor response from a realist perspective. This may include organisational strategies, industry norms, or broader economic structures. A realist approach aims to uncover these underlying mechanisms, offering a richer, more differentiated understanding of the relationship (Lacouture et al., 2015; Mingers and Standing, 2017). Thus, the suitability of a positivist approach in this domain stems from its commitment to empirical rigour and objectivity. In contrast, a realist approach provides depth by emphasising the underlying structures and mechanisms.

Initially, a positivist approach seemed appropriate, as the focus is on empirically measurable share-price reactions of investors following the publication of sustainability-related press releases. However, a more thorough examination of the research domain and the research questions reveals that the underlying relationships are more complex: The chemical industry is firmly embedded in global economic, regulatory and social structures whose influence on corporate communication and investor behaviour cannot be explained by directly observable phenomena alone (A et al., 2019; Bauer and Fuenfschilling, 2019; Lyu et al., 2023; Mallapragada et al., 2023). In addition, RQ3 involves analysing several content-related and textual characteristics, such as content, sentiment, readability and length for sustainability-related press releases. This requires a differentiated analysis of linguistic and semantic structures, extending beyond purely quantitative measurement and logical relationships, which are necessary for positivism as defined in poststructuralism (Fierke, 2002).

Based on these considerations, this thesis takes a realistic ontological stance. It assumes that observable market data and underlying mechanisms, such as regulatory frameworks and societal expectations, characterise investors' responses to sustainability-related press releases. This two-layered reality is consistent with the thesis's dual focus on measurable financial results and the textual characteristics that precede them.

Building upon this realist ontology, this thesis adopts a scientific realist epistemology. Epistemology is closely related to ontology. In contrast, epistemology is the study of how knowledge is acquired and considered valid (Devi Prasad Bhattarai, 2021). This realist epistemological stance holds that robust knowledge emerges when systematic, replicable observation of measurable phenomena is paired with theory-driven inference about the latent

mechanisms that shape them and thus treating both the observable market reactions as well as the underlying regulatory, social, and linguistic structures as equally valid objects of structured empirical inquiry (Booth et al., 2020; Downward, 2002; Edgley et al., 2016; Scott, 2005). This stance acknowledges that, although investors' responses can be directly measured, understanding the communication processes that lead to them requires structured methods to identify underlying textual characteristics. Accordingly, this thesis combines event studies with software-supported content analysis methods that identify quantifiable effects and underlying structures, such as content clusters or semantic patterns that are not directly observable but can be inferred. These considerations demonstrate that a realistic research approach better meets the requirements of this thesis: it allows for the study of observable effects and the underlying, complex mechanisms and structures that shape the interplay between sustainability-related press releases and investor responses. This duality reflects the belief, within a realist framework, that measurement-based validity and pattern-based interpretability are essential.

Although this thesis is guided by scientific realism, the research context of sustainability-related communication inevitably raises normative questions, as mentioned in the research (Schneider et al., 2019; Vogt and Weber, 2019; Weder and Milstein, 2021). Addressing such a topic requires methodological and epistemological clarity, as well as reflection on the underlying values that inform and shape the research. This is where axiology becomes relevant in the research philosophy.

The field of axiology assumes a pivotal role in shaping the ethical framework of research. Axiology is the 'researcher's view of the role of values in research' (Saunders et al., 2009). By providing researchers with a systematic way to identify and articulate their values within the research context, axiology enables them to navigate the ethical dilemmas that often arise in the pursuit of knowledge (Bahm, 1993). Axiology has two dimensions: the ethical and the aesthetic, also referred to as non-ethical (Saunders et al., 2009). From an axiological perspective, sustainability is often viewed as an ethical value that embodies environmentally responsible, socially beneficial, and economically viable practices, with the potential to positively impact society and the environment (Epstein et al., 2017; Tomșa et al., 2021). In the realm of consumption, contemporary patterns are dominated by hyperconsumption, a trend deemed unsustainable and with negative implications for human well-being (McDonagh, 1998). Advocates for sustainability argue for the necessity of reducing such consumption patterns and pivoting towards more sustainable ones (Ghorban Nejad et al., 2024; Glavič, 2021; Jackson, 2005; Schor, 2005). This might encompass energy-efficient products crafted

from sustainable materials or manufactured via environmentally friendly practices (Kilbourne et al., 1997).

It is essential to acknowledge that the notion of sustainability is not a static or universally consistent concept (Moore et al., 2017; Ruggerio, 2021; Vogt and Weber, 2019). There is considerable progress in sustainability. However, its nature remains contested. The term sustainability encompasses a variety of interpretations influenced by cultural, economic, and ideological factors (Vargas-Merino et al., 2023; Vogt and Weber, 2019). These disparities underscore the need to address critical perspectives that are frequently overlooked in specific academic discussions. This thesis acknowledges the plurality of values embedded in sustainability-related communication and approaches this complexity through an ethical lens grounded in realist philosophy.

The following chapter operationalises these principles through a research design that examines individual share price responses at the firm level. By combining event studies with software-supported content analysis, the design isolates firm-specific signals from broader market fluctuations.

3.2. Research Design

In light of the complex interplay between sustainability-related press releases and investor reactions, as discussed in the axiology section of Section 3.1, the chosen methods must enable the empirical observation of market reactions and account for the influence of underlying textual characteristics. In this section, the methodological requirements are derived from the research context, and potential methodological approaches are compared and evaluated. The decision in favour of the event study as the most suitable methodology for this work is justified.

Based on the discussion so far, the interaction between sustainability-related press releases and investor response may be difficult to categorise. While sustainability communications often address long-term goals (Fonseca et al., 2020; Henderson and Loreau, 2023; McLeod and Marshall, 2023), investors typically respond to new information in the short term (Ben-Rephael et al., 2017; Ma et al., 2021; Sofyan et al., 2020). Accordingly, the chosen methodology must capture short-term investor reactions and analyse the characteristics underlying the communication.

Against this background, this chapter compares various methodological approaches, justifying the decision to use the event study (Section 3.2.1) and a software-supported quantitative content analysis (Section 3.2.2) as the central research methods. This enables the analysis of observable investor reactions in temporal proximity to sustainability-related communication and, in line with the realistic research perspective presented in Section 3.1, the identification of underlying action mechanisms, for example, by evaluating the textual characteristics of press releases and their inclusion in sustainability indices.

3.2.1. Event Study

Based on the realist ontology and scientific realist epistemology outlined in Section 3.1, the following two approaches are considered to unravel the intricate relationship between sustainability communication and investor response: the event study methodology and fuzzy-set qualitative comparative analysis (Fs/QCA). The selection of the most appropriate method depends on establishing the following requirements: first, it must allow for the precise measurement of observable market effects; second, it must map temporal dynamics between events and reactions; and third, it must minimise subjective interpretation.

Event studies are well-suited to these requirements. The event study builds on Fama's (1970) ‘Efficient Market Hypothesis’ model. According to this model, an event – be it company- or market-related - in the capital market leads to a new share price valuation in an efficient market. The purpose of an event study is to assess the efficiency of the market by measuring the impact of information relevant to the market on the resulting excess or shortfall of returns (Fama, 1970). The reaction on the stock market, therefore, affects future prices and the added value associated with this event (Warner, 2007). By design, this approach facilitates the identification and quantification of ARs in response to defined events. This enables the empirical capture of investor reactions to sustainability-related press releases.

The inherent characteristics of the chemical industry, a field in which sustainability communication frequently engenders discernible and consequential market events, render it particularly conducive to utilising event studies to ascertain empirical relationships between sustainability messages and investor behaviour (Cubas-Díaz and Martínez Sedano, 2018; Lock and Seele, 2015; Yilan et al., 2022). Fs/QCA, in contrast, is better suited for exploratory, multi-causal analysis but less appropriate for capturing immediate, time-bound effects (Ragin and Rihoux, 2004; Rihoux, 2020; Schneider and Wagemann, 2006). Rather than focusing on individual variables in isolation, Fs/QCA can generally reveal how different combinations of

factors (causal configurations) contribute to an outcome (Schneider and Wagemann, 2006; Shang et al., 2024; X. Xu et al., 2024). Furthermore, Fs/QCA requires substantial subjective input during calibration, which can compromise the comparability and replicability of the results (Finn, 2022; Ragin and Rihoux, 2004). Consequently, the event study is adopted as the primary methodology, with Fs/QCA acknowledged as a potential approach for future exploratory analyses in a similar academic setting.

The event study methodology is a classical corporate finance methodology with a clear structure outlined in the following paragraph (Bowman, 1983; Latinović, 2023). These studies can be applied in various fields of research (Corrado, 2011). They are also used in sustainability and environmental research (Barroso Del Toro et al., 2022b; Duong et al., 2021; Ender and Brinckmann, 2019; Kajander et al., 2012; Wood et al., 2018).

The event study methodology follows a similar five-step procedure for many decades, first summarised by Bowman (1983):

1. **Event Identification**

The first step is to identify the event that should be analysed. This thesis examines sustainability-related press releases and the share prices of companies in the chemical industry. For each press release, the exact event date (t_0) is recorded, and the event window (e.g., $t_0 \pm k$ trading days) is defined. This is explained in more detail in section 3.4.

2. **Modelling the Security Price Reaction**

In this thesis, a separate estimation window is not used because a market-adjusted model is selected, as described in more detail below. Instead, the STOXX Europe 600 Index (2020–2023) serves as the primary benchmark for expected returns. In the regression model, the index is incorporated as a CAR2 term and serves as a control for systematic market risk. This methodology allows for the benchmarking of individual company share price reactions against overall market movements. Consequently, it filters out systematic market noise to more accurately isolate the event-driven net effects of sustainability communication.

3. Estimation of ARs

ARs are calculated for each event i and corresponding day t in the event window by benchmarking the firm-level stock return $R_{i,t}$ against the return of the respective reference index B (either B_1: STOXX Europe 600 Chemicals Index or B_2: STOXX Europe 600 Index):

$$AR_{i,t} = R_{i,t} - R_{B,t}$$

The abnormal return is defined as the portion of the stock return that may be attributable to the specific information event in question, as it serves to isolate the deviation from the expected return (MacKinlay, 1997). To analyse the average impact across the sample, the AAR for each day t is calculated:

$$AAR_t = \frac{1}{N}\sum_{i=1}^{N} AR_{i,t}$$

The CAAR over the event window [τ_1,τ_2] is defined as the sum of the daily AARs:

$$CAAR(\tau_1, \tau_2) = \sum_{t=\tau_1}^{\tau_2} AAR_t$$

4. Aggregation

The daily ARs are aggregated in order to calculate the CAR for each event:

$$CAR_i = \sum_{t=t_1}^{t_2} AR_{i,t}$$

This step is pivotal, as it captures the comprehensive wealth effect of an event across the entire temporal span. This encompasses both the potential dissemination of information prior to the formal announcement and the subsequent delayed market responses (Campbell et al., 1998; MacKinlay, 1997).

5. Statistical Testing

The CAAR is evaluated using a t-test in order to determine its statistical significance. The null hypothesis (H_0) assumes that the mean abnormal return is zero, i.e. that the event has no measurable impact on the share price (Campbell et al., 1998; MacKinlay, 1997). The test is determined as follows:

$$t_{CAAR} = \frac{CAAR}{\sigma_{CAAR}}$$

where σ_{CAAR} represents the standard error of the CAARs. In order to ensure that the results are not distorted by violations of the OLS assumptions (linear regression assumptions, also see Section 4.2.1.3), robust standard errors according to Newey-West (1987) are applied, particularly concerning heteroscedasticity or autocorrelation in the daily return data (Brown and Warner, 1985; Newey and West, 1987).

As mentioned in the second process step, there is no estimation window for a specific reason: the procedure for determining the estimation window and the subsequent calculations depend mainly on the selected model.

There is the market model and the market-adjusted model (Cable and Holland, 1999; Klein and Rosenfeld, 1987). The market model has been used for a long time and is common in research, utilising regression analysis to estimate the relationship between a stock's returns and the market's returns. This enables more precise predictions of expected returns and demonstrates superior performance compared to simpler models, such as the Capital Asset Pricing Model, in terms of accuracy (Brown and Warner, 1985; Cable and Holland, 1999). There is also potential for bias to occur in the event securities if there is a significant difference in size and weighting between the index constituents (Dimson and Marsh, 1986). In the context of contemporary research on sustainability, these models persist as benchmarks for isolating news effects, such as press releases. Moreover, recent studies have continued to utilise these methods to assess market reactions to ESG and climate-related events, thereby validating their sustained relevance and robustness in contemporary financial analysis (Birindelli and Chiappini, 2021; Goyal and Soni, 2025; Mateska et al., 2023).

The market-adjusted model, in contrast, is also well-established in research and assumes that the expected return equals the market return ($E\left(R_{i,t}\right) = R_{B,t}$) (Eldomiaty et al., 2020). This approach is well established and less sensitive to parameter estimation errors, especially when

sample sizes are large, and events occur frequently (Piccioni et al., 2024). The focus of this thesis is on a relatively homogeneous sector (the European chemical industry). Utilising a market-adjusted approach and an index for the chemical sector as a benchmark facilitates cost-effective, context-specific control of industry-wide drivers. This model choice aligns with the logic underpinning large ESG news event studies, which employ market-adjusted specifications to robustly isolate news effects (Birindelli and Chiappini, 2021; Piccioni et al., 2024).

The event study methodology employed in this thesis is directly informed by the research questions formulated in the introduction to Chapter 3. RQ1 and RQ2, which examine the impact of sustainability-related press releases on investor reactions and the differentiation according to ESG index membership, are primarily addressed by the event study. Modelling ARs facilitates an empirically robust analysis of market effects. This methodological approach facilitates the modelling of ARs, thereby enabling a robust, empirical analysis of market effects in line with the thesis's emphasis on observable financial outcomes (Kothari and Warner, 2004; MacKinlay, 1997). RQ3 focuses on identifying content-related and textual characteristics in sustainability-related press releases. Methodologically, RQ3 is also grounded in an event study with a regression model (see Section 3.5.3). However, the text categories it contains are based on a software-supported quantitative content analysis, which is presented in the following section.

3.2.2. Quantitative Content Analysis

To identify recurring content-related characteristics in sustainability-related press releases, a quantitative content analysis is conducted. Nevertheless, content analyses can also be conducted using a purely qualitative methodology, which has been considered in this thesis.

Qualitative content analysis is generally more interpretive, focusing on latent meanings, context and depth. This type of analysis is especially suitable for a rich, in-depth understanding of a phenomenon when the dataset is relatively small, or the research is rather exploratory (Elo and Kyngäs, 2008; Graneheim et al., 2017; Lindgren et al., 2020; Mayring, 2015). Different types of qualitative content analyses, such as those by Mayring, are challenging to ensure credibility, dependability, and transparency, even if they provide relatively clear, documented steps to ensure transparency and replicability for a qualitative approach (Gläser-Zikuda et al., 2020; Graneheim et al., 2017; Mayring, 2015). Qualitative content analysis poses additional challenges for research projects, primarily due to its scalability, generalisability, and potential

for researchers' subjectivity and bias (Elo and Kyngäs, 2008; Graneheim et al., 2017; Lindgren et al., 2020; Mayring, 2015). In this thesis, the following condition applies: the data set is relatively large. An analysis of 4,690 press releases, each with a mean text length of approximately 539 words (see also Table 14 in Section 5.2.3.1.3), would yield 2,527,910 words, which correlates with 3.2 times the English King James Version of the Bible (Jackson et al., 2006). Moreover, potential bias cannot be ruled out, as the author may be influenced by his employment in the chemical industry at the point of this thesis's publication.

In contrast, quantitative content analysis is suitable when large-scale data is required, as in this case (Akhmedov et al., 2021; Wiedemann, 2013). This form of analysis is also characterised by a relatively high degree of objectivity and replicability. This way, the potential for bias, like in the current thesis, can be minimised (Mogaji, 2021; Neuendorf, 2016). Research further indicates that quantitative content analysis is a suitable method when the research questions focus on content or patterns across many texts (Banks et al., 2018; Boettger and Palmer, 2010). Where this method reaches its limits is in recognising sarcasm, irony and cultural nuances (Graneheim et al., 2017; Lindgren et al., 2020). However, this is not relevant to the present thesis, as press releases published by chemical companies tend to be informative and neutral, given their purpose (e.g., financial reporting or strategic announcements), and are less likely to be humorous or culturally political (see also 3.2.3).

In this respect, a content analysis is used to empirically investigate RQ3, as it aligns more closely with the characteristics of this thesis than a purely qualitative approach. The method is implemented using NVivo, a software developed for scientific text analysis (QSR International, n.d.), which combines qualitative coding functions with quantitative routines such as word frequency, matrix and cluster analysis, and semantic grouping. These functions reflect fundamental principles of natural language processing (NLP) and allow the detection of latent thematic structures beyond mere keyword counting (Feng and Behar-Horenstein, 2023). Section 3.3.5 provides a detailed definition of the operationalisation of software-supported quantitative content analysis.

Generally, this approach reflects a scientific realist philosophy by linking observable data (i.e. press releases) with meaning structures inferred through systematic semantic modelling. It thereby establishes a bridge between quantitative rigour and qualitative interpretability, rendering it especially suitable for large-scale, replicable content analysis in the context of applied business research, discussed earlier in this section.

Given that the methodological foundations have been established, the next section will define the data sources and preparatory procedures required to implement this research design. This section covers the selection of companies and associated share prices, as well as press releases and associated sustainability-related text categories. In addition, the criteria used to ensure the dataset's consistency and quality will be examined in more detail.

3.3. Data Basis And Preparation

The following section provides a detailed description of the structure and origin of the data sources utilised in this thesis. The data sources were defined, and the associated press releases were manually retrieved from the respective company websites, along with the relevant share prices. The data serve as the foundation for all subsequent analyses. Thus, it is necessary to clarify the origin and select the data to obtain results that are as meaningful as possible.

In the following, the database comprises five central components:

- First, the selection and characterisation of the analysed companies (3.3.1) justify their membership in the STOXX Europe 600 Chemicals Index and their relevance in the context of sustainability communication.
- Second, the collection and content selection of sustainability-related press releases (3.3.2) defines formal and content selection criteria to narrow down relevant events.
- Third, the collection and processing of relevant share prices for the event study (3.3.3) include determining trading days and adjusting the price history to calculate ARs.
- Fourth, the consideration of ESG index affiliation as an explanatory variable (3.3.4) in order to systematically analyse possible differences in investor behaviour depending on ESG positioning.
- Fifth, the press releases were semantically categorised as part of the software-supported quantitative content analysis (3.3.5) to identify textual characteristics. Therefore, a dedicated operationalisation chapter for the content-related and textual characteristics is introduced.

Additionally, this chapter outlines the criteria for data validity and explains how they are adjusted or excluded from the analysis as needed. The aim is to create a consistent and meaningful database that aligns with the methodological approach and addresses the research questions.

3.3.1. Companies

The first step is to evaluate the companies representing the European chemical industry from a financial market perspective. To do this, this thesis uses a stock market index as a reference. Several indices come into question.

For example, the MSCI World Index comprises large- and mid-cap companies across 23 developed markets. This characteristic makes these indices a crucial benchmark (Avci et al., 2023; Hung and Shiu, 2016; Wu, 2022). Additionally, MSCI indices are frequently used in academic research and investment decisions, highlighting their impact on financial management (Chen et al., 2019; Öner, 2022). STOXX indices, especially the STOXX Europe 600, cover a broad portfolio of companies across sectors and sizes, making them an essential tool for financial analysis in Europe – the STOXX Europe 600 aggregates 90% of the market capitalisation of European companies (Sánchez et al., 2017). In contrast to the MSCI indices, which have global coverage, the STOXX indices can capture the specialities of the European market more effectively. Overall, there are more than 18,000 STOXX and DAX indices, a subindex of STOXX, each compiled and formed differently and reflecting different focus areas for investors (STOXX®, 2024a). Given this thesis's regional focus, selecting companies headquartered in Europe and operating in the chemical industry is essential. For these reasons, the STOXX indices are better suited to covering a specific regional topic in combination with the chemical industry sector. The STOXX Europe 600 Chemicals Index (SX4P, ISIN EU0009658608) reflects all characteristics best (STOXX®, 2024b).

Initially, this supersector index (STOXX Europe 600 Chemicals Index) was derived from the STOXX Europe 600 Index (SXXP, ISIN EU0009658202), which covers the 600 largest companies in Europe. This can be further divided into smaller industry sectors classified in the Industry Classification Benchmark (ICB) (STOXX®, 2024c). The ICB serves as the market standard for categorising companies based on their primary source of revenue. This system ensures a professional and accurate classification of companies within their respective business environments (Phillips and Ormsby, 2016). The ICB classification comprises four levels, ranging from broad to detailed, and includes 11 industries, which are further divided into 20 supersectors, 45 sectors, and 173 subsectors (STOXX®, 2024b).

The STOXX Europe 600 Chemicals Index is a supersector index. It is weighted by free-float market capitalisation and reviewed quarterly in March, June, September, and December. All components (e.g., company values) of each supersector index are subject to caps of 30% for the largest company and 15% for the second-largest company (STOXX®, 2024d).

Given the regional and sector-specific focus of this thesis, the STOXX Europe 600 Chemicals Index offers a suitable basis for identifying relevant companies. Combining a broad market overview with a precise focus on European chemical companies, it fulfils the thesis's geographical and content-related requirements.

All companies included in the period from 2020 to 2023 were systematically recorded based on this index. The following presentation (Table 1) provides a detailed explanation of the company sample's composition and selection criteria.

No.	Company	Country	Details of Absorption/Rejection
1	Air Liquide	France	< 2020 - 2023
2	Akzo Nobel	Netherlands	< 2020 - 2023
3	Arkema	France	< 2020 - 2023
4	BASF	Germany	< 2020 - 2023
5	Brenntag	Germany	< 2020 - 2023
6	Clariant	Switzerland	< 2020 - 2023
7	Covestro	Germany	< 2020 - 2023
8	Croda	United Kingdom	< 2020 - 2023
9	Ems Chemie	Switzerland	< 2020 - 2023
10	Evonik	Germany	< 2020 - 2023
11	Fuchs	Germany	< 2020 - 2023
12	Givaudan	Switzerland	< 2020 - 2023
13	Hexpol 'B'	Sweden	< 2020 – 21/09/2020
14	IMCD	Netherlands	< 2020 - 2023
15	Johnson Matthey	United Kingdom	< 2020 - 2023
16	K + S	Germany	< 2020 - 2023
17	Koninklijke DSM	Netherlands	< 2020 – 22/03/2021
18	LANXESS	Germany	< 2020 - 2023
19	OCI	Netherlands	20/06/2022 – 2023
20	Symrise	Germany	< 2020 - 2023
21	Umicore	Belgium	< 2020 – 21/09/2020 and 22/03/2021 - 2023
22	Victrex	United Kingdom	< 2020 – 20/03/2023
23	Wacker Chemie	Germany	Since 20/06/2022
24	Yara	Norway	< 2020 - 2023

Table 1: Companies From 2020 To 2023 In STOXX Europe 600 Chemicals Index (SX4P) In Ascending Alphabetical Order

18 of the 24 companies listed in Table 1 were included in the STOXX Europe 600 Chemicals Index for the entire period from 1 January 2020 to 31 December 2023 (in Table 1 mentioned in column 'Details of Absorption/Rejection' as '< 2020 – 2023'). The other companies were only

temporarily included in the index and were either added to or removed from it during that period. The company Umicore is an exception (Row 21 in Table 1). Umicore was removed on 21 September 2020 and added again a few months later, on 22 March 2021.

The selected companies are based in various European countries. German companies are the most frequently represented in the STOXX Europe 600 Chemicals Index, with nine companies, followed by the Netherlands (4), Switzerland (3), the United Kingdom (3), France (2), and Belgium, Norway, and Sweden (1 each).

The company Koninklijke DSM is excluded from further analysis, leaving a total of 23 companies. In 2022, it was announced that DSM and Firmenich would merge to form one company, combining DSM's health and nutrition divisions with Firmenich's flavour and fragrance divisions (Schoenmaker and Schramade, 2023). Shortly before, in March 2021, Koninklijke DSM was no longer included in the STOXX Europe 600 Chemicals Index (Row 17 in Table 1). The merger was completed in May 2023 (DSM-Firmenich AG, 2023). Koninklijke DSM is no longer included in this thesis's analysis to avoid diluting the data due to this fundamental realignment and change in company structure, including new markets and target groups. Even after the merger, the combined company was not included in the index (see Table 1). The selection of companies forms the basis for the event study analysis, which addresses RQ1 and RQ2. This analysis focuses on investor reactions to sustainability-related press releases and on differentiation by ESG index membership.

Having identified the relevant companies, the next section outlines the process of collecting and preparing data from their sustainability-related press releases. The selection of these releases will further refine the dataset and serve as key input for the subsequent empirical analyses.

3.3.2. Press Releases

Based on the company selection in Section 3.3.1, this section describes the systematic collection and processing of press releases. It is used to evaluate texts related to sustainability (RQ1) and to conduct a quantitative content analysis (RQ3). Both are conducted as event studies, with the publication characteristics and the content of the press releases serving as the events. The press releases were manually retrieved from the respective company websites and compiled into a Microsoft Excel spreadsheet for further analysis. In 2.3.3, the importance and timing of the press releases were already explained. All press releases available in English

published between 2020 and 2023 are analysed. Table 2 summarises the companies to be analysed with the URL and the number of press releases for the stated conditions.

No.	Company	URL	No. Press Releases
1	Air Liquide	https://www.airliquide.com/group/press-releases-news	204
2	Akzo Nobel	https://www.akzonobel.com/en/media/latest-news---media-releases-	263
3	Arkema	https://www.arkema.com/global/en/media/newslist/?qc=newslist	293
4	BASF	https://www.basf.com/global/en/media/news-releases	758
5	Brenntag	https://corporate.brenntag.com/en/media/news/	167
6	Clariant	https://www.clariant.com/en/Corporate/News	274
7	Covestro	https://www.covestro.com/press/?h=1&t=Corporate%20News	228
8	Croda	https://www.croda.com/en-gb/media-hub/news	94
9	Ems Chemie	https://www.ems-group.com/en/media/financial-/-media-information/ems-group/	32
10	Evonik	https://corporate.evonik.com/en/media/press-releases	596
11	Fuchs	https://www.fuchs.com/group/press/press-releases/company-business-finances/	58
12	Givaudan	https://www.givaudan.com/media/media-releases	157
13	Hexpol ‘B’	https://www.hexpol.com/news-and-events/	30
14	IMCD	https://www.imcdgroup.com/media-centre?publicationType=GroupTemplateMPress&year=2020%2C2021%2C2022%2C2023	157
15	Johnson Matthey	https://matthey.com/news	115
16	K + S	https://www.kpluss.com/en-us/newsroom/press-releases/	103
17	LANXESS	https://lanxess.com/en/media/press-releases?query=	305
18	OCI	https://oci-global.com/news-stories/press-releases/	86
19	Symrise	https://www.symrise.com/newsroom/press-releases/	195
20	Umicore	https://www.umicore.com/en/newsroom/	296
21	Victrex	https://www.victrex.com/en/news	24
22	Wacker Chemie	https://www.wacker.com/cms/en-us/press-and-media/press/press-releases/overview.html	159
23	Yara	https://www.yara.com/news-and-media/news/	258
Total			4852

Table 2: Overview Of The URLs Of The Press Releases And Their Respective Numbers Per Company

Most press releases are in American English. The subsequent analysis will examine both British and American English press releases. Furthermore, companies that provide 50 or fewer events will be excluded from further analysis. This is standard scientific practice for event studies (Barroso Del Toro et al., 2022a; Bartholdy et al., 2007). Accordingly, the following companies are excluded from the analysis: EMS Chemie (32 press releases, Row 9 in Table 2), Hexpol 'B' (30 press releases, Row 13) and Victrex (24 press releases, Row 21). After removing the three companies, there are still 20 companies remaining, which, compared to Table 1, are distributed across Europe as follows, sorted in descending order by number of mentions: Germany (9), the Netherlands (3), the United Kingdom, Switzerland and France (2 each), and Belgium and Norway (1 each).

In the context of this thesis, press releases represent the events analysed as defined by Fama (1970). To be included in the analysis, a press release must meet specific formal and content-related criteria. Firstly, a precise temporal localisation is required. For this purpose, the publication date of the release must be recognisable in the metadata, as this is the only way to define a reliable event window (Varlamov et al., 2022; Weare and Lin, 2000). Therefore, each web-based press release requires a publication date and year, as well as an existing URL available on the Internet. Conversely, press releases for which either no publication date is given or the URL is not (or no longer) available, are excluded from the analysis. One example of this is the company Croda, where 40 of the 94 press releases initially found lacked a precise date, leaving only 54 releases for the dataset.

Secondly, the content of the press releases must meet a minimum standard to be suitable for quantitative content analysis. Although the structure and format of releases differ from company to company, some core editorial elements are common to almost all press releases, including title, lead, body text, quotes, multimedia elements, and contact details (Bilan et al., 2024). To answer RQ3, the title and body text (later referred to as the variable 'text') in particular represent the central unit of analysis, as only based on these elements can a systematic evaluation of sustainability-related terms be employed. Press releases that only consist of references to external file formats (e.g. PDF documents), are purely linking short messages or are incomplete in terms of content, are accordingly not included in the analysis.

Additionally, some companies use recurring elements in each press release, such as forward-looking statements. Companies use forward-looking statements to emphasise their progress and positive future prospects (Bozanic et al., 2012; McLaren-Hankin, 2008; Mio et al., 2020). While forward-looking statements can be informative and elicit reactions from investors and analysts, their predictive value is often less than that of non-forward-looking statements. Non-

forward-looking statements are generally more accurate and better at predicting future earnings, thus providing more reliable data for analysis (Bonsall et al., 2014; Bozanic et al., 2012). Due to this discrepancy and the different objectives of the statements, forward-looking statements are expressly not analysed in this thesis. Such recurring, mostly formulaic passages have no significance for the underlying research questions but can dilute the dataset and distort the analysis. They are therefore removed from all analysed press releases. These criteria ensure that only press releases are included in the analysis, enabling a valid and comparable evaluation within the framework of the event study and text analysis procedures, in terms of their chronological classification and content structure. Table 3 provides an overview of the number of press releases after applying the previously discussed minimum criteria for press releases to be analysed. The total share of press releases per analysed company is also presented. This adjustment is the final basis for the total number of press releases to be analysed.

No.	Company	No. Cleaned Press Releases	Total Share in Percentage
1	Air Liquide	204	4,3
2	Akzo Nobel	263	5,6
3	Arkema	293	6,2
4	BASF	758	16,2
5	Brenntag	166	3,5
6	Clariant	274	5,8
7	Covestro	227	4,8
8	Croda	54	1,2
9	Evonik	581	12,4
10	Fuchs	58	1,2
11	Givaudan	154	3,3
12	IMCD	157	3,3
13	Johnson Matthey	113	2,4
14	K+S	103	2,2
15	LANXESS	266	5,7
16	OCI	86	1,8
17	Symrise	195	4,2
18	Umicore	296	6,3
19	Wacker Chemie	159	3,4
20	Yara	283	6,0
Total		4690	100

Table 3: Overview Of The Number Of Press Releases After Data Cleaning For Each Company And Share Of Press Releases

During the final data cleaning process, the company sample was reduced to the 20 companies listed in Table 3. Therefore, this table differs in its composition from both the list of companies in the STOXX Europe Chemicals Index (Table 1), as outlined in Section 3.3.1 and from the overall overview of all press releases collected (Table 2). The resulting data set of 4,690 qualified press releases serves as the basis for identifying the individual events in the event study.

The final data set of 4,690 cleaned press releases forms the basis for further analysis. While this section describes the selection process and the cleaning of the raw data, the detailed methodological transformation of these texts into measurable variables – including clustering, sentiment measurement, and complexity indices – is presented in the following Section 3.3.5. First, in the next section, these communication events are linked to the relevant share price data to evaluate investors' responses to sustainability-related press releases.

3.3.3. Share Prices

To capture the investor response to the identified press releases, this section outlines how the relevant share price data is collected and prepared. These financial figures provide the quantitative basis for calculating ARs within the event study framework.

First, the share prices must be collected before assigning them to the press releases. This thesis uses Yahoo Finance as the primary data source for share prices (https://finance.yahoo.com/). Yahoo Finance is a common source for researching historical share prices and deriving statements about investor behaviour in the context of event studies, for example (Abotaleb et al., 2024; Song, 2016). At the same time, other researchers have utilised Yahoo Finance data and sentiment analysis of X to predict stock market performance (Padmanayana et al., 2021; Rodríguez-Ibánez et al., 2023; Tash et al., 2024). This approach highlights the interdisciplinary nature of Yahoo Finance in the context of financial research (Tanulia and Girsang, 2019).

The data records of the respective companies, exported in tabular form in Microsoft Excel, include the trading days for each company on the stock exchange in the country where the company is headquartered. Since the returns required for the event study to calculate ARs and, consequently, CARs are dimensionless values, the currency in which the shares are quoted is irrelevant to the analysis. The share prices are only required to calculate the returns (see 3.3.1). Therefore, using companies with different currencies does not affect the results.

Not every day a press release was published was necessarily a trading day (e.g., on weekends or national or supra-regional public holidays). If a press release was published on a non-trading day, the closing price of the previous trading day is taken as the closing price. For example, the press release was published on Saturday, so the Friday closing price is used as the reference. Consequently, t_{-1} is also this Friday with the same closing price as t_0.

Depending on the length of the event window, ARs may also be earned a few days before or after the event. In this case, the press release is published when calculating share returns. The exact calculation used in this thesis, as well as the length of the event window, is described in more detail in Chapter 3.4.1. The event window also determines the period during which share prices are collected. If a press release is published at the start of the review period, e.g. on 2 January 2020, and the event period is 11 days, the share price data for the corresponding trading days are collected on the day of publication (t_0), as well as five days before (up to t_{-5}) and five days after (up to t_{+5}) publication. In this example, t_{-5} for the STOXX Europe 600 Chemicals Index (SX4P, ISIN EU0009658608) would be the share price on 23 December 2019, which closed at EUR 1,032.16. Consequently, share price data is collected beyond the actual investigation period, which extends from 19 December 2019 to 8 January 2024, rather than from 1 January 2020 to 31 December 2023.

This also makes it necessary to clean some of the data collected on share prices. Share prices are only considered if they fall within the ±1-trading-day window around the publication date of the press release. When a release is issued on a non-trading day, the closing price from the previous trading session is used as the event-day observation (t_0). For example, when BASF would have published an update on Easter Sunday, 4 April 2021, European exchanges were closed. Consequently, the closing price on Thursday, 1 April 2021, was assigned to t0, while the first trading day on which investors could react – Tuesday, 6 April 2021 – was assigned to t_{+1}. All prices outside the ±1-day window are excluded from the analysis. Additionally, any information in the exported spreadsheet format that does not allow conclusions to be drawn about the company's date and closing price is not considered. The share price data are essential for calculating ARs and CARs, and thus form the quantitative basis for analysing the market reactions in RQ1 and RQ2.

The stock returns used in this analysis were derived from Yahoo Finance's historical closing prices. The return is calculated as the percentage change in a stock's closing price at time t relative to the previous trading day, $t-1$. This approach ensures that daily price fluctuations are accurately captured before being incorporated into subsequent aggregation steps. The detailed mathematical derivation and final formula for this return calculation are explicitly

explained in Section 3.4.1 once the event window has been methodologically discussed and defined.

The prepared dataset on share prices and returns enables precise linking of press releases to market reactions across all relevant companies and periods. Building on this data foundation, the next step is to investigate potential explanatory factors that may influence these reactions. One such factor is whether a company is included in a recognised sustainability index, which may signal to investors that the company is committed to sustainability and shape their expectations and responses.

3.3.4. Sustainability Indices

This section introduces the first explanatory variable beyond pure market data: the inclusion of companies in sustainability indices. As a proxy for institutionalised ESG performance, index membership can convey reputational benefits, affect investor composition, and thus plausibly influence share price movements in the context of sustainability-related press releases (Atayah et al., 2024; Ng and Rezaee, 2020; Serafeim, 2020; Zhang et al., 2025).

The sustainability indices constitute an additional data set that has yet to be collected for this thesis. To briefly summarise the findings from the literature review, incorporating sustainability indices can enhance the impact of sustainability-related press releases by increasing visibility and attracting investor attention (Durand et al., 2019; Lo and Kwan, 2017). Followingly, RQ 2 investigates the following: ‘Does the market reaction to sustainability-related press releases differ between companies additionally featured in sustainability indices?’ Several key sustainability indices relevant to this thesis were already discussed in 2.2.3, including the DJSI, the FTSE4Good, and the MSCI World Sustainable Development Index. To ensure a valid data basis, this thesis analyses the annual and sustainability reports of the respective companies during the period under review to determine which indices are most relevant. The indices mentioned most frequently over the entire period are then used to answer RQ2. For example, if the FTSE4Good Index is the most frequently mentioned in the reports of most companies, then it becomes the benchmark for the investigation. If the analysed company is listed in the index for the respective year, e.g., 2021, a binary variable is assigned a value of ‘1’ if the company is listed in the index for that year; otherwise, it is assigned a value of ‘0’. If more indices are relevant, the same procedure will be applied to them. If several indices are relevant, they are examined individually. Many sustainability indices are not comparable with each other.

The allocation of companies to sustainability indices facilitates the analysis of disparities in investor reactions, as outlined in RQ2 and developed in 2.2.3.

In Chapter 4, Section 4.1, the key metrics used to determine the inclusion of the sustainability index are discussed in detail, along with the methodological approach and preliminary results. As the first explanatory variable, index membership introduces a formalised ESG signal into the model that may influence investor perception through reputational effects or altered investor composition. To deepen the analysis, the focus shifts from structural recognition to the content of corporate communication itself. Specifically, the textual characteristics of sustainability-related press releases are examined in the next section to identify patterns that may affect investors' responses.

3.3.5. Operationalisation of Content-Related And Textual Characteristics

Having established the entire data basis in Sections 3.3.1 to 3.3.4, this section deals with the operationalisation of the content-related and textual characteristics. The aim is to convert the qualitative information from the press releases into mathematically tangible variables to enable statistical analysis of RQ3.

Initially, 11 content categories were developed through a multi-stage process within the software NVivo. The process begins with language-specific parsing (taking into account British and American English) of press release texts and the identification of noun phrases. Subsequently, these linguistic units were algorithmically grouped according to semantic similarity, such as grouping ‘house’, ‘houses’, and ‘housing’, to reveal underlying thematic structures (Elliott-Mainwaring, 2021; Lumivero, 2025).

After pre-processing, agglomerative hierarchical cluster analysis was conducted (Jackson and Bazeley, 2019). The Pearson correlation coefficient was used to assess semantic similarity based on the co-occurrence of 567 identified keywords (Lumivero, 2025). This software-supported approach enabled the objective grouping of terms into statistically distinct topic nodes, which were initially visualised in a hierarchical chart displaying overarching themes and nested subtopics. A representative screenshot is included in the appendices to this thesis and is referenced in 3.5.3.1. To ensure internal validity, these clusters were manually checked for strategic consistency using a qualitative research design (Silver and Lewins, 2014).

The categorisation of sustainability-related subjects provides the analytical framework for identifying textual characteristics that directly address RQ3. To operationalise these characteristics, the topics and associated keywords derived in NVivo were exported to Excel for further cleaning and preparation. This step ensures consistent assignment of themes across the whole dataset of 4,690 press releases.

The following cleaning criteria were applied:

1. Duplicates were removed to ensure a unique, transparent assignment of keywords to each category.

2. Sparse categories (fewer than five keywords) were deleted or merged with related categories where appropriate.

3. Overlapping or synonymous categories were consolidated. For example, the theme ‘hydrogen’ was subsumed under ‘energy’. This decision is grounded in the fact that hydrogen serves as a clean energy carrier, producing no carbon dioxide emissions when used (Baykara, 2018; Melis and Happe, 2001; Tarhan and Çil, 2021). Due to its potential role in a low-carbon future and increasing technological maturity, hydrogen was treated as a sub-theme of energy (Abdin et al., 2020; Johnston et al., 2005; Kovač et al., 2021).

Following the implementation of this cleaning process, 11 distinct content categories were finalised: carbon, energy, materials, production, project, recycling, solutions, supply, sustainable, technology, and value. A total of 567 keywords were assigned to these categories, thereby establishing a structured, reproducible dataset for subsequent statistical analysis. The thematic consistency of each keyword-category assignment was manually validated, and the binary structure of the final variables enables straightforward integration into the regression models described in Section 4.5.3.

Second, the word count N_i defines the cleaned text length for each press release i.

$$N_i = Total\ number\ of\ words\ (tokens)\ in\ document\ i$$

This calculation is automated using the SPSS Text Analytics module. The tokenisation process, which removes punctuation and formatting, ensures only valid words are counted and may result in fewer words than in the original press release text retrieved from the corporate

websites (Anandarajan et al., 2019; Chai, 2023; HaCohen-Kerner et al., 2020; Hickman et al., 2022). This value is needed again for the next step as well.

Third, the sentiment analysis is performed using the SPSS Text Analytics module. It is based on a frequency analysis of the relative proportions of neutral, positive, and negative (neu, pos, neg) statements in each press release (Rössler, 2017). The mathematical calculation is performed according to the formula for relative frequency:

$$Sentiment_{i,k} = \frac{n_{i,k}}{N_i}$$

Here, $n_{i,k}$ represents the number of identified terms of category k (positive, negative, or neutral) in press release i, while N_i represents the total number of words in the press release i. The continuous proportions generated in this way allow for a representation of the linguistic details.

Fourth, in addition to identifying events, the readability of press releases is analysed to gain further insights into textual characteristics and complexity, answering RQ3. As mentioned in Section 2.3.3, the literature suggests that the readability of texts in the chemical industry, particularly in sustainability-related press releases, is low due to numerous technical terms associated with chemistry and sustainability. This assumption can be confirmed through descriptive analysis. The Simple Measure of Gobbledygook (SMOG) Index is used as the readability index. The purpose of this established index is to calculate the reading grade level required to comprehend a given text (Harry and Laughlin, 1969). In more detail, the index counts polysyllabic words and estimates the number of years of education required to understand the text (Harry and Laughlin, 1969). This makes the index a suitable metric for materials containing specialised jargon, for example, those in the chemical sector (Issa et al., 2024; Powell et al., 2021; Šuto et al., 2023; Ulusoy et al., 2023). The index shows a strong correlation with other established readability assessments. For instance, it has been reported that the correlation with the Gunning Fog Index is significant; as such, the index provides a multifaceted perspective on readability, offering an alternative to assessments that rely exclusively on a single component of linguistic complexity (Hamnes et al., 2016). Both the SMOG Index and the Flesch indices provide grade-level assessments. However, SMOG's distinctive emphasis on polysyllabic words enhances its reliability in contexts requiring familiarity with specialised terms (Han and Carayannopoulos, 2020). Conversely, the Flesch Reading Ease Index can generate greater variability in results that may not be directly

associated with educational attainment, hindering general comprehension (Matsuura and Jaeah, 2024). Nevertheless, the SMOG index has been employed across a range of readability assessments, thereby demonstrating its robustness in evaluating health and environmental materials (Oydanich et al., 2022). Utilising a singular, consistent index serves the primary function of reducing confusion. Moreover, it is a crucial component in maintaining a standard for evaluating the textual complexity present within press releases and a wide range of other communication forms (Shin et al., 2024). Based on this discussion and the decision to focus on the SMOG index, SPSS supports calculating this index using the following formula:

$$SMOG \approx 1.0430 \sqrt{Number\ of\ Polysyllabics\ x\ \frac{30}{n_{sentences}}} + 3.1291$$

The data basis has now been finalised, encompassing the selection of companies, the collection of press releases, the extraction of stock market price data, the sustainability indices and the categorisation of press releases' sustainability topics. The next step is to outline the methodological parameters required to conduct the event study analysis. The following chapter introduces the event window, discusses the control variables and explains the calculation of the key figures to ensure a robust empirical study.

3.4. Event Window And Control Variables

Following the presentation of the underlying database, this chapter provides a concrete illustration of the methodological implementation of the event study. The focus of this chapter is twofold. Firstly, Section 3.4.1 defines the event window, the time frame for analysing share price reactions around the publication of sustainability-related press releases. It is asserted that both theoretical considerations and common scientific standards are taken into account. Secondly, Section 3.4.2 presents the control variables that map potential external influences and enable more precise identification of causal effects. It is essential to acknowledge the significance of both methodological components to formulate reliable scientific outcomes concerning the interplay between sustainability communication and capital market reactions.

3.4.1. Event Window

A fundamental methodological component of the event study involves defining a distinct event window surrounding the event under scrutiny. This section outlines the event window used for analysing share price reactions to sustainability-related press releases, along with the scientific considerations that underpin this selection.

The determination to implement an 11-day event window ([-5, +5]) is predicated on a well-founded methodological trade-off. In event studies, a relatively short window is preferable in order to preserve the internal validity of the results (McWilliams and Siegel, 1997). Extended time frames have been shown to engender the occurrence of confounding events – including, but not limited to, simultaneous macroeconomic shocks, interest rate decisions or industry-specific news – which have the potential to obscure the abnormal returns and, consequently, distort the causality between the press release and the market reaction (Du et al., 2017; McWilliams and Siegel, 1997).

The five-day period preceding the event (t_0) is particularly relevant in the context of potential information leakage or market anticipation, phenomena that occur with considerable frequency, especially in a highly regulated sector such as the chemical industry (Bartov et al., 1998; MacKinlay, 1997; Sletten, 2011). The five-day period following the event provides the time needed for price discovery. In contrast to quarterly figures, sustainability reports frequently contain qualitative and intricate information; therefore, the market requires sufficient time to thoroughly evaluate and integrate this non-financial data (Lackmann et al., 2012; Supawat and Arnat, 2023). The selection of 11 days thus ensures that the full economic impact is captured without compromising the statistical integrity of the dataset by introducing extraneous variables.

To ensure accurate statistics, the time frame before the event date is extended by one more day (t_{-6}). This adjustment is necessary because the difference between t_{-6} and t_{-5} helps determine the stock return at t_{-5}:

$$R_{i,t-5} = \frac{P_{i,t-5} - P_{i,t-6}}{P_{i,t-5}}$$

The stock exchange has been chosen as the domestic exchange for the company's headquarters (e.g., BASF is based in Germany, so its domestic exchange is also located there). Depending on the country, the trading days may also vary. To ensure the best possible

comparability across various trading centres, six trading days before (until t_{-6}) and five trading days after (until t_{+5}) the publication date of the press release (t_0) are finally used. The remaining agreements relevant to this thesis regarding the handling of share prices and their allocation to press releases were previously outlined in Section 3.3.3 and remain in effect.

Additionally, the same logic and timing are applied when collecting closing prices for the benchmark indices STOXX Europe 600 and STOXX Europe 600 Chemicals Index. The daily returns serve as the basis for calculating ARs and CARs at the company level. Specifically, CAR1 uses the STOXX Europe 600 Chemicals Index as a benchmark, while CAR2 uses the STOXX Europe 600 Index.

The study period commences in 2020, primarily attributable to substantial constraints in the availability and consistency of the data (data limitations). Although political milestones such as the EGD (see also 1.1.1) form the regulatory context, the scientific limitation is technically justified. Prior to 2020, there was no truly standardised and binding sustainability reporting, rendering the assignment of companies to sustainability indices impracticable. The latter are prerequisites for answering the research questions in the present thesis. The information is often voluntary and lacks uniformity across companies and industries, suggesting heterogeneous, often incomplete digital records (Christensen et al., 2021). Research has also indicated that analysing supply chain data is a complex process, which hinders its practical application and integration for transparency and performance measurement. This finding suggests that a significant number of organisations are still transitioning to robust digital infrastructures (Sanders et al., 2019).

Nevertheless, 2020 marked a crucial turning point in the standardisation of ESG communication. In preparation for the CSRD (Corporate Sustainability Reporting Directive) and the EU Taxonomy Regulation, companies have professionalised their reporting cycles and improved the precision of their sustainability messages (Kim and Yang, 2025; Quttainah and Paczkowski, 2025; Singhania and Saini, 2023; Tettamanzi et al., 2022). Starting earlier would have resulted in a significant amount of missing data due to incomplete digital datasets, jeopardising the comparability of events within the sample. Therefore, limiting the period to 2020–2023 ensures data integrity and the validity of the statistical tests by providing a homogeneous observation period.

In summary, it can be concluded that the selected event window of 11 trading days offers a good balance, for this thesis, between temporal proximity to the event and analytical precision, given the limitation to the 2020 to 2023 observation period. The process under discussion

enables the targeted isolation of capital market reactions to sustainability-related press releases, thereby ensuring that external influences do not distort these responses. Moreover, to ensure that macroeconomic or company-specific factors do not cause systematic distortions, suitable control variables are introduced in the following section.

3.4.2. Control Variables

To draw valid causal conclusions about the relationship between sustainability-related press releases and share price reactions, it is essential to consider potential confounding factors. The subsequent section outlines the selection and integration of control variables that systematically map external influencing variables, thereby enhancing the informative value of this event study's design.

Incorporating control variables can enhance the efficacy of simulations and analyses by minimising variance and optimising the precision of estimates. This field was examined in the 1980s and is especially advantageous in complex systems where multiple factors interact (Lavenberg and Welch, 1981). Using control variables is crucial for excluding alternative explanations for observed relationships, thereby enhancing the reliability of causal inferences (Klarmann and Feurer, 2018). Research often lacks sufficient justification for including control variables or fails to adequately explain their relationships with the dependent variables. Therefore, this thesis must provide a robust theoretical basis for selecting and including these variables (Atinc et al., 2012; Bernerth and Aguinis, 2016).

Macroeconomics plays a crucial role in the context of this thesis, as it examines the relationship between corporate announcements, specifically sustainability-related press releases, and share prices. The interest rate is one major macroeconomic influencer in research. Higher interest rates generally harm share prices because borrowing becomes more expensive, reducing consumer spending (Agwu and Haydar, 2023; Depari, 2022; Verma and Bansal, 2021). Another factor is inflation. This factor also has an adverse effect on share prices, as it reduces purchasing power and can lead to higher interest rates. However, inflation can occasionally have a positive impact on share prices (Depari, 2022; Fauziah et al., 2020; Kuntamalla and Maguluri, 2022). Therefore, inflation and interest rates can also be interrelated and should be checked for multicollinearity (Aini et al., 2024; Booth and Ciner, 2001; Şen et al., 2020; Wang and Hausken, 2025). When selecting the control variables, it is also necessary to consider that this thesis is a spatially limited analysis, focusing solely on Europe and the chemical industry. Under this assumption, interest rates and inflation are collected from the

respective countries where the companies are headquartered for this thesis. The Gross Domestic Product (GDP) is a common factor that is positively related to share prices, as economic growth can lead to higher incomes and increased investor trust in companies (Keswani et al., 2024; Spång and Alexius, 2018). However, this variable is frequently used for studies focusing on long-term economic phenomena (Tian et al., 2024). Since this thesis considers a relatively short-term period, this variable will not be treated as a control.

Although the following control variable is rather macroeconomic, it has a significant impact on the company's finances: gas prices. The general increase in energy prices, such as those for natural gas, has an adverse impact on the profitability of energy-intensive industries, including the chemical industry. This is because higher operational costs cannot always be fully passed on to consumers (Ferriani and Gazzani, 2022; Liu et al., 2021; Milewska and Milewski, 2023). Additionally, the Ukraine war, which began in 2022, and the COVID-19 pandemic, which began two years earlier, both fall within the period considered in this thesis, from 2020 to 2023. Both events have significantly increased energy prices, particularly in Europe, leading to significant economic consequences and contributing to high operational costs (Kalogiannidis et al., 2022; Miocic et al., 2022; Shevchenko, 2023; Xing et al., 2023). The increase in energy prices has contributed to inflationary pressures in the Eurozone, affecting businesses and consumers alike. Despite a decline in energy prices after the mentioned period, inflation remains relatively high, posing a challenge to economic stability (Miocic et al., 2022; Shevchenko, 2023). Considering these events and the scientific literature, the gas price is used as an energy indicator and a control variable for this thesis. As previously mentioned, corporate financial factors also play a role in selecting suitable control variables.

Such variables related to corporate financial factors could include fundamental ratios. Scientific studies indicate that some key figures, such as return on assets (ROA), return on equity (ROE), debt/equity ratio (DER), earnings per share (EPS), and price/earnings ratio (P/E ratio), usually have a significantly positive (Pangestu and Wijayanto, 2020; Restanti et al., 2023) or sometimes no significant influence on share prices (Friyanto et al., 2025; Tjahjo et al., 2020). Nevertheless, these indicators reflect the company's health and profitability, which are crucial for investor confidence (Fauziah et al., 2020; Mulyanto and Riyanti, 2020). EPS and P/E ratios are directly linked to share prices, as well-documented in the academic literature. Empirical studies have demonstrated that EPS exerts a substantial influence on share prices, underscoring its significance in investor decision-making (Amiputra et al., 2021; Ammy and Azizah, 2021; Sulistiono and Subchan, 2022). Furthermore, the P/E ratio has been shown to have a considerable impact on share prices, serving as an intermediary in the relationship between financial metrics and share price movements (Amiputra et al., 2021; Farusda, 2022).

The P/E ratio is a metric that reflects market perception and investor sentiment regarding a company's future earnings potential.

Consequently, the P/E ratio serves as a valuable tool for understanding how news and press releases may affect share prices (Ammy and Azizah, 2021; Farusda, 2022). ROA and ROE are recognised as significant indicators of operational efficiency and shareholder returns. However, some empirical studies have shown that they do not consistently affect share prices in event studies. Some studies suggest that ROA and ROE do not significantly affect share prices when considered independently (Bayhaqiy et al., 2022; Dewi and Pusparini, 2024; Sulistiono and Subchan, 2022). Regarding debt considerations, the DER is a measure of a company's financial leverage (Fauzy et al., 2023; Innocent et al., 2014; Mrs. Vijayalaxmi Baddi and Dr. Gurupad Junnaykar, 2025). However, the impact of DER on share prices has been demonstrated to be equivocal. Indeed, certain studies have indicated that DER negatively influences share prices, suggesting that investors perceive high leverage negatively (Amiputra et al., 2021; Nurul Khoiriyah and Sri Layla Wahyu I, 2023; Tania Audinawati Br Tarigan and Menik Indrati, 2024). In the context of event studies, EPS and P/E ratios are favoured, as discussed earlier, due to their direct and substantial influence on share prices and their capacity to reflect market perceptions and investor sentiment. Consequently, both variables will be employed in this thesis.

A company's size and its earnings history also influence the price of its shares. Large corporations with stable, predictable earnings tend to exhibit more consistent, foreseeable movements in their share prices (Ferreira et al., 2019; Mehr-un-Nisa and Nishat, 2011). Basic literature has scientifically established that market capitalisation is a crucial element in event studies. This indicator helps control for the size effect, which can distort results (Nguyen et al., 2023; Rashata, 2021; Vasishth et al., 2021). This is particularly important in cases where event securities differ systematically in size from the index constituents or when the size effect is large and volatile (Dimson and Marsh, 1986). Market capitalisation provides a consistent metric for comparing companies, thereby facilitating a more accurate assessment of the impact of press releases on share prices across firms of varying sizes (Dimson and Marsh, 1986).

Alternatively, earnings can be volatile due to several factors, including corporate earnings management, market conditions and non-operating factors (Ahmed and Sulong, 2023; Alawadi and Rashid, 2023; Bilal Ahmed and Zunaidah Sulong, 2024). They might not accurately reflect a company's financial health or market position at the time of the event, leading to misleading conclusions in event studies. While share prices can forecast the reversal of earnings growth, relying solely on earnings may not provide a complete picture of the market's reaction to press

releases, as other factors, such as market and size, also play significant roles (Fama and French, 1995). The use of market capitalisation in event studies mitigates biases associated with the size effect, thereby facilitating a more precise analysis of the relationship between press releases and share prices. Conversely, relying solely on earnings can be problematic due to their volatility and limited correlation with stock returns. Therefore, this thesis uses market capitalisation as an additional control variable.

The data for this analysis were sourced from professional financial databases and official company announcements. Daily share prices (see 3.3.3), index returns, and financial control variables (market_cap, eps, pe_ratio) were obtained from Yahoo Finance. Macroeconomic data (intrate, inflate) were sourced from Eurostat, while gas prices were determined via Trading Economics. The specific sources and URLs for the sustainability-related press releases (announcements) are detailed in Section 3.3.2 (Table 2). To summarise and further explain them, the thesis uses a total of six control variables, listed in Table 4 below.

Control Variable	Abbreviation	Frequency	Data Source
Interest Rate	intrate	Monthly	Eurostat (https://ec.europa.eu/eurostat/)
Inflation Rate	inflate	Monthly	Eurostat (https://ec.europa.eu/eurostat/)
Market Capitalisation	market_cap	Yearly	Yahoo Finance (https://finance.yahoo.com/)
Earnings-per-Share	eps	Yearly	Yahoo Finance (https://finance.yahoo.com/)
P/E Ratio	pe_ratio	Daily	Yahoo Finance* (https://finance.yahoo.com/)
Gas prices	gas	Daily	Trading Economics (https://tradingeconomics.com/commodity/eu-natural-gas)

*Table 4: Overview Of Control Variables (*The dividend [share price] and divisor [EPS] are used to calculate pe_ratio)*

Interest and inflation rates were collected on a monthly basis. This is because these variables tend not to fluctuate significantly on a daily basis, particularly when they serve a catalytic purpose, such as for control variables for long-term studies like this one from 2020 to 2023 (Aini et al., 2024; Alvarez et al., 2001; Indrajaya, 2022; Pennacchi, 1991). One study indicates that sustainability-related press releases significantly influence stock return volatility, which can be effectively analysed using monthly data on control variables (Zhang et al., 2018). To further enhance precision, country-level data on interest rates and inflation are used rather than Euro area-level aggregates. This approach addresses the diverse economic conditions present in the European jurisdictions where the sample companies are based.

The collection of annual data on the control variables market_cap and EPS has been shown to help mitigate the impact of short-term market volatility. This approach ensures that the analysis reflects more stable and reliable financial conditions and is not subject to constant fluctuations (Elfiswandi et al., 2022; Ruhani and Mat Junoh, 2023). Moreover, the availability of these data is constrained by the respective companies' publication schedules for quarterly and annual reports (Abdul Salam et al., 2021; Gajewski and Quéré, 2001; Nor Izah Ku Ismail and Chandler, 2004). Consequently, more frequent collection is generally not feasible.

This differs from the last two control variables, the P/E ratio and gas prices. This data source can be made available on a daily basis. The P/E ratio, as defined in fundamental literature, is calculated by dividing the current share price by EPS (Anderson and Brooks, 2005). This thesis utilises this fundamental formula to calculate the P/E ratio. The formula is based on the daily share price and the corresponding EPS, which, according to the current literature, is calculated on an annual basis (Anderson and Brooks, 2005).

Daily data on gas prices have enabled more accurate forecasting models, which are crucial for, e.g., chemical companies' energy management and economic planning (Alex Scott, 2022; Wang et al., 2020). Models that use daily data have been shown to have higher predictive accuracy than those that use less frequent data (Su et al., 2019). This facilitates the identification of the immediate impact of specific events on gas prices, a crucial aspect of event studies aimed at understanding short-term effects, such as the impact of sustainability-related press releases on the stock market (Wen et al., 2021). Fluctuations like those at the start of the Ukraine war and during COVID-19 are characterised by sustained volatility and are of considerable importance to the chemical industry (Enescu and Szeles, 2023; Iliyasu et al., 2024). Both events have resulted in a substantial increase in energy prices, particularly for natural gas and oil, which has directly elevated the operating costs of companies reliant on these energy sources, like the chemical industry relevant to this thesis (Enescu and Szeles, 2023; Gong, 2023; Kalogiannidis et al., 2022; Kot et al., 2024). The volatility of energy prices has affected financial markets, influencing share prices and increasing companies' risk profiles (Aliu et al., 2023). Given this dynamic in the context discussed, gas prices are collected on a daily basis. Compared to other control variables, they are analysed as closely as possible to minimise their influence on the thesis design.

Having defined the event window and the relevant control variables, the next step in this thesis is to analyse the relationships between the dependent variable (CAR1) and the independent

variables, defined as control variables. Therefore, this thesis will employ regression models, which will be outlined in the following section.

3.5. Regression Models

This section defines the regression models in the order of the research questions, from RQ1 to RQ3. Regression models can be employed to verify or falsify assumptions from the research questions, with the results presented in regression analyses 4.2.1.2, 4.2.2.2, and 4.2.3.2.

Regression models are frequently used to construct predictive models that estimate the likelihood of specific outcomes (Gunst, 1999; Ranstam and Cook, 2018). A regression analysis is a statistical method used to identify and quantify the relationship between variables (Liang and Zeger, 1993). This thesis, in particular, has many variables to examine, and regression analysis can be helpful.

In a regression analysis, there is a dependent variable and one or more independent variables. Dependent variables are defined as the outcomes that are the focus of the thesis, while independent variables are defined as the factors hypothesised to influence these outcomes (Babbie, 2020; Creswell and Creswell, 2017). In this thesis, the dependent variable is the cumulative abnormal return (CAR1), which is employed to measure the stock market's reaction to sustainability-related press releases. The independent variables encompass event-specific characteristics (e.g., indicators of sustainability in press releases) and control variables (e.g., market_cap, EPS, and macroeconomic factors), as outlined in the foundational event study literature (Brown and Warner, 1985; MacKinlay, 1997).

Having laid the foundations for understanding regression analysis and models, the first model for RQ1 will be defined.

3.5.1. Regression Model RQ1

Since the first two research questions were answered via a regression analysis, there is a difference between the model of research questions one and two and the independent variable. While RQ1 focuses exclusively on the independent variable 'sustainability-related press releases ' (= text_sus_i), this is extended in RQ2 by a further independent variable 'companies that were represented in a sustainability index in the year surveyed' (= $\text{djsi}_i \; and \; ftse4good_i$). So first, the regression analysis for examining RQ1 is described with the variables mentioned in the following formula:

$$\begin{aligned} \text{CAR}_i = \beta_0 &+ \beta_1 \cdot \text{text\_sus}_i + \beta_2 \cdot \text{market\_cap}_i + \beta_3 \cdot \text{eps}_i + \beta_4 \cdot \text{pe\_ratio}_i \\ &+ \beta_5 \cdot \text{intrate}_{c,t} + \beta_6 \cdot \text{gas}_t + \beta_7 \cdot \text{inflate}_{c,t} + \beta_8 \cdot \text{CAR}_{\text{STOXX600}} \\ &+ \varepsilon_i \end{aligned}$$

In this regression model, CAR_i is the dependent variable and the cumulative abnormal return of company i over the event window [-5;5], where abnormal returns are defined as the deviation of firm-level returns from the respective benchmark return as specified in 3.2.1. text_sus_i is the dummy variable indicating whether a press release with sustainability-relation was issued (1=yes, 0=no). market_cap_i is the market capitalisation of the company i, representing the firm size. The profitability is measured in earnings per share eps_i of each company i. pe_ratio_i is the Price-to-earnings ratio, reflecting the market valuation relative to earnings. The interest rate of the region or country c is named $\text{intrate}_{c,t}$. gas_t is the price of natural gas on the stock market at time t capturing industry-relevant external conditions. $\text{Inflate}_{c,t}$ measures the inflation rate of the country c or region where the company is headquartered at the time t. And $\text{CAR}_{\text{STOXX600}}$ is the cumulative abnormal return of the STOXX Europe 600 Index, as a mother index of the STOXX Europe 600 Chemicals Index, representing particularly regional reactions of a broader index to the events. A comparison index, such as the STOXX Europe 600 Index, helps assess the dependencies between asset returns and market trends in extreme situations (Budescu, 1993). This is an important factor in robust event study analysis and is foundational in event studies, particularly in constructing market models and detecting CARs (Budescu, 1993; Karafiath, 2009). Studies using market indices show greater precision in analysing event impacts and are therefore best suited to this thesis, which

deals with volatile market conditions (Zhang et al., 2013). As all companies in the supersector index STOXX Europe 600 Chemicals are also represented in the superordinate STOXX Europe 600 Index, this relationship must be checked for multicollinearity in the next section. Multicollinearity is defined as the occurrence of a situation in which two or more explanatory variables in a regression model are found to be highly correlated. This phenomenon can impede the accurate determination of the individual effects of each variable on the dependent variable. Consequently, this may result in unreliable probability values and confidence intervals for the regression coefficients (J. H. Kim, 2019).

For the sake of completeness, it should also be mentioned that:

- β_0 is the intercept. The intercept is pivotal for providing the dependent variable's baseline value when all predictors are absent or set to zero (Heien, 1968; Pouliot, 2016).
- β_1 to β_8 are the coefficients of the corresponding variables indicating the intensity and direction of the correlations between both. On the one hand, when the coefficient is positively correlated, there is a relationship. On the other hand, when the coefficient is negative, it indicates an inverse relationship (Nimon and Oswald, 2013; Thompson and Borrello, 1985).
- ε_i is the error term that captures the effects of variables not included in the regression model above, failures in the measurement, and other disturbances affecting the dependent variable (Moulton, 1986; Wallis, 1972).

The regression model defined in RQ1 serves as the basis for RQ2, as control variables need to be added rather than a new regression model formulated. The extension for RQ2 is presented in the next section.

3.5.2. Regression Model RQ2

As mentioned above, this regression analysis is extended by a further independent variable to investigate RQ2, determining whether and, if so, which impact sustainability indices have on companies' stock market valuation in conjunction with sustainability-related press releases.

The websites of the companies under review were used to analyse index references in sustainability and annual reports. During the reporting years, these documents were available either as interactive online presentations or as PDFs. The analysis was conducted by systematically reviewing the tables of contents and, where no clear structure was apparent, by utilising specific search terms. Both specific sustainability indices, such as the ‘FTSE4Good’, ‘DJSI’, or ‘Dow Jones Sustainability Index’, and more general terms, including ‘sustainability’, ‘sustainability index’, or ‘sustainability indices’, were used. In addition, related or similar combinations of terms were also taken into account in order to ensure that relevant index mentions were captured as comprehensively as possible. In this way, a large number of distinct sustainability indices mentioned in the respective company publications could be identified. The findings from this review are summarised in Table A - 1, which consolidates the identified index references across all companies and reporting years. For improved readability, Table A - 1, along with all other tables and figures labelled with the prefix A, has been relocated to the Appendices for more detailed examination.

This table shows that the two sustainability indices, FTSE4Good and DJSI, receive the most mentions (36 and 20, respectively) among the other indices. In the FTSE4Good, the 36 annual mentions are spread across more than half of the companies (11 out of 20), while in the DJSI, there are still twice as many (six companies) as in the following index, with three companies (DAX 50 ESG). Both indices, unlike the others mentioned, are leading sustainability indices with global impact (Perez, 2011). Other indices, such as the SXI Switzerland Sustainability 25 Index or the DAX 50 ESG, have a rather regional impact and thus limited value for this thesis, which focuses on Europe. Additionally, this preliminary investigation confirms that the FTSE4Good and DJSI sustainability indices, already mentioned in the academic discourse (see also Section 2.2.3), significantly impact the context of the present thesis.

Both indices are created as binary variables for the regression analysis and are thus initially separate in the analysis of this thesis. Both have in common that they include ESG criteria. While the DJSI focuses on sustainability practices when evaluating companies, the FTSE4Good focuses on predefined criteria for social responsibility, including environmental sustainability, stakeholder relationships and human rights (Collison et al., 2008; Perez, 2011).

Both evaluate companies using criteria relevant to this thesis. They both provide an important benchmark for investors seeking to invest in sustainability, thereby helping to establish sustainability among investors (Consolandi et al., 2009; Perez, 2011). These sustainability indices are also compared with traditional stock market benchmarks, indicating that they are on par with them and highly significant (Collison et al., 2008; Cunha et al., 2020; Rehman et al., 2024). However, what essentially distinguishes them, and this can be decisive for the interpretation of the results later on, are, above all, methodological differences as well as their performance and risk management. Both indices include ESG criteria. However, they focus on different aspects when evaluating companies for inclusion in the respective index (Collison et al., 2008; Consolandi et al., 2009). In addition, these indices differ in their financial performance and risk management and are, therefore, not comparable in terms of returns and volatility (Collison et al., 2008; Fernandes et al., 2018). Therefore, both must be considered individually, even as individual variables. Consequently, the following linear regression model arises:

$$\begin{aligned} \mathrm{CAR}_i = {} & \beta_0 + \beta_1 \cdot \mathrm{text\_sus}_i + \beta_2 \cdot \mathrm{djsi}_i + \beta_3 \cdot \mathrm{ftse4good}_i + \beta_4 \cdot \mathrm{market\_cap}_i \\ & + \beta_5 \cdot \mathrm{eps}_i + \beta_6 \cdot \mathrm{pe\_ratio}_i + \beta_7 \cdot \mathrm{intrate}_{c,t} + \beta_8 \cdot \mathrm{gas}_t + \beta_9 \\ & \cdot \mathrm{inflate}_{c,t} + \beta_{10} \cdot \mathrm{CAR2} + \varepsilon_i \end{aligned}$$

The independent variables djsi_i and $\mathrm{ftse4good}_i$ are the discussed dummy variables indicating whether the company was included in the respective sustainability index for the four years surveyed from 2020 to 2023? If the company in question was part of one of the indices in the respective year, a ‘1’ is entered; otherwise, a ‘0’ is entered. The dependent variable and the other independent variables remain the same as reported in RQ1.

While RQ1 and RQ2 are very similar in terms of their basic characteristics, further considerations must be made for RQ3 in the following section in order to meet the requirements of the research question.

3.5.3. Regression Model RQ3

The regression analysis for RQ3 is designed to assess whether, and to what extent, the presence of specific sustainability-related content categories in press releases influences capital market reactions.

The regression models are based on the entire set of 4,690 qualified press releases from Section 3.3.2. This approach ensures that sustainability-related press releases (n = 1,884) are evaluated within the broader context of general corporate communications. By including the entire dataset, the press releases without specific sustainability keywords (n = 2,806) serve as an implicit statistical baseline. This allows RQ3 to isolate the additional effect of sustainability signals relative to conventional corporate news, while also accounting for textual characteristics, such as word count, readability and sentiment, should these prove statistically significant.

To achieve robust results and avoid multicollinearity, the regression analysis is conducted in stages: the content-related characteristics are analysed first, followed by the textual characteristics.

3.5.3.1. Content-Related Characteristics

The conversion of qualitative press releases into quantitative regression variables was carried out systematically in NVivo (see also 3.2.2). A cluster analysis of word similarity was used to group the 567 identified keywords into 11 statistically distinct topic categories. This computer-assisted approach minimises subjectivity in category formation (see also 3.3.5); a hierarchical chart is included in the appendices to enhance transparency and provide a representative example (see Figure A - 1 in ‘Appendices’).

For the regression model of RQ3, the content categories derived in Section 3.3.5 are integrated into the model as binary dummy variables (0/1). The operationalisation of these categories as binary dummy variables is methodologically justified: First, according to signal theory (Loughran and McDonald, 2011), the mere appearance of a topic constitutes the essential market signal; a higher word frequency does not necessarily correlate with greater informational value for investors (Bi et al., 2017; Rennekamp, 2012; Umar, 2017). Second, this avoids a 'document length bias,' in which longer texts would dominate the model simply due to their volume (Dubois et al., 2024; Hu et al., 2025; Zhang et al., 2024). Third, binary coding

can perform well and help ensure greater statistical robustness against outliers in text data when thresholds are carefully optimised (Sinha et al., 2025).

Each press release was coded according to the presence or absence of keywords assigned to these categories. This binary assignment, indicating the appearance (1) or absence (0) of a particular topic, enables the transformation of qualitative content characteristics into variables suitable for quantitative analysis. This binary transformation supports a scientific realist framework, which seeks to explain observable market reactions through latent communicative mechanisms (see also 4.2.2).

Based on this approach, the following regression model is formulated:

$$\begin{aligned}\mathrm{CAR}_i = {} & \beta_0 + \beta_1 \cdot \mathrm{text\_sus}_i + \beta_2 \cdot \mathrm{market\_cap}_i + \beta_3 \cdot \mathrm{eps}_i + \beta_4 \cdot \mathrm{pe\_ratio}_i \\ & + \beta_5 \cdot \mathrm{intrate}_{c,t} + \beta_6 \cdot \mathrm{gas}_t + \beta_7 \cdot \mathrm{inflate}_{c,t} + \beta_8 \cdot \mathrm{text\_carbon}_i \\ & + \beta_9 \cdot \mathrm{text\_energy}_i + \beta_{10} \cdot \mathrm{text\_materials}_i + \beta_{11} \\ & \cdot \mathrm{text\_production}_i + \beta_{12} \cdot \mathrm{text\_project}_i + \beta_{13} \cdot \mathrm{text\_recycling}_i \\ & + \beta_{14} \cdot \mathrm{text\_solutions}_i + \beta_{15} \cdot \mathrm{text\_supply}_i + \beta_{16} \\ & \cdot \mathrm{text\_sustainable}_i + \beta_{17} \cdot \mathrm{text\_technology}_i + \beta_{18} \cdot \mathrm{text\_value}_i \\ & + \beta_{19} \cdot \mathrm{CAR2} + \varepsilon_i\end{aligned}$$

The 11 new variables included in the regression analysis, text_carbon, text_energy, text_materials, text_production, text_project, text_recycling, text_solutions, text_supply, text_sustainable, text_technology, and text_value, are binary variables. The value of the variable is equal to ‘1’ as soon as search terms assigned to the respective category appear in one of the press release texts; otherwise, the value is ‘0’. This regression analysis aims to determine whether and, if so, which sustainability-related text categories influence share price.

It can be assumed that the analysed press releases are predominantly voluntary publications. Unlike mandatory publications, the timing and content of press releases are strategically controlled by companies, making them suitable indicators of corporate communications (Arslan-Ayaydin et al., 2020; Rawson et al., 2023). However, it is essential to note that the dataset includes all official publications within the study period. A clear distinction between purely voluntary strategic messages and those potentially driven by regulatory requirements (e.g., ad-hoc disclosure obligations or new ESG reporting standards) is methodologically challenging, as these motives often overlap. Furthermore, the structure of the websites, the

categorisation of the respective press releases, and their assignment to corresponding stakeholder areas (investors, customers, etc.) are considered heterogeneous for this thesis. Therefore, the study views the dataset as a holistic representation of corporate activities and acknowledges this lack of differentiation as a methodological limitation.

The decision to incorporate all 11 content categories within a regression model is substantiated by the systematic thematic validation and cleaning procedures outlined in Section 3.3.5. In particular, overlapping or sparsely populated categories were either merged or excluded in order to ensure conceptual clarity and statistical viability. For instance, the subject 'hydrogen' was allocated to 'energy' based on its strategic relevance for low-carbon technologies (see also 3.3.5).

Further analysis of RQ3 will also examine whether mentioning multiple categories—i.e., at least two of the 11 defined categories—is statistically significant. Specifically, it considers whether the share price responds differently when several categories are mentioned in a press release, even when repetitive terminology may appear as noise to investors (Xiaoman et al., 2023). To clearly explore this connection, a structured approach with the following regression model and the variable $text\_sum$ is employed:

$$\begin{aligned} \mathrm{CAR}_i = \beta_0 + \beta_1 \cdot \mathrm{text\_sus}_i + \beta_2 \cdot \mathrm{market\_cap}_i + \beta_3 \cdot \mathrm{eps}_i + \beta_4 \cdot \mathrm{pe\_ratio}_i \\ + \beta_5 \cdot \mathrm{intrate}_{c,t} + \beta_6 \cdot \mathrm{gas}_t + \beta_7 \cdot \mathrm{inflate}_{c,t} + \beta_8 \cdot \mathrm{CAR2} + \beta_9 \\ \cdot \mathrm{text\_sum}_i + \varepsilon_i \end{aligned}$$

To strengthen the robustness of the thesis, an auxiliary investigation will be conducted in the context of RQ3. Especially in regression models incorporating content analyses with many variables, there is a relatively high potential of overfitting and multicollinearity (Austin and Steyerberg, 2015; Chan et al., 2022; Hardt et al., 2012; Khumalo, 2024). That is why this thesis tries to address this by summing up the text categories into related overarching topics, also called text clusters in the following, as follows:

Clusters	Assigned Categories
Emissions & Energy	text_carbon (CO_2, GHG emissions) text_energy (energy consumption, renewable energies)
Resources & Recycling	text_materials (raw materials, materials) text_recycling (recycling, reuse) text_supply (if relevant for raw material supply)
Production & Innovation	text_production (manufacturing, production processes) text_technology (technological solutions) text_project, text_solutions (general innovation projects)
Overarching sustainability & value proposition	text_sustainable (broad term) text_value (value proposition)

Table 5: Overview of assigned text categories to new text clusters

This clustering is operationalised with four new binary variables into the following regression model:

$$\begin{aligned} \mathrm{CAR}_i = {} & \beta_0 + \beta_1 \cdot \mathrm{text\_sus}_i + \beta_2 \cdot \mathrm{market\_cap}_i + \beta_3 \cdot \mathrm{eps}_i + \beta_4 \cdot \mathrm{pe\_ratio}_i \\ & + \beta_5 \cdot \mathrm{intrate}_{c,t} + \beta_6 \cdot \mathrm{gas}_t + \beta_7 \cdot \mathrm{inflate}_{c,t} + \beta_8 \cdot \mathrm{CAR2} + \beta_9 \\ & \cdot \mathrm{text\_cluster\_emisionenergy}_i + \beta_{10} \cdot \mathrm{text\_cluster\_circular}_i + \beta_{11} \\ & \cdot \mathrm{text\_cluster\_innovation}_i + \beta_{12} \cdot \mathrm{text\_cluster\_sustainvalue}_i + \varepsilon_i \end{aligned}$$

While these regression models are intended to identify the topics addressed within the framework of RQ3, the following section examines additional textual characteristics to analyse the transmission of corporate sustainability messages.

3.5.3.2. Textual Characteristics

Based on the extant literature on financial communication, it can be assumed that the content of corporate press releases and their linguistic properties, such as text length, readability, and sentiment, may influence investors' perceptions (Do et al., 2025; Pan et al., 2018; Riley and Luippold, 2015).

In this regard, the following regression model will be tested:

$$\begin{aligned}\mathrm{CAR}_i = \beta_0 + \beta_0 + \beta_1 \cdot \mathrm{text\_sus}_i + \beta_2 \cdot \mathrm{market\_cap}_i + \beta_3 \cdot \mathrm{eps}_i + \beta_4 \\ \cdot \mathrm{pe\_ratio}_i + \beta_5 \cdot \mathrm{intrate}_{c,t} + \beta_6 \cdot \mathrm{gas}_t + \beta_7 \cdot \mathrm{inflate}_{c,t} + \beta_8 \\ \cdot \mathrm{CAR2} + \beta_9 \cdot \mathrm{wordcount}_i + \beta_{10} \cdot \mathrm{smog\_index}_i + \beta_{11} \cdot \mathrm{text\_pos}_i \\ + \beta_{12} \cdot \mathrm{text\_neu}_i + \beta_{13} \cdot \mathrm{text\_neg}_i + \varepsilon_i\end{aligned}$$

This model incorporates three variables of interest related to textual characteristics. The text length is measured using the variable '$wordcount$'. This variable aims to examine the extent to which measured market reactions are attributable to substantive signals rather than to the quantity of information provided.

The readability is approximated using the SMOG index ('$smog\_index$'). This variable shall investigate whether increased mental effort resulting from technical and chemical terminology reduces the corresponding market response. The index facilitates the assessment of comprehensibility as a moderating factor in communication within a multivariate framework, measured as the equivalent of years of formal education (see 3.3.5).

The sentiment is operationalised using the proportion of positive, neutral, and negative terms ('$text\_pos$', '$text\_neu$', '$text\_neg$'). This variable helps examine whether nuances in positive sentiment in reporting elicit stronger investor responses than neutral or negative reports. However, companies rarely present their own reports in a negative light (Bushman and Pinto, 2024; Pollach and Hansen, 2021).

This model specification supports the third research question by enabling a fine-grained examination of which communicative topics are associated with stronger capital market responses. The binary structure of the independent variables ensures robustness against scale distortions and facilitates interpretability for categorical textual features.

Furthermore, this approach reflects a fundamental methodological decision that aligns with the prevailing research philosophy: rather than relying on subjective interpretations of message content, the model is grounded in replicable, observable textual indicators (see also Section 3.2.2). The applied coding procedure is both scalable and reliable, as confirmed through manual validation and frequency distributions.

Further tests are necessary to obtain the most robust results possible from the respective regressions within the framework of the underlying event study. However, despite rigorous

statistical precautions and preliminary tests, methodological limitations cannot be entirely excluded. The following section will address the methodological limitations of the thesis.

3.6. Methodological Limitations

Despite the thorough consideration of all relevant influencing factors, this thesis has inherent limitations. The following chapter reflects on the key methodological limitations arising from the framework conditions, the data basis, and the methodology chosen for this thesis, without fundamentally questioning the validity of the results.

When analysing the short-term effects of sustainability-related press releases on investor reactions, which is particularly relevant for RQ1, the event study methodology offers a precise and proven approach (see also 3.2). However, it should be noted that the model can capture only short-term effects and cannot fully reflect medium- or long-term developments (Oler et al., 2008; Pang et al., 2023). These latter effects are only reflected in share prices after a delay (MacKinlay, 1997). Followingly, it seems evident that undertaking comprehensive, long-term capital market research would require supplementary longitudinal studies or qualitative approaches (Certo et al., 2017; Neale, 2021; Teherani et al., 2015).

In addition to the structural short-term nature of the period under investigation, the context dependency must also be critically reflected upon. Regardless of the methodological time horizon, it is necessary to consider the risk of exogenous shocks that occur within the observation period and can affect market movements independently of the event being analysed (Corbo et al., 2016; Gavalas et al., 2022; Ju et al., 2014). Despite the judicious selection and implementation of control variables for this thesis (see also 3.4.2), it cannot be discounted that external macroeconomic events in the period from 2020 to 2023, particularly in the context of the pandemic caused by COVID-19, the war in Ukraine, or other geopolitical uncertainties, may have exerted an additional influence on the observed market reactions (Bogliacino et al., 2021; Corbo et al., 2016).

Another methodological aspect of this thesis is the construction of the variables CAR1 (dependent variable) and CAR2 (independent variable). Both metrics utilise the companies' daily share price returns ($R_{i,t}$) as the identical minuend, resulting in a mathematically determined, high correlation between these values. This statistical dependency is intentionally incorporated into the research design: CAR2 serves not as a causal explanatory variable in the regression model, but rather as a control for systematic market risk. This approach

effectively filters out systematic noise from the broader European stock market (STOXX Europe 600) to isolate industry-specific performance. Consequently, the model can precisely isolate and evaluate the net effect of sustainability communication at the company level. The resulting high explanatory power ($R^2 \approx 0{,}90$) demonstrates the successful control of general market influences and should not be interpreted as a methodological bias.

Processing different currencies, especially the control variables market_cap, gas, and EPS, may have led to minor rounding discrepancies in some cases (Jakob et al., 2021). For example, large-scale currency transitions (e.g. to the Euro) may reduce rounding biases for higher-value figures. In contrast, smaller discrepancies may persist or re-emerge over time due to cognitive rounding tendencies and information uncertainty. In the present thesis, minor rounding effects were identified during the processing of the selected control variables. These were addressed by applying consistent rounding logic to all relevant datasets. The resulting discrepancies are negligible and do not affect the validity of the model, particularly since the primary dependent variables, ARs and CARs, are interpreted relative to one another.

A further limitation relates to the differentiation of disclosure types and the resulting sample composition (see also 3.5.3). Although press releases are traditionally classified in academic literature as instruments of voluntary disclosure, increasing regulatory requirements in ESG reporting, such as those introduced by the EU Taxonomy and the CSRD, have created a hybrid communication environment. In this context, the distinction between strategic signalling and compliance-driven reporting is increasingly ambiguous (Cicchiello et al., 2023; Darnall et al., 2022; Fornasari and Traversi, 2024). This thesis adopts a holistic approach by including all 4,690 qualified press releases from the study period to establish a robust statistical baseline, foregoing manual separation between voluntary and potentially regulatory-mandated disclosures. While this comprehensive method captures the full spectrum of information available to investors, it also implies that the sustainability events identified for regression analysis ($n = 1{,}884$) may comprise both discretionary and compliance-driven signals. As a result, the observed market reactions cannot be attributed exclusively to voluntary management decisions, which should be considered when interpreting the 'signal purity' of the findings.

Two key challenges complicate the interpretation of the results on ESG index membership (RQ2): Firstly, the two ESG indices analysed (DJSI and FTSE4Good) differ significantly in their valuation approaches, weighting criteria and thematic focus. While some indices focus primarily on environmental criteria, others place greater emphasis on social and governance criteria. This diversity of content makes it difficult to standardise the comparability of ESG

affiliations across the company sample (Bataeva, 2024; Clément et al., 2022; Lukács et al., 2024; Mayer and Reizingerné Ducsai, 2023).

Secondly, the transparency of the allocation criteria is also limited: the methodological bases of the index providers are not publicly accessible in all cases or are only published in a highly aggregated form (Berg et al., 2022; Erhart, 2022; Gyönyörová et al., 2023). The resulting lack of transparency in index inclusion reduces traceability for external third parties and makes it difficult to establish a reliable theoretical basis for binary ESG categorisation (Erhart, 2022; Gyönyörová et al., 2023).

Although the ESG categorisation is based on a documented procedure, inherent uncertainties may exist regarding comparability, temporal fit, and methodological transparency, as also confirmed by other publications (Clément et al., 2022; Del Vitto et al., 2023). These aspects should be considered when interpreting the results from RQ2.

A quantitative content analysis was employed to identify textual characteristics manually extracted from the respective company websites (see also 3.2 and 3.3.5). Clustering algorithms, such as those implemented in NVivo, are frequently based on neural networks or complex optimisation techniques. Whilst the methods in question offer considerable advantages in terms of scalability and pattern detection, they are frequently criticised for their limited transparency and interpretability (Ran et al., 2023; Shahina and Pradeep Kumar, 2022; Sinha and Lobiyal, 2013). The underlying grouping logic in such models is typically encoded in high-dimensional latent representations, which hinders understanding and reproduction of the specific criteria used to assign individual segments to clusters. This methodological limitation, frequently referred to as the 'black box problem', has the potential to compromise the conceptual clarity and consistency of the generated categories (Bertsimas et al., 2021; Mi et al., 2020; Peng et al., 2022; Zhang et al., 2021). Conversely, conventional clustering methodologies such as k-means or hierarchical clustering depend on explicit distance metrics or linkage criteria, thereby affording enhanced transparency and interpretability (Shahid, 2023).

To counterbalance these limitations and enhance the reliability of the thematic classification, a manual validation step was introduced. To assess consistency and minimise potential misclassifications, a stratified random sample of over 100 press release segments was reviewed (Castro-Filho and Bias, 2022; Liang et al., 2022).
This combined approach was chosen intentionally: it leverages the analytical power and efficiency of software-based methods while grounding the results in human interpretability and

theoretical relevance. Consequently, it is consistent with the dual requirements of methodological rigour and practical applicability in a DBA thesis, which has two goals: both practical and theoretical outcomes.

Rather than indicating reservations about the conclusions, this methodological reflection underscores the challenges of implementing quantitative content analysis in the context of corporate sustainability communication and its reception by capital markets.

3.7. Conclusion

Notwithstanding the methodological limitations previously discussed, a consistent and scientifically sound thesis design was intended to be developed, providing a reliable basis for answering the research questions. The present chapter systematically summarises the central methodological decisions and reflects on their significance within the overall research logic.

This thesis's core presents a synthesis of a capital-market-oriented event study and a software-supported quantitative content analysis of sustainability-related press releases. This dual approach facilitates the measurement of short-term share price reactions to sustainability-related press releases and the systematic recording of content-related and textual characteristics in corporate press releases. The subsequent explanations provide a concise overview of the methodological implementation and its integration within the research design of this thesis.

The methodological architecture of this thesis is grounded in a realist research philosophy. It brings together empirical measurability and structural interpretation, ensuring that each research question is addressed with methodological coherence and conceptual depth.

This approach transcends mere method adaptation, thereby opening up an interdisciplinary perspective on the field of tension between investor reactions and corporate sustainability communication. The use of a dual perspective facilitates the systematic analysis of two distinct phenomena: first, the immediate reaction of investors; and second, the content and textual characteristics of corporate communication, as measured by sustainability-related press releases in the context of this thesis.

This thesis extends existing event-study approaches and contributes to the empirical foundation for communication strategies in the context of sustainability and capital markets. In

particular, combining quantitative capital market measurement with software-supported quantitative content analysis creates methodological connectivity for future research projects at the intersection of sustainability, investor relations, and strategic communication.

Moreover, the methodological framework developed enables partial transferability of the results to other industries or regions, provided that the specific contextual factors are considered. While the deliberate focus on the European chemical industry increases the thesis's internal validity, it also provides a template for comparable analyses in industries with similarly high ESG requirements and transformation dynamics.

While designing the methodology, alternative research approaches were considered, including purely qualitative methods for evaluating texts and panel data models for analysing long-term performance. However, these were rejected in favour of a combination of more empirically focused and quantitatively verifiable methods, as the former did not meet the objective of measuring short-term capital market reactions with the same degree of accuracy and content.

The chosen research design thus aims to meet academic standards for methodological rigour and to offer practical applicability for decision-makers seeking to align communication strategies with capital market expectations. In the following section, the thesis's empirical results will be presented, building on the methodological foundation outlined in this chapter. Thus, it systematically evaluates the relationship between sustainability-related press releases and capital market reactions, as well as the content-related and textual characteristics identified through quantitative content analysis.

4. Analysis And Empirical Results

The present chapter builds upon the methodological foundation established in Chapter 4, which is dedicated to the empirical analysis and resolution of the three research questions. The objective is to systematically record and evaluate the effects of sustainability-related press releases on investor reactions. This focus involves conducting both descriptive and inferential statistical analyses, with validation steps incorporated to ensure the model's integrity and reliability.

By doing this, this chapter helps to achieve the two main research objectives of the thesis: Firstly, by analysing the existence and variability of investor responses (RQ1 and RQ2), it advances signalling theory in the context of sustainability-related press releases, particularly concerning the credibility of the sender, which is characterised by the sender's sustainability index reputation. Secondly, by identifying the content-related and textual characteristics associated with significant market reactions (RQ3), this study provides investor relations and corporate communications professionals with practical insights to enhance the impact of sustainability-related messaging.

These research objectives are operationalised through the following three questions:

- RQ1: ‘How do sustainability-related press releases affect the share prices of companies listed in the STOXX Europe 600 Chemicals Index?’

- RQ2: ‘Does the market reaction to sustainability-related press releases differ between companies additionally featured in sustainability indices?’

- RQ3: ‘Do content, sentiment, readability and length of sustainability-related press releases coincide with share price movements of companies in the STOXX Europe 600 Chemicals Index?’

Section 4.1 validates the underlying statistical assumptions to ensure the dataset is suitable for answering the research questions. The results of the empirical study are presented and interpreted in Section 4.2, with the presentation structured to correspond to the three research questions that guided the thesis. Each subsection (4.2.1-4.2.3) includes descriptive findings, model results, robustness checks, and relevant diagnostics. The chapter concludes with Section 4.2.4, which summarises the main results and discusses their theoretical and practical significance.

The following section examines whether the existing dataset is suitable for deriving empirical results by conducting preliminary statistical tests. This marks an important step in this thesis, as it ensures that the data is not prone to distortion and can be further processed for the empirical results.

4.1. Assumption Testing And Model Diagnostics

It is necessary to ensure that the observed effects are due to the sustainability-related press releases and not to systematic differences or peculiarities of the companies that may have existed before the thesis and thus could jeopardise the validity of the thesis results.

To avoid this, four statistical tests are performed. These verifications examine whether there are

1.) Significant differences in the return behaviour of the parent index STOXX Europe 600 and the sub-index STOXX Europe 600 Chemicals,

2.) Significant differences in the return behaviour of the companies within the STOXX Europe 600 Chemicals and,

3.) Significant differences in the return behaviour of companies in the STOXX Europe 600 Chemicals index on days with and without news announcements.

A first test uses a paired t-test to compare the two benchmark indices, STOXX Europe 600 Chemicals and STOXX Europe 600. The t-test examines whether an observed difference between the means could have occurred by chance or whether it is sufficiently large to be considered statistically significant (Mishra et al., 2019; Proffitt, 2020; Quirk and Cummings, 2016). Specifically, a dependent t-test is conducted because two related samples are being compared: the STOXX Europe 600 Chemicals Index and the STOXX Europe 600 Index, which represent returns from the same period, 2020-2023 (Proffitt, 2020; Ross and Willson, 2017). Thus, there is a direct link between the two samples. It ensures that the selected industry-specific benchmark does not exhibit any systematic return distortions compared to the overall market. This confirmation is required to ensure the subsequent calculation of abnormal returns

at the company level. Returns are observed for each index each day. Consequently, the values of these two groups are in pairs.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	stoxx_return	,0002	1029	,01180	,00037
	stoxx_chem_return	,0003	1029	,01303	,00041

Paired Samples Correlations

		N	Correlation	Significance One-Sided p	Significance Two-Sided p
Pair 1	stoxx_return & stoxx_chem_return	1029	,899	<,001	<,001

Paired Samples Test

		Paired Differences					t	df	Significance One-Sided p	Significance Two-Sided p
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper				
Pair 1	stoxx_return - stoxx_chem_return	-,00010	,00570	,00018	-,00045	,00025	-,569	1028	,285	,569

Paired Samples Effect Sizes

			Standardizer[a]	Point Estimate	95% Confidence Interval Lower	95% Confidence Interval Upper
Pair 1	stoxx_return - stoxx_chem_return	Cohen's d	,00570	-,018	-,079	,043
		Hedges' correction	,00571	-,018	-,079	,043

a. The denominator used in estimating the effect sizes.
Cohen's d uses the sample standard deviation of the mean difference.
Hedges' correction uses the sample standard deviation of the mean difference, plus a correction factor.

Figure 4: SPSS Output On The Paired T-Test With 'Stoxx_return' And 'Stoxx_chem_return'

In Figure 4, the value pair '$stoxx\_return$' and '$stoxx\_chem\_return$' can be seen. Here, '$stoxx\_return$' stands for the returns of the STOXX Europe 600 Index and '$stoxx\_chem\_return$' consequently for the returns of the STOXX Europe 600 Chemicals Index. The mean values in the 'Paired Sample Statistics' section are similar at 0.0002 and 0.0003. The standard deviation (as shown in Figure 4: '$Std.Deviation$', also abbreviated as SD) results indicate that both indices exhibit slightly different volatilities: STOXX Europe 600 (0.0118) and STOXX Europe 600 Chemicals Index (0.01303). In the Paired Samples Correlation section, the correlation coefficient of 0.899 indicates a high positive correlation between the returns of the two indices. This was expected, as the STOXX Europe 600 Chemicals Index is a sub-index of the STOXX Europe 600 Index, as proven by statistical analysis. In the Paired Samples Test (t-test) section, the difference in the mean values is minimal at -0.0001. The p-value (two-sided) is greater at 0.569 and thus exceeds the significance level of 0.05. Hence, the difference is not significant. Cohen's d in the Paired Samples Effect Sizes section is small at -0.018.

These test results indicate that the difference in the mean values is not statistically significant. Consequently, there is no evidence that the returns of the parent index STOXX Europe 600 and the sub-index STOXX Europe 600 Chemicals differ over the period 2020-2023. Cohen's

d, which measures the effect size of the difference, also confirms that the difference has virtually no impact. In summary, this test procedure reveals that although the STOXX Europe 600 Chemicals exhibits slightly higher volatility, the average returns are nearly identical to those of the STOXX Europe 600. This indicates that the performance of the chemicals index is well aligned with that of the broader market. Consequently, RQ1, which posits that sustainability-related press releases influence returns in the chemicals index, is unaffected by this analysis, as the indices are comparable in their basic behaviour.

The second test examines whether there are significant differences among the 20 companies listed in the STOXX Europe 600 Chemicals Index. If there are notable differences, the respective companies should be treated separately. Average returns are once again used as the scientific basis here. This time, the groups are not the two indices but the companies themselves. Since there are 20 companies, the ANOVA test is chosen, which can model more than two groups. The ANOVA test assesses whether there are significant differences among groups without performing multiple tests that would increase the Type I error rate (Altman and Bland, 1996; Lani, 2010; Mood et al., 2019). A Tukey HSD test, also known as a post hoc test, is used to determine whether the means of pairs of groups differ significantly (Kolm, 1984; Midway et al., 2020; Piepho, 2018).

ANOVA

return

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	,004	19	,000	,423	,986
Within Groups	9,045	20353	,000		
Total	9,049	20372			

ANOVA Effect Sizes[a,b]

			95% Confidence Interval	
		Point Estimate	Lower	Upper
return	Eta-squared	,000	,000	,000
	Epsilon-squared	-,001	-,001	-,001
	Omega-squared Fixed-effect	-,001	-,001	-,001
	Omega-squared Random-effect	,000	,000	,000

a. Eta-squared and Epsilon-squared are estimated based on the fixed-effect model.

b. Negative but less biased estimates are retained, not rounded to zero.

Figure 5: SPSS Output On The ANOVA Analysis Of The Return Means

The results are presented in Figure 5. The low F-value of 0.423 in the analysis shows that the differences between the groups are relatively small. The p-value (also '$Sig.$') of 0.986 exceeds the significance level of 0.05, which emphasises that there are no significant differences between the groups. The ANOVA effect sizes, Eta-Squared and Omega-Squared, measure the strength of the difference between the groups. The lower the value, the smaller the strength (Liu, 2022; Mordkoff, 2019; Okada, 2013; Olejnik and Algina, 2003). Since both values are 0, no difference in strength can be measured. The Tukey-HSD test, which, as already described, checks whether the means of individual companies differ significantly in pairs, also shows no significant differences among the companies. All pairwise comparisons show $p > 0.05$, indicating that there are no significant differences among the companies. Consequently, all companies can be considered statistically equal, suggesting that there are no systematically better or worse companies in terms of their average returns.

Since there are no significant differences between the indices used in this thesis or within the company set from the STOXX Europe 600 Chemicals Index, it is essential to check whether there are any anomalies on days with or without press release publication.

The third and final test examines whether there are significant differences in the stock returns of companies in the STOXX Europe 600 Chemicals Index on days with or without a press release. When analysing this question, the prerequisites for parametric tests, which include ANOVA and t-tests, may not be met. Accordingly, a non-parametric test should be used because the dependent variable, 'return', is unlikely to be normally distributed, and these tests are more robust against ordinal data (here: company) and outliers (Grech and Calleja, 2018; McDonnell Sill, 2021). Specifically, the Mann-Whitney U test was used to analyse differences in the distributions of returns between the two groups (with and without the press release) (McKnight and Najab, 2010; Nachar, 2008). Additionally, a median test was conducted to assess any general differences between the two groups.

Independent-Samples Median Test

Return across PR

Independent-Samples Median Test Summary

Total N		20385
Median		,000
Test Statistic		,902[a]
Degree Of Freedom		1
Asymptotic Sig.(2-sided test)		,342
Yates's Continuity Correction	Chi-Square	,869
	Degree Of Freedom	1
	Asymptotic Sig.(2-sided test)	,351

a. Multiple comparisons are not performed because there are less than three test fields.

Figure 6: Independent-Samples Median Test: Return Across PR (press releases)

The Chi-square test in Figure 6 yields a value of 0.869. This value shows that the observed frequencies are very close to the expected frequencies. This means that there are no significant deviations between the groups. The p-value is 0.351, greater than the significance level of 0.05. The p-value indicates that there is no statistically significant difference between the two groups' average values. Since the medians do not show a statistically significant difference, the Mann-Whitney U test can also be used to examine the distributions of the returns.

Independent-Samples Mann-Whitney U Test Summary

Total N	20385
Mann-Whitney U	33023360,000
Wilcoxon W	40806845,000
Test Statistic	33023360,000
Standard Error	331928,848
Standardized Test Statistic	1,794
Asymptotic Sig.(2-sided test)	,073

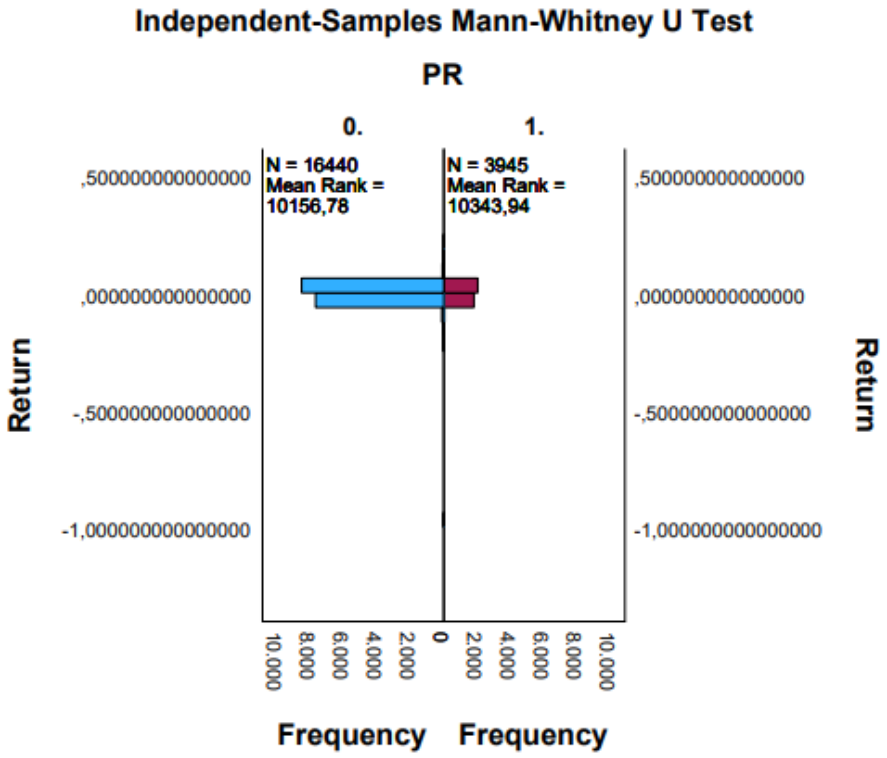

Figure 7: Mann-Whitney U Test Results

At 33,023,360, the Mann-Whitney U value in Figure 7 is relatively high. A high U-value indicates that the two groups have similar rank distributions, i.e. the values of one group are not systematically higher or lower than those of the other. In this respect, the two groups have similar rank distributions of returns in the analysis. The z-value of 1.794 is relatively close to 0, indicating that the differences in the rank distributions are not significant. For a significance level of 0.05, the critical z-value is approximately ±1.96. Since 1.794 is smaller than 1.96, it can be confirmed that there are no significant differences in the distributions of returns between the two groups. For completeness, the following descriptive statistics are mentioned: the group of dates without a press release is N=16,440, and the dates on which at least one press release appeared are N=3,945 (see Figure 7).

Furthermore, the mean rank values, 10,156.78 (without press release) and 10,343.94 (with press release), differ only insignificantly, which further supports the lack of significance of the results. In summary, the analysis reveals no significant differences between the two groups (with and without a press release) in either the medians (using the median test) or the distributions (using the Mann-Whitney U test) of returns. This indicates that the groups are largely homogeneous, and further analyses could focus on other variables (including control

variables). Finally, this test demonstrates that, on average, news days do not deviate to such an extent that they distort the entire distribution.

Finally, none of the three checks could be substantiated, and thus no statistically significant differences in returns could be identified. The returns alone do not offer sufficient differences to draw clear conclusions. Therefore, reviewing the research questions relevant to this thesis is not ruled out on statistical grounds in advance.

In summary, these tests examine whether ARs differ between groups or at specific points in time. These are, therefore, hypothesis tests of means or (analogous to variance) methods that provide information on whether there is a statistically significant difference. For all the regression analyses carried out as part of this event study, further tests are presented in the next Section 4.2, based on each research question, as necessary, to support the thesis's robustness.

Nevertheless, the present dataset can therefore be used to evaluate the empirical results in the following section.

4.2. Empirical Results

This chapter presents the results obtained using the methodological approach detailed in Chapter 3. The presentation of the results is structured regarding the three research questions (RQ1-RQ3) formulated in the introduction. This structure enables each research question to be evaluated directly, allowing the underlying topics to be analysed conclusively.

Each of the three research questions is divided into two parts: the descriptive analysis and the regression analysis. This descriptive analysis aims to facilitate a fundamental understanding of the core assertions in the dataset, prior to analysing the relationships between the variables in the regression analysis.

Followingly, Section 4.2.1 presents the results of RQ1, analysing the relationship between sustainability-related press releases and share price reactions among European chemical companies. This subchapter, in comparison to Section 4.2.2 (RQ2) and 4.2.3 (RQ3), is extensive because RQ1 provides the methodological and content-related basis for the subsequent analyses. In particular, validating the regression model provides the basis for transferring to RQ2 and RQ3.

Section 4.2.2 follows this with an analysis of RQ2, examining whether capital market reactions differ when an ESG index is included. Again, the analysis is divided into descriptive (4.2.2.1) and empirical (4.2.2.2) analyses.

Addressing RQ3, Section 4.2.3 examines the extent to which specific communicative characteristics in sustainability press releases are associated with changes in share price. The descriptive findings (4.2.3.1) are structured by categories and clusters, word count, readability and sentiment before the regression analysis results (4.2.3.2) are presented according to content and textual characteristics that influence the variables.

A final section (5.2.4) summarises the key findings of all three research questions (RQ1-RQ3). However, the next chapter first addresses RQ1 and presents its descriptive results to establish a basis for further analysis.

4.2.1. Findings For RQ1

To address RQ1 first, this section examines the impact of sustainability-related press releases on investor response, as evidenced by changes in share prices. Alongside the descriptive presentation (4.2.1.1) and regression results (4.2.1.2), a detailed examination of the Ordinary Least Squares (OLS) assumptions (4.2.1.3), robustness analysis (4.2.1.4), justification of model reduction (4.2.1.5) and additional tests (4.2.1.6) is provided. The descriptive results form the basis for answering RQ1 and provide initial findings from the dataset in the next section.

4.2.1.1. Descriptive Results RQ1

The descriptive results of the data are essential for understanding the quantitative analysis of RQ1, which examines the influence of sustainability-related press releases on the share prices of companies within the STOXX Europe 600 Chemicals Index. This section aims to present the distributions, means, and scatter of key variables to gain an initial insight into the structure of the dataset. The key variables are those identified as particularly relevant to the thesis, such as the number of sustainability press releases and the returns of the companies analysed. The analysis fulfils two central functions: it provides initial indications of possible correlations and, at the same time, enables the early identification of potential distortions before these are analysed in depth as part of the regression analysis.

Press release	Binary value	Total amount	Percentage
Not sustainability-related	0	2,806	59.8
Sustainability-related	1	1,884	40.2
		4,690	100.0

Table 6: Press Releases Based On Their Sustainability Relation

For this thesis, a total of 4,690 press releases were analysed (see Table 6). Each company published a different number of press releases from 2020 to 2023 (see Table 7). 40.2% of all press releases (1,884 of 4,690) published by the companies during the analysed period were identified as sustainability-related (Table 6). Conversely, 59.8% have no relation to sustainability.

The analysis at the company level, presented in Table 7, reveals apparent differences in communication practices. While 86.2% of press releases at Yara and 77% at Johnson Matthey refer to sustainability, the proportion is significantly lower at Wacker Chemie (15.7%), IMCD (12.1%) and K+S (8.7%). The mean share of sustainability-related press releases across all companies is 38.5%.

A heterogeneous picture also emerges regarding share returns. The mean return in the period under review is 6.62%, but the range spans from -53.34% (LANXESS) to +100.01% (IMCD), i.e., over 153 percentage points. This also confirms the assumption made in Section 3.2 that share prices and, consequently, returns were highly volatile during the period under review, and underscores the fact that the market-adjusted approach appears to have been the correct methodological choice for the event study. For Table 7, this means that no uniform trend can be identified, suggesting no direct correlation between sustainability communication and share price performance.

Although IMCD achieves the highest return (+100.01%) with a comparatively low sustainability share (12.1%), other examples, such as Johnson Matthey (-44.00% with a 77% sustainability share) or Clariant (-41.69% with a 47.1% sustainability share), invalidate this assumption. Similarly, Yara, with an 86.2% sustainability share, shows hardly any return growth (-0.03%), while Covestro, with a 61.2% share, at least records a return of +24.89%.

No.	Company	Press Releases	Sustainability-related press releases	Share of Sus.-Rel. in Percentage	Total Return 2020-23
1	Air Liquide	204	117	57.4	+52.83
2	Akzo Nobel	263	59	22.4	-18.30
3	Arkema	293	76	25.9	+ 8.74
4	BASF	758	335	44.2	-28.57
5	Brenntag	166	45	27.1	+70.67
6	Clariant	274	129	47.1	-41,69
7	Covestro	227	139	61.2	+24.89
8	Croda	54	23	42.6	-0.1
9	Evonik	581	200	34.4	-32.31
10	Fuchs	58	11	19.0	-18.16
11	Givaudan	154	58	37.7	+14.01
12	*IMCD*	*157*	*19*	*12.1*	*+100.01*
13	Johnson Matthey	113	87	77.0	-44.00
14	*K+S*	*103*	*9*	*8.7*	*+27.77*
15	LANXESS	266	79	29.7	-53.34
16	OCI	86	38	44.2	+39.72
17	Symrise	195	79	40.5	+ 6.50
18	Umicore	296	112	37.8	-43.41
19	*Wacker Chemie*	*159*	*25*	*15.7*	*+67.25*
20	Yara	283	244	86.2	- 0,03
Total		4,690	1,884	$\bar{x} = 38.5$	$\bar{x} = 6.62$

Table 7: Overview Of Press Releases With Sustainability Relation And Their Share Of Publication And Total Returns On Company Level

Instead, the high dispersion of the values suggests that numerous external factors, such as macroeconomic conditions, industry effects, or corporate strategy, are also likely to play a role. Therefore, it is all the more essential to conduct a regression analysis in the next step, which statistically controls for these influencing factors. This is one possible way to adequately analyse the isolated effect of sustainability communication on capital market reactions. This overarching analysis is presented in the following section, utilising regression models.

Before analysing the regression models, the CAARs for the 11 days are calculated to isolate external influences and measure the specific market reaction to the events (see Table 8).

Benchmark Model	CAAR (Mean)	Standard Deviation	t-Statistics	p-value	N
CAR1 (Industry)	-0.357%	0.05269	-4.641	< 0.001	4,690
CAR2 (Sector)	-0.223%	0.05460	-2.803	< 0.005	4,690

Table 8: Cumulative Average Abnormal Returns (CAAR) for the 11-Day Event Window (N = 4,690)

The CAARs are -0.357% (industry benchmark, CAR1) and -0.223% (sector benchmark, CAR2). A one-sample t-test confirms statistical significance: CAR1 yields a t-statistic of -4.641 ($p < 0.001$), and CAR2 shows -2.803 ($p = 0.005$). These significant negative CAAR values demonstrate that, on average, all 4,690 press releases trigger a systematic, although slight, negative price reaction. This provides a statistical basis for investigating, through regression analysis, how sustainability-related press releases affect market reactions.

4.2.1.2. Regression Analysis RQ1

The results presented here build on the descriptive analysis, which provided initial indications of possible correlations between the number of sustainability press releases and the companies' share returns. The following multivariate analysis aims at investigating these correlations in a statistically sound manner while controlling for other influencing factors. To this end, a linear regression model is used that considers the independent variables defined in Section 4.4.2. The focus is on whether sustainability-related press releases have a significant influence on the CARs of the companies represented in the STOXX Europe 600 Chemicals Index from 2020 to 2023 and, thus, on capital market reactions.

The regression model tested is as follows:

$$\begin{aligned} \mathrm{CAR}_i = {} & \beta_0 + \beta_1 \cdot \mathrm{text\_sus}_i + \beta_2 \cdot \mathrm{market\_cap}_i + \beta_3 \cdot \mathrm{eps}_i + \beta_4 \cdot \mathrm{pe\_ratio}_i \\ & + \beta_5 \cdot \mathrm{intrate}_{c,t} + \beta_6 \cdot \mathrm{gas}_t + \beta_7 \cdot \mathrm{inflate}_{c,t} + \beta_8 \cdot \mathrm{CAR2} + \varepsilon_i \end{aligned}$$

For this regression model, the preliminary results in Figure 8 show the following SPSS output:

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	,950[a]	,903	,902	,01645627389	1,735

a. Predictors: (Constant), text_sus, pe_ratio, eps, CAR2, gas, cap, intrate, inflate

b. Dependent Variable: CAR1

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	11,749	8	1,469	5423,183	<,001[b]
	Residual	1,268	4681	,000		
	Total	13,017	4689			

a. Dependent Variable: CAR1

b. Predictors: (Constant), text_sus, pe_ratio, eps, CAR2, gas, cap, intrate, inflate

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	-,004	,001		-7,861	<,001		
	CAR2	,919	,004	,952	207,512	<,001	,988	1,012
	intrate	,000	,000	,005	,918	,359	,742	1,347
	gas	3,120E-5	,000	,031	4,787	<,001	,510	1,962
	cap	-8,632E-6	,000	-,003	-,715	,475	,972	1,029
	eps	1,362E-5	,000	,004	,878	,380	,942	1,062
	pe_ratio	5,829E-7	,000	,008	1,715	,086	,963	1,038
	inflate	1,254E-6	,000	,000	,011	,991	,441	2,265
	text_sus	,002	,000	,015	3,173	,002	,973	1,027

a. Dependent Variable: CAR1

Figure 8: SPSS Output From The Regression Model In The Context Of RQ1

The adjusted R² of 0.902 indicates substantial explanatory power for the model but should be considered in the context of the variable construction described in Section 3.6. As detailed in that section, employing the same stock return ($R_{i,t}$) for both CAR1 and CAR2 introduces a mathematically induced correlation. In the current analysis, the elevated R^2 primarily demonstrates the effective filtering of systematic market noise. This outcome establishes a robust statistical foundation for isolating the remaining variance, thereby clarifying the specific influence of sustainability communication without conflating it with methodological bias. The F-value of 5,423.183 ($p < 0.001$) further demonstrates the statistical significance of the model.

Within the model, the variables CAR2, gas and text_sus are significant ($p < 0.05$). The regression model employs CAR2 to control for general market movements, as demonstrated by the standardised beta coefficient of 0.952 and a notably high t value (207.512 in Figure 8). This methodology enables the isolation of the net effect of sustainability communication

(text_sus) on company-level returns by filtering out the systematic noise from the broader European stock market. The text_sus variable consequently shows a significant but comparatively small effect ($t = 3.173$; $p = 0.002$; $\beta = 0.015$) in comparison to the macroeconomic effects and therefore represents a corrected signal. These findings demonstrate that sustainability press releases, after accounting for prevailing market dynamics and energy prices, independently contribute to explaining individual share price reactions. The remaining control variables (market_cap, eps, pe_ratio, intrate and inflate) show no significant correlations with the dependent variable. Therefore, the central effects in the model are robust and can be mainly explained independently by external drivers.

The results align with previous research outlined in Sections 2.2 and 2.3 and underscore the need for robust statistical tests to avoid bias from heteroskedasticity or autocorrelation. The following section discusses these methodological requirements, including the verification of OLS assumptions and the use of robust standard errors (Newey-West).

4.2.1.3. OLS Assumptions

Before the results of RQ1 can be stated and analysed, it must first be determined whether an OLS regression is possible in the present case. To verify this, the assumptions of the Gauss-Markov Theorem are applied. The theorem asserts that the OLS estimator is the best linear unbiased estimator (BLUE) for the coefficients in a linear regression model, provided that the errors are homoscedastic and uncorrelated (Davidson, 2018; Hallin, 2014; Shaffer, 1991).

This conclusion is contingent upon the fundamental assumptions of linearity, unbiasedness, and minimum variance, and it holds irrespective of the distribution of the errors (Hallin, 2014). The OLS estimator is considered uniquely efficient because it minimises the variance of the estimated coefficients relative to other linear unbiased estimators (Allen and Stone, 2001; Davidson, 2018). This efficiency can be extended to linear models with less than full rank by applying generalised inverse matrices (Albert, 1973; Lewis and Odell, 1966).

In the context of this study, OLS is suitable for analysing how various text and control variables, as well as sustainability-related press releases and inclusion in the ESG index, explain the CARs of the components of the STOXX Europe 600 Chemicals Index.

As these assumptions pertain to the model residuals, they can be evaluated only after the model has been estimated (Brown, 2018; Davidson, 2018). Therefore, a dedicated model

diagnostics section follows in Section 4.2.1.4, allowing a direct evaluation of assumption validity and, if necessary, the implementation of corrections, such as applying Newey-West standard errors for heteroscedasticity.

This theorem then gives rise to the following assumptions, which must be checked in the context of OLS regressions:

- Linearity: The relationship between the dependent variable (y) and the independent variables (x) is linear, as demonstrated by the following equation: ($y = x\beta + e$), where (β) is the parameter vector and (e) is the error term (Davidson, 2018; Shaffer, 1991).

- Full rank of matrix (also called: no multicollinearity): The matrix (X) must possess full column rank; that is to say, the columns of (X) must be linearly independent. This is a prerequisite for ensuring the uniqueness of the parameter estimates (Oktaba, 1984).

- Unbiasedness of Errors: It is expected that the value of the error term (e) will be zero, i.e. $E(e) = 0$ (Davidson, 2018; Shaffer, 1991).

- Homoscedasticity: Errors are observed to possess constant variance (σ^2) and are found to be uncorrelated. Consequently, the error variance matrix is found to be equal to ($\sigma^2 I$), where I denotes the identity matrix (Brown, 2018; Davidson, 2018).

- Independence of Errors (also called: no autocorrelation): It can be deduced from the data that the error terms are uncorrelated with each other. This indicates that the covariance between any two distinct error terms is zero (Brown, 2018).

The conventional assumption of error independence, as stipulated by the Gauss-Markov theorem, is not subjected to independent evaluation in the present thesis. In time series analysis, identifying patterns, trends, and the potential for predictability in data is paramount (Chatfield and Xing, 2019). Systematic tests for autocorrelation, including the Durbin-Watson and Breusch-Godfrey tests, are conventionally applied under the assumption of regularly spaced series observations (Chen, 2016; Phillips, 1986; Savin and White, 1977; Tsay, 2005; Uyanto, 2020).

Given the data's event structure and the irregular time intervals between the press releases, implementing a systematic test for autocorrelation, such as the Durbin-Watson or Breusch-

Godfrey test, is not methodologically sound. Implementing such evaluations needs an evenly spaced time series, a requirement that the present data structure does not meet.

Whilst the normality of residuals is not an indispensable prerequisite for the Gauss-Markov theorem, it is frequently assumed in practice when conducting hypothesis tests and constructing confidence intervals. This is because the normality of the residuals facilitates the derivation of the sampling distributions of the estimators (Lehmann, 2012; Oktaba, 1984). In practice, the normality of residuals is more pertinent to testing hypotheses and other inferential statistics than to the Gauss-Markov theorem itself (Oktaba, 1984). Against this background, the normal distribution is also analysed in this thesis.

Therefore, four of the above basic assumptions and one additional assumption regarding the normal distribution are tested in this thesis, resulting in a total of five assumptions. In the following, these five assumptions are examined in turn using the results of the regression analyses:

1. Linearity

To test Gauss-Markov's assumption of linearity, a residual scatterplot plots the standardised residuals against the predicted values (Abdullahi et al., 2015; Behnken and Draper, 1972; Wasilewski, 1989). The plot in
Figure A - 2 shows a symmetric distribution of residuals around the zero line, with no discernible patterns or systematic deviations. The scatterplot's flat red line of best fit confirms the linearity between the dependent and independent variables. This visual evidence provides clear, sufficient proof that the assumption of linearity holds. Based on these unambiguous results, further investigation or transformation is not necessary. Thus, the basis for applying the OLS regression method is secured.

2. Multicollinearity

The Variance Inflation Factor (VIF) is an indicator of multicollinearity that measures the extent to which the variance of a regression coefficient is increased by correlations with other

independent variables (J. H. Kim, 2019; Senaviratna and A. Cooray, 2019; Tamura et al., 2019). This indicator is included in the total linear regression results of the entire model (Figure 8). There is little or no multicollinearity if the VIF is less than 5. With a value between 5 and 10, multicollinearity is moderately present, and beyond that, it is strongly pronounced (J. H. Kim, 2019; Kyriazos and Poga, 2023). The highest value in this linear regression is 2.265 (inflation rate in Figure 8). Thus, this value and all values below it are unimportant, indicating that multicollinearity does not prevail.

3. Unbiasedness of Errors

The assumption that the errors are unbiased implies that the expected value of the errors is zero: $E(\varepsilon i) = 0$. This assumption is crucial for treating the regression coefficient estimates as unbiased (Nakonechnyi et al., 2020; Portnoy, 2023).

To test this assumption, the mean value of the residuals is calculated. The statistics shown in Figure A - 3 indicate that the mean residual is zero, strongly suggesting that this condition is met.

4. Heteroscedasticity

To avoid the p- and F-tests becoming unreliable due to the distortion of coefficient standard errors, heteroscedasticity is detected (Cleasby and Nakagawa, 2011; Farbmacher and Kögel, 2017; Long and Ervin, 2000; Zhang and Lai, 2024).

Based on the plot in Figure A - 4, heteroscedasticity cannot be ruled out. The points are not randomly distributed around the red line (linear fit). Instead, there are areas of varying dispersion. In particular, the points are more dispersed at higher unstandardised predicted values (Knaub, 2021). This indicates possible heteroscedasticity. The red line indicates a trend or pattern in the residuals, suggesting that their variance is systematically related to the predicted values. This contradicts the assumption of homoscedasticity. To be sure whether heteroscedasticity is present, the Breusch-Pagan test is performed.

Figure A - 5 shows the results of the Breusch–Pagan test. The p-value is below 0.001, indicating a statistically significant violation of the homoscedasticity assumption. This test is based on an auxiliary regression of the squared OLS residuals on the independent variables.

Under the null hypothesis of constant error variance, the resulting test statistic follows a chi-squared distribution (Breusch and Pagan, 1979). A high test statistic, such as the observed value of 15,088, suggests that the residual variance systematically depends on the independent variables. This, combined with the highly significant p-value, provides clear evidence of heteroscedasticity. The remaining Gauss–Markov assumption, that of a normal distribution, is examined in the following section, followed by a presentation of statistical remedies to address the identified heteroscedasticity.

5. Normal distribution of the residuals

According to the Gauss-Markov assumptions, the error terms (residuals) should be normally distributed for a given set of values of the independent variables. This assumption is essential for the validity of the t- and F-tests, as they require normality of the errors to provide reliable p-values and confidence intervals (Dasgupta and Mishra, 2004; Sen and Srivastava, 1990).

The histogram in Figure A - 6 shows the distribution of the model's residuals. The distribution is bell-shaped, indicating an approximation to a normal distribution. However, there is a slight deviation at the tails. The Q-Q plot (quantile-quantile plot) in Figure A - 7 compares the observed residuals to an ideal normal distribution. Most points lie on the diagonal line, indicating that the residuals are normally distributed overall. At the left and right ends, slight deviations from the line indicate minor problems. This observation at the margins is consistent with the histogram.

Accordingly, a Shapiro-Wilk and Kolmogorov-Smirnov test are also carried out. These tests statistically assess whether the distribution of the residuals significantly deviates from normality (Razali and Wah, 2011; Yap and Sim, 2011). Both tests are significant ($p < 0.001$), as shown in Figure A - 8. This means that the residuals are not perfectly normally distributed.
The graphical methods show that the distribution of the residuals is normal overall, with slight deviations at the edges. However, the Shapiro-Wilk and Kolmogorov-Smirnov tests show that the residuals are not perfectly normally distributed. Still, this is not necessarily a problem for the OLS regression, as normality is less critical, especially for large data samples like in this case ($n = 4{,}690$), as long as the residuals are independent and homoscedastic (Bilon, 2023; Kim and Park, 2019; O. Emmanuel et al., 2020). Therefore, the OLS regression is considered robust to minor violations of the normal distribution assumption, especially given the large sample size.

Summary of Gauss-Markov assumptions

As demonstrated in Table 9, the data satisfy four of the five central Gauss-Markov assumptions: linearity, freedom from multicollinearity, unbiasedness of the error terms, and sufficient normality of the residuals for the given sample size.

Assumption	Prerequisite	Result
Linearity	The relationship between the dependent and independent variables is linear.	Linearity is given.
No multicollinearity (full rank of matrix)	The columns of X (independent variables) must be linearly independent.	The full rank of the matrix is given.
Unbiasedness of Errors	$E(\epsilon)=0$	Unbiasedness is given.
Homoscedasticity	Constant variance and uncorrelated errors ϵ.	Homoscedasticity is violated.
Normality of error terms	Error terms are normally distributed.	The normal distribution is violated, but this is less critical for large data samples as long as the residuals are independent and homoscedastic.

Table 9: Summary Of Gauss-Markov Assumptions

It is essential to note that only the assumption of homoscedasticity is violated; the other assumptions remain intact. This could lead to distorted standard errors and, without appropriate correction, potentially erroneous inference conclusions (Dudek, 1979; Ketz, 2019; Mansournia et al., 2021; Wooldridge, 2023). For this reason, the following section addresses the elimination of these potentially erroneous inferences, focusing on ensuring the validity and robustness of the results and the relationships between the variables.

4.2.1.4. Robust Standard Errors

To ensure reliable estimators despite heteroscedasticity, robust standard errors, as proposed by Newey and West (1987), were used in the subsequent analysis (Newey and West, 1987; Nurlaila et al., 2017). Although these corrections are also used to address autocorrelation, systematic autocorrelation is not anticipated in the present data structure, which is characterised by irregularly occurring events and a paucity of temporal sequentially, as discussed earlier in this chapter. Consequently, an explicit test for autocorrelation was not

conducted, as the event study's methodological framework and the data's inherent characteristics effectively preclude its occurrence.

The Newey-West method employs a weighted covariance matrix estimate for error terms across multiple time steps (Kolokotrones et al., 2024; Newey and West, 1987). This maintains the efficiency of the estimators while correcting the common error-prone underestimation of standard errors. Alternatively, the error structure could be modelled using generalised least squares (GLS) or an autoregressive model (e.g., AR(1) or AR(2)). However, these methods were not used for several reasons. First, GLS models require explicit modelling of the error structure (e.g., an AR(1) process), which can lead to different interpretations of the coefficients (Lusompa, 2021). Conversely, Newey-West only corrects the standard errors, while the regression coefficients remain unchanged (Smith and McAleer, 1994). Furthermore, AR(1) or AR(2) models assume a specific error structure (e.g. that the error is systematically derived from previous errors) (Lusompa, 2021). The Newey-West method does not require any explicit assumption about the form of the dependence and can adaptively weight higher lags, which is particularly advantageous for economic time series (Zhu and Yang, 2022). Heteroskedasticity can only be corrected by GLS in specific structures, while Newey-West automatically and robustly handles both heteroskedasticity and autocorrelation, which is advantageous in the present case (Nurlaila et al., 2017; Rogers et al., 2018). This makes Newey-West particularly suitable for data with different volatility, as is typical for market reactions to company announcements (Rogers et al., 2018).

For these reasons, the Newey-West correction was chosen as a robust and economical method for ensuring valid standard errors under heteroskedasticity, without compromising the interpretability of the coefficients.

After using the Newey-West test in R with the command 'coeftest(model, vcov = NeweyWest(model)', the following output is shown in Figure 9.

```
t test of coefficients:

              Estimate  Std. Error  t value  Pr(>|t|)
(Intercept) -3.9969e-03  6.5899e-04  -6.0653 1.421e-09 ***
CAR2         9.1884e-01  7.5381e-03 121.8929 < 2.2e-16 ***
gas          3.1199e-05  6.6467e-06   4.6939 2.757e-06 ***
cap         -8.6320e-06  1.3304e-05  -0.6488  0.516486
eps          1.3619e-05  1.5112e-05   0.9012  0.367522
pe_ratio     5.8287e-07  3.1766e-07   1.8349  0.066582 .
inflate      1.2537e-06  1.1491e-04   0.0109  0.991295
intrate      1.6888e-04  1.8519e-04   0.9119  0.361852
text_sus     1.5761e-03  5.3897e-04   2.9243  0.003469 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Figure 9: R Output After Newey-West Test For RQ1

The results remain largely unchanged compared to the regression model without Newey-West adjustments (see Figure 8). Although CAR2, gas, and text_sus continue to be significant predictors, the applied correction yields more precise, conservative estimates of the variable values. Specifically, the unstandardized coefficient (B) for the central variable text_sus is adjusted from 0.002 (see Figure 8) to 0.0015761 (≈ 0.0016, Figure 9). This minor adjustment delivers a corrected market signal free of heteroscedasticity. Even after this more rigorous testing, the effect remains highly significant, with a p-value of 1% significance level. The Newey-West correction produces more robust statistics and mitigates the bias associated with biased standard errors. Given this increased validity, this model is designated as the primary basis for addressing RQ1 and for all subsequent analyses (RQ2 and RQ3) in this thesis. Accordingly, this will serve as the primary model in the work to ensure a distortion-free interpretation of the results, including the next section that addresses model reduction of insignificant variables.

4.2.1.5. Model Reduction And Parsimony

Since the variables intrate, eps, pe_ratio, and inflate do not significantly influence the model, the model's explanatory power was also tested by removing these variables. The model remains robust, with an R^2 of 0.902, which means that 90.2% of the variance in the dependent variable (CAR1) is explained by the independent variables CAR2, gas, and text_sus (see Figure A - 9). The ANOVA shows that the model is highly significant overall ($F = 14{,}457.171;\ p < 0.001$). CAR2 has the strongest influence with a standardised coefficient of 0.952 and is highly significant (p < 0.001). Gas also has a significant, albeit small, positive

effect ($beta = 0.031;\ p < 0.001$). text_sus has also a small but significant positive effect ($beta = 0.015;\ p = 0.001$). After applying the robust standard errors (see Figure A - 10), CAR2 remains highly significant, as do gas and text_sus. The robust standard errors correct for heteroscedasticity. For text_sus, the influence remains stable and still significant ($t = 3.230;\ p = 0.001$). The Breusch-Pagan test shows significant heteroscedasticity ($p < 0.001$, see Figure A - 11). However, the correction by robust standard errors ensures the reliability of the results. The residual plots indicate that some heteroscedasticity may remain, despite the adjustments made. However, this is mitigated by the robust correction. All VIF values are below 5, indicating no multicollinearity. The mean of the residuals is 0, confirming the unbiasedness of the estimates. In summary, it can be stated that the test of the Gauss-Markov assumptions for the model without insignificant variables allows the following OLS linear regression model with robust standard errors:

$$\mathrm{CAR}_i = \beta_0 + \beta_1 \cdot \mathrm{text\_sus}_i + \beta_2 \cdot \mathrm{gas}_t + \beta_3 \cdot \mathrm{CAR2} + \varepsilon_i$$

To answer RQ1, a complete regression model was tested, including all previously defined independent variables. This indicated that the variables intrate, eps, pe_ratio and inflate exert no significant influence on the dependent variable (CAR1). In a reduced model, these variables are removed to determine their effects on model quality. The reduced model explained 90.2% of the variance in CAR1 ($R^2 = 0.902$), indicating minimal loss of explanatory power. Consequently, a considerably more concise model was identified, characterised by its exceptional precision and substantial explanatory capacity.

The decision to reduce the model is founded upon the scientific principle of model parsimony. This concept aims to formulate a robust, readily interpretable model with a minimal number of explanatory variables. Parsimonious models are considered to be more straightforward to interpret, less prone to error, and generally more robust against overfitting (Bentler and Mooijaart, 1989; Marsh and Hau, 1996; Raykov and Marcoulides, 1999). Furthermore, lower variance in parameter estimates is observed, particularly with large sample sizes, thereby enhancing statistical precision (Bentler and Mooijaart, 1989).

The existing literature also emphasises that simpler models are easier to generalise and require fewer computing resources, which makes them particularly suitable for applications with extensive datasets (Mulaik, 1998; Urraca et al., 2018). Parsimonious models also represent complete hypotheses with a higher potential for falsification, thereby strengthening scientific reproducibility (Dubova et al., 2025; Mulaik, 1998). However, it should be noted that there are also warnings against oversimplification, as excessive reductions can eliminate

relevant influencing variables and impair explanatory power, especially in complex contexts (Coelho et al., 2019; Marsh and Hau, 1996). In this particular instance, however, no significant loss effects were identified.

The thesis's structured study design confers a distinct benefit. In the ensuing research questions, further variables are introduced to analyse additional correlations. These additional correlations may pertain to the ESG index status or content-related and textual characteristics, for example. If the initial model already contained all insignificant variables, the model structure would risk becoming unnecessarily complex and opaque as the thesis progressed. Consequently, by focusing on the significant variables in the initial model, a sustainable, lean and scientifically sound foundation is established for subsequent analyses. Building on this consolidated model, the following section explores targeted methodological refinements and additional testing procedures. These are intended to validate the robustness of the results and determine whether alternative modelling approaches could provide further insight.

4.2.1.6. Model Refinements And Interaction Effects

Given the model structure outlined above, it would be worthwhile to explore whether alternative modelling approaches could yield additional insights. So first, the appropriateness of a panel regression approach was evaluated. A panel model was examined to assess whether more advanced model structures could provide additional insights. The choice of this method is based on the data structure and the specific requirements of the research question (Sun et al., 2018). A panel model would be appropriate if the data included repeated observations of the same unit over time and modelling of firm-specific or temporal effects were required (Battese and Coelli, 1995; Imai and Kim, 2021; Tsionas and Kumbhakar, 2014). In a panel data set, each firm is observed multiple times over time, allowing firm-specific fixed or random effects to be estimated meaningfully. However, this is not the case in the present thesis (Allison, 1994; Zulfikar, 2018).

The data structure consists of individual press releases, where each observation corresponds to a particular company announcement and the immediate market effect on this announcement is measured. Although each company issues several press releases over time, there is no regular panel structure in which each company is repeatedly observed at the same points in time. Instead, each press release represents an independent observation (Allison, 1994), so a classic cross-sectional rather than a panel analysis is the more appropriate method (Zulfikar, 2018). In this respect, a Breusch-Pagan-Lagrange multiplier (LM) test is not conducted.

RQ1 analyses the impact of sustainability-related press releases (text_sus) on the share price of the companies represented in the STOXX Europe 600 Chemicals Index (CAR1). It is conceivable that the effects of text_sus are moderated by other variables. Accordingly, this thesis also examines whether large companies receive more attention for sustainability-related press releases and, consequently, have a more substantial impact on their share prices than smaller companies. This is measured in the thesis by market capitalisation. The results show that the interaction term text_sus × cap does not significantly affect CAR1 (see Figure A - 12 and Figure A - 13 in the Appendices). There is no evidence that market capitalisation moderates the effect of sustainability-related press releases on share prices. The model with the interaction term explains virtually no variance in the dependent variable. Therefore, including this interaction term in the final model does not make sense.

Finally, several potential interaction effects were analysed. The interaction term text_sus × gas does not significantly influence CAR1 (see Figure A - 14 and Figure A - 15 in the Appendices). This suggests that the impact of sustainability-related messages in press releases is independent of energy prices. The model has very low explanatory power, so this term should not be meaningfully included in the final model. The interaction term text_sus × CAR2, on the other hand, is significant but negative (see Figure A - 16 and Figure A - 17 in the Appendices) This suggests that the impact of sustainability messages on CAR1 decreases as CAR2 values increase. After a Newey-West test, the interaction term is found to be insignificant. All other modifications were also subjected to the Newey-West test; however, the results were consistent with those of the OLS regression without robust standard errors. Accordingly, RQ2, highlighted in the following section, builds on the findings of RQ1 and draws on the final OLS regression model developed in that context.

4.2.2. Findings For RQ2

Based on the previously validated regression model, this section analyses whether capital market reactions to sustainability-related press releases depend on whether the publishing companies are included in established sustainability indices. To this end, descriptive analyses of index membership are conducted (4.2.2.1), followed by an extended regression analysis

that addresses the central research question (4.2.2.2). Again, the following section starts with the descriptive results.

4.2.2.1. Descriptive Results RQ2

Of the 4,690 press releases analysed, 30.5% (1,431 releases) were from companies included in the DJSI at the time of publication (see Table 10).

Press release	Binary value	Total amount	Percentage
No DJSI member	0	3,259	69.5
DJSI member	1	1,431	30.5
		4,690	100.0

Table 10: Press Releases Based On The DJSI Membership In The Year Of Publication

In contrast, 49.3% (2,312 releases) came from companies listed in the FTSE4Good at the time of publication (Table 11). Membership is based on the calendar year; for example, if a company was listed in the index in 2022, all announcements from that year are considered part of the index.

Press release	Binary value	Total amount	Percentage
No FTSE4Good member	0	2,379	50.7
FTSE4Good member	1	2,311	49.3
		4,690	100.0

Table 11: Press Releases Based On The FTSE4Good Membership In The Year Of Publication

The data thus show a broader representation in the FTSE4Good than in the DJSI, indicating different inclusion criteria or stricter requirements for the DJSI. An analysis at the company level (Table 12) also shows that some companies, such as Clariant (8 out of 8 possible index nominations), Evonik, and LANXESS (7 nominations each), were consistently or widely represented in the DJSI and FTSE4Good indices. In contrast, eight companies were not listed in either index during the period under review, including BASF, Brenntag, Fuchs, IMCD, K+S, OCI, Wacker Chemie and Yara.

No.	Company	DJSI	FTSE4Good	Total Mentions	Share of potential mentions
1	Air Liquide	2	4	6	75%
2	Akzo Nobel	0	4	4	50%
3	Arkema	4	0	4	50%
4	BASF	0	0	0	0%
5	Brenntag	0	0	0	0%
6	Clariant	4	4	8	100%
7	Covestro	0	4	4	50%
8	Croda	0	1	1	12,5%
9	Evonik	3	4	7	87,5%
10	Fuchs	0	0	0	0%
11	Givaudan	0	4	4	50%
12	IMCD	0	0	0	0%
13	Johnson Matthey	3	3	6	75%
14	K+S	0	0	0	0%
15	LANXESS	4	3	7	87,5%
16	OCI	0	0	0	0%
17	Symrise	0	2	2	25%
18	Umicore	0	3	3	37,5%
19	Wacker Chemie	0	0	0	0%
20	Yara	0	0	0	0%

Table 12: Mentions by Companies in Sustainability Indices

The descriptive results demonstrate that a considerable proportion of the companies analysed were represented in at least one of the two sustainability indices, DJSI and FTSE4Good, with some companies appearing in both indices over the entire period under review. However, 40% of the analysed companies were not affiliated with any index. This finding suggests significant variations in external ESG perceptions within the STOXX Europe 600 Chemicals Index, and potentially also in the communication strategies employed by these companies. The following extended regression model is used to examine whether membership of one of the indices exerts a systematic influence on the share price reaction following the publication of sustainability-related press releases.

4.2.2.2. Regression Analysis RQ2

The regression model developed and validated in RQ1 serves as the analytical basis and is now expanded to include binary variables reflecting index membership in the DJSI and FTSE4Good. The objective of this section is to analyse whether companies listed in these sustainability indices demonstrate divergent responses in the capital market to sustainability-related press releases compared to companies that do not possess such a listing, such as

BASF or Wacker. Before examining the respective interactions between sustainability-related press releases and the index membership of DJSI and FTSE4Good, it is first determined whether the two indices considered in the existing model generally influence the stock market movements of the chemical companies analysed in this thesis.

Based on the definition in 4.2.1.5 about the consolidated basic version, the following model

$$\mathrm{CAR}_i = \beta_0 + \beta_1 \cdot \mathrm{text\_sus}_i + \beta_2 \cdot \mathrm{gas}_t + \beta_3 \cdot \mathrm{CAR2} + \varepsilon_i$$

will be extended by the binary variables,

$$\mathrm{DJSI}_i \quad \text{and} \quad \mathrm{FTSE4Good}_i$$

resulting in the following model:

$$\mathrm{CAR}_i = \beta_0 + \beta_1 \cdot \mathrm{text\_sus}_i + \beta_2 \cdot \mathrm{gas}_t + \beta_3 \cdot \mathrm{CAR2} + \beta_4 \cdot \mathrm{DJSI}_i + \beta_5 \cdot \mathrm{FTSE4Good}_i + \varepsilon_i$$

Including these two binary variables does not violate the linearity assumption, as they are categorical indicators. A test for multicollinearity indicates no problematic correlations: the highest VIF is 1.132 (for the DJSI), well below the critical threshold of 5 (Figure 10).

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,950[a]	,903	,903	,01644429801

a. Predictors: (Constant), ftse4good, text_sus, CAR2, gas, djsi

b. Dependent Variable: CAR1

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	11,750	5	2,350	8690,500	<,001[b]
	Residual	1,267	4684	,000		
	Total	13,017	4689			

a. Dependent Variable: CAR1

b. Predictors: (Constant), ftse4good, text_sus, CAR2, gas, djsi

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	-,003	,000		-6,816	<,001		
	CAR2	,919	,004	,952	207,881	<,001	,991	1,009
	gas	3,183E-5	,000	,031	6,781	<,001	,981	1,019
	text_sus	,002	,000	,015	3,184	,001	,991	1,009
	djsi	-,001	,001	-,010	-2,082	,037	,883	1,132
	ftse4good	-,001	,001	-,007	-1,498	,134	,889	1,125

a. Dependent Variable: CAR1

Figure 10: SPSS Output For RQ2 With The Index Assignments Of DJSI And FTSE4Good

Firstly, the regression coefficients in Figure 10 indicate a significant negative relationship between the DJSI and the CARs. The p-value is less than 0.05, indicating statistical significance. At the same time, the Breusch-Pagan test indicates heteroscedasticity in the error terms (p-value below the 0.05 level).

These distortions in Figure A - 18 suggest that interpreting p-values without robust adjustments is unreliable. For this reason, the regression is re-estimated with robust standard errors, as per Newey-West (Figure 11). The results indicate that neither the DJSI nor the FTSE4Good index has a significant effect on CAR1 in the robustly corrected model ($p > 0.05$).

```
t test of coefficients:

               Estimate  Std. Error t value  Pr(>|t|)
(Intercept) -3.2106e-03  9.7398e-04 -3.2964 0.0009866 ***
text_sus     1.5662e-03  5.7666e-04  2.7160 0.0066323 **
djsi        -1.1551e-03  1.2068e-03 -0.9572 0.3385263
ftse4good   -7.6274e-04  1.0489e-03 -0.7272 0.4671297
CAR2         9.1864e-01  1.0650e-02 86.2582 < 2.2e-16 ***
gas          3.1830e-05  1.0231e-05  3.1112 0.0018745 **
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Figure 11: Newey-West Test For Autocorrelation And Heteroscedasticity With DJSI And FTSE4Good.

The text_sus variable, on the other hand, remains significant, thus confirming the results from RQ1. Sustainability-related press releases influence investor reaction regardless of whether the company is listed in an ESG index. Due to the lack of main effects, possible interaction tests (e.g. text_sus × DJSI) are not pursued any further. Even the temporary reintroduction of initially insignificant control variables (such as eps, pe_ratio, inflate, intrate) does not change the assessment of the index variables.

The findings of this RQ2‘s examination suggest that the provenance of a press release, whether it originates from an ESG-listed company or not, has little impact on the capital market's response. Instead, the specific content of the release (measured by text_sus), along with general market signals (CAR2) and energy costs (gas), appears to be the decisive factor. This outcome aligns with the prevailing theoretical perspective that investors, particularly during market volatility, respond predominantly to short-term signals and tangible communication content rather than abstract ESG classifications (Eliwa and Elmaghrabi, 2025; Qu and Su, 2024; Sun et al., 2025).

Additionally, these findings suggest that ESG index membership may not moderate investors' responses to sustainability communication. One potential interpretation of this phenomenon is that investors prioritise the content of the press releases themselves, rather than the fact that they originate from a company listed in a sustainability index. This phenomenon may be attributable to several factors, including limited awareness of index methodologies, a lack of transparency, or the relative weighting of concrete messaging over abstract ESG classifications in investor perception. This observation raises the question of whether specific content-related or textual characteristics within sustainability-related press releases may be more decisive in shaping investors’ reactions. This question lies at the core of RQ3, which is addressed in the following section. A more detailed explication and examination of the possible causes and theoretical implications of this finding can also be found in Section 5.1.2.

4.2.3. Findings for RQ3

This section employs the findings from the preceding section on RQ2 to analyse the relationship between the content and textual characteristics of sustainability-related press releases and investor reactions. In contrast to the research methods of RQ1 and RQ2, which focused on general correlations between sustainability-related press releases and investor responses, as well as the inclusion of press releases in ESG indices, this part of the analysis takes a more detailed perspective by examining the content of the press releases themselves. The objective of RQ3 is to determine whether content-related and textual characteristics, such as thematic focus, text length, readability, and sentiment, are systematically correlated with abnormal share price movements. The structure of this section, like 4.2.2, is divided into two main analysis steps, which are presented in the following subsections. Section 4.2.3.1 presents the descriptive results, including frequencies, distributions and preliminary patterns for each textual feature: the assigned categories of sustainability-related press releases (4.2.3.1.1), semantically derived clusters (4.2.3.1.2), text length (4.2.3.1.3), readability (4.2.3.1.4) and conveyed sentiment (4.2.3.1.5).

Building on these descriptive findings, the empirical results of the regression analyses are presented in Section 4.2.3.2. Here, the effects of content (4.2.3.2.1) and textual (4.2.3.2.2) characteristics are assessed to determine whether specific communication patterns are statistically associated with investor responses. At the end of this section and thus at the end of this chapter, all findings are summarised. However, first, the descriptive analysis in the next section provides the basis for answering RQ.

4.2.3.1. Descriptive Results RQ3

To provide a well-founded answer to RQ3, a systematic descriptive analysis of the examined press releases will be carried out. This section aims to provide a sophisticated understanding of the frequency with which sustainability issues are addressed, the textual characteristics in which they are expressed, and the established content-related priorities.

This analysis forms the basis for the subsequent regression analysis and is structured as follows according to the variables to be analysed: Initially, the content-related characteristics are analysed. Sustainability-related categories from the press releases are formed and

analysed quantitatively using NVivo software (4.2.3.1.1). These are then consolidated into overarching thematic clusters based on the text categories formed (4.2.3.1.2). The textual characteristics are then analysed descriptively. The length of the press releases is analysed (4.2.3.1.3), their readability is assessed (4.2.3.1.4), and the sentiment they convey is examined (4.2.3.1.5). The following section, however, is dedicated to the text categories.

4.2.3.1.1. Categories

As a starting point, the following section examines the frequency and distribution of sustainability-related terms across 11 content categories.

Company	carbon	energy	materials	production	project	recycling	solutions	supply	sustainable	tech	value	Total
Air Liquide	73	62	0	41	6	0	20	2	22	2	0	228
Akzo Nobel	17	5	1	4	0	1	23	1	34	0	1	87
Arkema	17	12	16	7	1	9	31	1	10	1	0	105
BASF	110	64	35	44	2	80	95	10	133	2	7	582
Brenntag	3	4	2	3	0	2	19	1	22	1	2	59
Clariant	46	16	7	23	4	11	39	0	52	6	2	206
Covestro	62	42	38	16	1	53	30	1	50	1	5	299
Croda	1	0	0	1	0	0	8	11	10	2	0	33
Evonik	58	54	13	27	1	19	47	1	101	6	1	328
Fuchs	4	1	1	0	2	0	0	0	9	0	0	*17*
Givaudan	4	1	1	12	0	0	21	2	24	0	7	72
IMCD	0	0	1	6	0	1	10	0	7	0	1	26
Johnson Matthey	21	44	1	22	1	10	8	2	14	62	4	189
K+S	4	0	0	1	1	1	0	1	5	1	1	*15*
LANXESS	40	10	13	14	0	7	12	1	47	0	0	144
OCI	25	29	1	11	7	0	3	2	5	1	3	87
Symrise	4	6	2	17	1	0	19	5	43	3	4	104
Umicore	34	28	9	13	6	39	11	7	35	2	20	204
Wacker Chemie	4	6	3	5	0	0	2	0	11	3	0	34
Yara	26	164	0	152	7	2	6	5	16	1	209	588
Total	553	548	144	419	*40*	235	404	*53*	650	*94*	267	3,407

Table 13: Overview Of Sustainability-Related Terms By Category And Company

The 4,690 press releases analysed contain 3,407 sustainability terms from the 11 predefined text categories (Table 13). A communication is considered 'sustainability-related' if it includes at least one term from these categories. The average number of terms per press release is

0.73 across all releases. Within the press releases classified as sustainable, the average number of terms per release is 1.81.

The most frequently mentioned categories are 'sustainable' (650), 'carbon' (553) and 'energy' (548). This prioritisation reveals that companies' sustainability communication focuses primarily on general sustainability references, climate impact and energy efficiency. This aligns with regulatory requirements and the expectations of capital-market-oriented investors, as discussed in Section 2.3.1. The categories 'technology' (94), 'supply' (53), and 'project' (40) are less prominent, suggesting that innovation-oriented sustainability issues are underrepresented or given less weight in corporate communications.

The company-specific frequencies indicate that Yara employs most terms from sustainability categories, with 588 mentions, particularly in the areas of 'energy,' ‘production’, and 'value'. BASF is the second-most-mentioned company, with 582 mentions. The company focuses strongly on the categories 'carbon', 'recycling', 'solutions' and 'sustainable'. Evonik is third with 328 mentions, concentrating on the general ‘sustainable development’ category.

This use of terminology is indicative of the company's strategic orientation. As a supplier in the agricultural and fertiliser sector, Yara's communications refer to operational priorities in energy and production (Yara International ASA, 2025). In contrast, BASF places significant emphasis on the circular economy as a strategic objective. This commitment is evident in the recurrent use of the terms 'carbon' and 'recycling' (BASF, 2025). Evonik, conversely, tends to use general sustainability terminology, indicating a communication focus that is less specific to individual topics. This approach aligns with the broader concept of sustainability communication, which shows that press releases function as hybrid communicative artefacts that combine informative and promotional elements (Catenaccio, 2022).

Given the established correlation between the absolute number of terms and the number of published messages, a density-based analysis is also presented in the following Table 14.

Company	carbon	energy	materials	produc-tion	project	recycling	solutions	supply	sustain-able	tech	value	Total
Air Liquide	0.36	0.30	0.00	0.20	0.03	0.00	0.10	0.01	0.11	0.01	0.00	1.12
Akzo Nobel	0.06	0.02	0.00	0.02	0.00	0.00	0.09	0.00	0.13	0.00	0.00	0.33
Arkema	0.06	0.04	0.05	0.02	0.00	0.03	0.11	0.00	0.03	0.00	0.00	0.36
BASF	0.15	0.08	0.05	0.06	0.00	0.11	0.13	0.01	0.18	0.00	0.01	0.77
Brenntag	0.02	0.02	0.01	0.02	0.00	0.01	0.11	0.01	0.13	0.01	0.01	0.36
Clariant	0.17	0.06	0.03	0.08	0.01	0.04	0.14	0.00	0.19	0.02	0.01	0.75
Covestro	0.27	0.19	0.17	0.07	0.00	0.23	0.13	0.00	0.22	0.00	0.02	1.32
Croda	0.02	0.00	0.00	0.02	0.00	0.00	0.15	0.20	0.19	0.04	0.00	0.61
Evonik	0.10	0.09	0.02	0.05	0.00	0.03	0.08	0.00	0.17	0.01	0.00	0.56
Fuchs	0.07	0.02	0.02	0.00	0.03	0.00	0.00	0.00	0.16	0.00	0.00	0.29
Givaudan	0.03	0.01	0.01	0.08	0.00	0.00	0.14	0.01	0.16	0.00	0.05	0.47
IMCD	0.00	0.00	0.01	0.04	0.00	0.01	0.06	0.00	0.04	0.00	0.01	0.17
Johnson Matthey	0.19	0.39	0.01	0.19	0.01	0.09	0.07	0.02	0.12	0.55	0.04	1.67
K+S	0.04	0.00	0.00	0.01	0.01	0.01	0.00	0.01	0.05	0.01	0.01	0.15
LANXESS	0.15	0.04	0.05	0.05	0.00	0.03	0.05	0.00	0.18	0.00	0.00	0.54
OCI	0.29	0.34	0.01	0.13	0.08	0.00	0.03	0.02	0.06	0.01	0.03	1.01
Symrise	0.02	0.03	0.01	0.09	0.01	0.00	0.10	0.03	0.22	0.02	0.02	0.53
Umicore	0.11	0.09	0.03	0.04	0.02	0.13	0.04	0.02	0.12	0.01	0.07	0.69
Wacker Chemie	0.03	0.04	0.02	0.03	0.00	0.00	0.01	0.00	0.07	0.02	0.00	0.21
Yara	0.09	0.58	0.00	0.54	0.02	0.01	0.02	0.02	0.06	0.00	0.74	2.08

Table 14: Density Of Sustainability-Related Terms In Press Releases

Table 14 illustrates that Yara employs most sustainability-related terms at the highest intensity, with a density of 2.08 terms per communication. This is despite Yara having significantly fewer publications (283) than BASF (758). Despite achieving second place overall, BASF only achieves a density of 0.77. Notably, Johnson Matthey (1.67) and Covestro (1.32) also exhibit high densities. This relative perspective enables a more precise evaluation of the intensity of communication, thereby demonstrating that a high absolute number of mentions does not necessarily correlate with a high communicative focus on sustainability. Conversely, the density-based values indicate which companies prioritise sustainability topics in terms of content, irrespective of publication volume.

In conclusion, the following assertion could be derived: The category-based analysis reveals differences in the content of sustainability communication, allowing initial conclusions to be drawn about the strategic positioning of individual companies. These findings provide a robust foundation for the subsequent analysis, which will examine whether individual categories also have relevant effects on capital market reaction. For instance, consider the cases of Yara,

which prioritises energy and production, and BASF, which emphasises the circular economy (BASF, 2025; Yara International ASA, 2025).

This category-based analysis thus provides initial indications of thematic focuses and strategic communication profiles within the companies' sustainability reporting. To build on these insights and more effectively identify overarching patterns, the following section presents a content-related clustering of the terms used.

4.2.3.1.2. Clusters

The 11 sustainability-related categories were grouped into four overarching clusters to facilitate the condensation of analytical data and highlight broader communication trends. This approach enables a more differentiated thematic interpretation, thereby illuminating how companies methodically structure their sustainability messaging around pivotal focus areas such as emissions, circularity, innovation, and value orientation.

Company	Emission Energy	Circular	Innovation	Sustainvalue	Total
Air Liquide	105	2	60	22	189
Akzo Nobel	19	3	26	35	83
Arkema	28	23	34	10	95
BASF	152	102	132	140	526
Brenntag	7	4	22	24	57
Clariant	59	16	67	54	196
Covestro	85	74	44	54	257
Croda	1	11	11	10	33
Evonik	97	28	74	102	301
Fuchs	4	1	2	9	16
Givaudan	5	3	31	30	69
IMCD	0	1	15	8	24
Johnson Matthey	50	13	70	18	151
K+S	4	2	2	6	14
LANXESS	44	18	24	47	133
OCI	36	3	19	7	65
Symrise	10	7	35	47	99
Umicore	54	49	30	43	176
Wacker Chemie	8	3	9	11	31
Yara	171	7	158	218	554
Total	939	370	865	895	3,069

Table 15: Overview Of Sustainability-Related Terms By Cluster And Company

A total of 3,069 sustainability-related terms from the respective clusters were mentioned in the 4,690 press releases (Table 15). The total is lower than the number of terms across the 11 individual categories (3,407), because a term that can be assigned to several categories, such as 'carbon' and 'energy', is counted only once in the respective cluster. This thematic summarising method is advantageous because it avoids multiple counts and enables a structured presentation of the communicative focus in sustainability communication.

At the company level, the order of the most frequent mentions remains essentially unchanged compared to the categorisation: Yara (554 mentions), BASF (526), and Evonik (301) have high stakes. It is noteworthy that Yara is particularly strongly represented in the 'Emissions/Energy' (171), 'Innovation' (158) and 'Sustainvalue' (218) clusters. In contrast, BASF is predominant within the 'Circular' cluster, receiving 102 mentions. This observation reinforces the communicative emphasis on the circular economy previously identified during the categorial analysis. Evonik displays an evenly distributed presence across all clusters, without setting a thematic focus.

The findings of this thesis could permit conclusions regarding the content focus and strategic communication orientation of the companies in question. In line with its positioning in the agricultural and fertiliser industry, Yara places significant emphasis on topics such as emissions, energy, and innovation. Conversely, BASF's strategic focus on 'circular' indicates its articulated ambition to establish closed material cycles as a core of its sustainability goals. Evonik's extensive communication strategy predominantly emphasises a generalist sustainability narrative. All findings regarding strategic communication align with or are similar to those of the content-related categories in 4.2.3.1.1. In contrast, Fuchs, K+S, and IMCD have relatively low visibility in cluster-based sustainability communication, with fewer than 30 mentions. This could indicate a low relevance of corresponding topics or a targeted thematic focus.

As the regression results for the clusters are not significant, the interpretation of this section is purely descriptive. Nevertheless, the cluster analysis provides valuable insights into the companies' content focus and strategic positioning in sustainability communication. A more in-depth analysis of these correlations would be the subject of further studies, but it is beyond the scope of this thesis.

In conclusion, the cluster analysis provides a condensed perspective on the thematic orientation of the companies' sustainability communication. Despite the absence of statistically

significant findings in the regression analysis, the results offer valuable insights into the strategic content priorities. The next stage in this process is to focus on a textual characteristic of press releases: their length.

4.2.3.1.3. Text Length

In this section, the length of the analysed press releases is considered a textual characteristic of sustainability-related press releases. The number of words used can indicate a company's tendency to frame its messages in a compact or detailed manner. This, in turn, allows conclusions to be drawn about the communicative intention, the target group addressed, or the complexity of the content.

Label	Value
Valid (n)	4,690
Missing (n)	0
Mean	539.05
Standard Deviation	367.54
Minimum	7.00
Maximum	4,784.00
25th percentile	317.00
Median (50th percentile)	465.00
75th percentile	671.00

Table 16: Analysis Of The Word Count For All Investigated Press Releases

As demonstrated in Table 16, the mean word count for the 4,690 press releases analysed was 539.05, with a standard deviation of 367.54. The substantial level of variation already indicates a wide range in text length. The range of values extends from a minimum of seven words to a maximum of 4,784 words. Percentiles were calculated to further characterise the data. The descriptive analysis in Table 16 reveals that 25% of the press releases under review contain a maximum of 317 words. The mean length of these releases is 465 words, and 75% remain under 671 words.

This finding aligns with the conclusions drawn from the existing literature on the subject: Catenaccio (2022), for instance, demonstrates that company press releases are intentionally kept concise to facilitate journalists' expeditious access to pertinent content. Concurrently, the substantial range, from minimalist short announcements to multi-page statements, demonstrates that press releases can vary considerably in content and form. For instance, the shortest press release, comprising seven words, refers to additional financial reports available on the company website (Umicore). Conversely, the most extensive press release, a letter of

intent for an IPO, includes a comprehensive regulatory explanation from OCI and is 4,784 words long. This range indicates the broad scope of editorial diversity within press communications, encompassing subjects from factual announcements to sustainability topics and capital market-related disclosures.

An analysis of the company level, as illustrated in Table 17, elucidates the variance mentioned earlier. Fuchs (Ø 882 words), Givaudan (Ø 852) and OCI (Ø 810) publish the longest communications on average, while Arkema (Ø 280) and IMCD (Ø 325) tend to use compact formats.

Company	Min	Max	Mean
Air Liquide	61	4335	540,84
Akzo Nobel	197	2073	432,3
Arkema	41	865	280,41
BASF	92	2524	692,42
Brenntag	89	2292	462,19
Clariant	55	2162	555,49
Covestro	12	1872	629,26
Croda	49	965	402,52
Evonik	24	1592	485,33
Fuchs	77	1851	882,07
Givaudan	74	3617	851,84
IMCD	14	578	324,90
Johnson Matthey	77	1678	473,06
K+S	91	1325	495,67
LANXESS	50	1202	510,57
OCI	30	4784	809,91
Symrise	80	1838	578,88
Umicore	7	2159	400,14
Wacker Chemie	9	2197	534,57
Yara	76	2517	572,31

Table 17: Word Count Per Company

The mean minimum word count is approximately 60 words, while the mean maximum is 2,121 words. This value corresponds to approximately four A4 pages with a single line height and Arial font size 11 (see Figure A - 19) and can be categorised as extensive.

It is also noteworthy that, besides Umicore, Wacker Chemie frequently issues concise press releases that often provide links to additional content on their website. This underscores the

distinct purpose of press releases as a gateway to communication, intended to provide information links rather than exhaustive content.

The results on the number of words demonstrate the extent to which press releases vary in terms of content and form, as evidenced by the variation in both the average length and the range between the shortest and longest releases. It has been observed that companies differ in their approach to text style; some opt for a concise, forward-looking style, while others choose an explanatory, detailed style.

The subsequent section analyses the comprehensibility of the messages under scrutiny. That is, the emphasis will be on the complexity of the language style rather than the amount of information within the messages. To achieve this objective, the readability of the press releases is analysed.

4.2.3.1.4. Readability

The preceding section illustrates the significant variations in the length of press releases issued by the analysed companies. In the subsequent stage of the investigation, the present thesis will examine the comprehensibility of the formulation of these releases. This thesis's central question is whether the texts are directed towards a general audience or are customised for a specialised reading public. The SMOG index evaluates textual complexity as discussed in 3.3.2.

The SMOG index is used to evaluate the readability of the 4,690 press releases, with no missing values. The mean SMOG value was 17.12 ($SD = 2.51$). A mean SMOG value of 17.12 indicates that readers would require more than 17 years of formal education to comprehend the press releases with ease (Antunes and Lopes, 2019). Followingly, this means the SMOG value can be categorised as relatively high. The range is 7.55 to 34.42, indicating substantial variation in the comprehensibility of the press releases (Table 18).

Label	Value
Valid (n)	4,690
Missing (n)	0
Mean	17.12
Standard Deviation (SD)	2.51
Minimum	7.55
Maximum	34.42
25th percentile	15.57
Median (50th percentile)	17.04
75th percentile	18.65

Table 18: Descriptive Analysis Of The SMOG Readability Index (Rounded To Two Decimal Places)

The percentile values make this distribution even more tangible: 25% of the texts have a SMOG value of 15.57 or less, half are below 17.04 (the median), and 75% are below 18.65. This suggests that a significant proportion of press releases, approximately three-quarters, are classified as linguistically rather demanding.

These texts, primarily intended for specialist audiences such as engineers, analysts, or journalists with technical backgrounds, may be complex for non-experts to access and understand.

At the same time, the analysis demonstrates that difficulty in understanding is not limited to long texts. For example, the message most challenging to read, a short press release from Evonik with only 73 words, achieves a high SMOG score of 34.42. This is because the text consists of a single sentence with numerous multisyllabic technical terms. This contrasts with the simplest press release, which has a score of 7.55, in which Umicore announces the start of a share buyback programme, which is concise, factual, and easy to understand.

The mean SD of 2.51 indicates that most texts are distributed around the mean. The readability levels of the press releases are relatively stable, with only a small number of statistical outliers at the upper and lower ends of the distribution.

The overall readability analysis indicates that the press releases of the analysed companies exhibit a high degree of linguistic complexity measured by the SMOG index. The target group is situated within a professional environment, a characteristic reflected in the texts' predominantly academic comprehensibility.

After analysing formal characteristics, such as length and readability, the next section examines the sentiment of the content in the releases. The following sentiment analysis assesses the proportion of neutral, positive, and negative language elements in the press releases.

4.2.3.1.5. Sentiment

Following an analysis of formal textual characteristics such as length and readability, the subsequent section will focus on the content-based sentiment of the press releases. The extent to which the analysed texts are formulated neutrally, positively, or negatively is examined. The objective is to conclude the linguistic restraint or emphasis employed in sustainability communication, with a particular focus on the chemical industry.

The average proportions provide a clear picture: neutral phrases account for the largest share, with a mean value of 0.8484 (see Table 19). This is followed by positive sentiments with a mean of 0.14 (Table 20) and a very low negative proportion of 0.01 (Table 21).

Label	Value
Valid (n)	4,690
Missing (n)	0
Mean	0.85
Standard Deviation	0.05
Minimum	0.48
Maximum	1.00
25th percentile	0.82
Median (50th percentile)	0.85
75th percentile	0.88

Table 19: Descriptive Analysis Of Neutral Press Releases (Rounded To Two Decimal Places)

The low SD of 0.05 in the neutral range shows that the values are closely clustered around the mean. The median of 0.85 confirms this: half of all press releases have a neutral share of at least 85%. The maximum value of 1.00 is also shown in many completely neutral press releases.

Label	Value
Valid (n)	4,690
Missing (n)	0
Mean	0.14
Standard Deviation	0.05
Minimum	0.00
Maximum	0.52
25th percentile	0.10
Median (50th percentile)	0.14
75th percentile	0.17

Table 20: Descriptive Analysis Of Positive Press Releases (Rounded To Two Decimal Places)

The mean value of positive wording in the texts is 14%. In this case, too, the dispersion is low (SD = 0.05), indicating a largely consistent level of positive language. The median figure is

also 14%. The highest value recorded was 52%, suggesting that many press releases adopted a distinctly positive tone. Conversely, other releases lacked positive terminology.

Label	Value
Valid (n)	4,690
Missing (n)	0
Mean	0.01
Standard Deviation	0.02
Minimum	0.00
Maximum	0.25
25th percentile	0.00
Median (50th percentile)	0.01
75th percentile	0.02

Table 21: Descriptive Analysis Of Negative Press Releases (Rounded To Two Decimal Places)

The negative proportion, as measured by the mean, is minimal at 1%. The SD is approximately 0.02, and the median is 0.01. Despite the negative nature of the text in this particular sample, the proportion of negative terms was found to be a mere 25%. A significant proportion of the messages do not contain any terms that could be perceived as negative.

This distribution aligns with expectations for corporate press relations in the chemical industry, as outlined in Section 2.3.3. The communication process is characterised by its factual and objective nature, emotional restraint, and the aim of conveying information in a structured, risk-minimising manner.

The high degree of neutrality observed reflects a clearly defined PR strategy: content should not be exaggerated but rather presented in a credible manner. Positive aspects such as success or innovation are emphasised, yet in a balanced manner without excessive euphoria. Conversely, harmful content is generally avoided or toned down in its language, constituting yet another typical feature of professional crisis prevention and reputation management.

The analysis of sentiment provides a clear picture: the press releases examined are characterised by a predominantly neutral, factual style. The text's positive aspects are emphasised with restraint, while harmful content is deliberately avoided or toned down. In summary, the analysis of the tone suggests that the industry is characterised by restrained, factual and sober communication. The function of press releases is to provide information; they are not designed to provoke strong emotional responses. This approach is consistent with the chemical industry's self-image and the regulatory requirements to which it is subject (see also 1.1).

This finding concludes the descriptive analysis of the examined press releases. In the ensuing analysis, the findings are transferred to a regression model to determine whether and to what extent specific content-related and textual characteristics have a statistically measurable influence on the investor reaction.

4.2.3.2. Regression Analysis RQ3

Based on the descriptive analysis findings, a regression analysis is conducted to examine the central relationship between the characteristics of sustainability-related press releases and investor reaction. The objective in this chapter is to ascertain whether systematic effects on companies' share prices can be derived from the content or textual characteristics of press releases. To achieve this objective, the characteristics, including text length, readability, tone, and thematic categories and clusters, are integrated into a regression model. The analysis is based on the previously defined event windows and uses CAR1 as the dependent variable.

4.2.3.2.1. Content-Related Characteristics

In the initial phase of the regression analysis, the 11 text categories delineated in Section 3.3 were examined: text_carbon, text_energy, text_materials, text_production, text_project, text_recycling, text_solutions, text_supply, text_sustainable, text_technology and text_value. The frequency with which these phenomena appear in press releases is shown in Table 22.

Variable	1 = including	0 = not including	Sum
text_sus	1,884	2,806	4,690
text_carbon	553	4,137	4,690
text_energy	548	4,142	4,690
text_materials	144	4,546	4,690
text_production	419	4,271	4,690
text_project	40	4,650	4,690
text_recycling	235	4,455	4,690
text_solutions	404	4,286	4,690
text_supply	53	4,637	4,690
text_sustainable	650	4,040	4,690
text_technology	94	4,596	4,690
text_value	267	4,423	4,690

Table 22: Text Categories For The Sustainability-Related Press Releases

The most frequently represented categories are text_sustainable (n = 650), text_carbon (n = 553) and text_energy (n = 548), suggesting that general sustainability references, climate-related subjects, and energy efficiency are the predominant themes in sustainability-related press releases within the chemical industry. In contrast, categories such as text_technology (n = 94), text_supply (n = 53), and text_project (n = 40) are less frequent, possibly indicating an underrepresentation of innovation-oriented sustainability themes.

It is essential to note that a single press release may encompass multiple sustainability categories. Consequently, the total number of mentions across categories exceeds the number of sustainability-related press releases (text_sus, n = 1,884).

The following regression model was constructed to include all 11 text categories. The purpose of including them was to examine whether specific topics, such as recycling or technology, have an impact on the investor reaction:

$$\begin{aligned}\mathrm{CAR}_i = {} & \beta_0 + \beta_1 \cdot \mathrm{CAR2} + \beta_2 \cdot \mathrm{gas}_t + \beta_3 \cdot \mathrm{text\_carbon}_i + \beta_4 \cdot \mathrm{text\_energy}_i \\ & + \beta_5 \cdot \mathrm{text\_materials}_i + \beta_6 \cdot \mathrm{text\_production}_i + \beta_7 \\ & \cdot \mathrm{text\_project}_i + \beta_8 \cdot \mathrm{text\_recycling}_i + \beta_9 \cdot \mathrm{text\_solutions}_i + \beta_{10} \\ & \cdot \mathrm{text\_supply}_i + \beta_{11} \cdot \mathrm{text\_sustainable}_i + \beta_{12} \cdot \mathrm{text\_technology}_i \\ & + \beta_{13} \cdot \mathrm{text\_value}_i + \varepsilon_i\end{aligned}$$

The variable text_sus is not used in this model because the 11 text categories are all subsumed under it, potentially overlapping their effects. The research question is interested in the correlation between specific communication patterns and share price reactions. The goal is not to examine whether sustainable or non-sustainable PMs have different effects (this has already been tested in RQ1). Instead, the aim is to determine whether specific sustainability topics (e.g., recycling or technology) have different effects on investor responses in the stock market. The analysed model remains dominated almost exclusively by CAR2 and gas. text_carbon, text_energy, text_materials, text_solutions, etc., show no statistical relevance, indicating that the terms used in the press releases have no direct impact on investor reactions. The model was re-estimated using OLS and then corrected using the Newey-West correction.

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	11,747	13	,904	3326,591	<,001[b]
	Residual	1,270	4676	,000		
	Total	13,017	4689			

a. Dependent Variable: CAR1

b. Predictors: (Constant), text_value, text_technology, gas, text_materials, text_supply, text_project, CAR2, text_solutions, text_sustainable, text_recycling, text_carbon, text_energy, text_production

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-,004	,000		-9,419	<,001
	CAR2	,919	,004	,952	207,325	<,001
	gas	3,149E-5	,000	,031	6,683	<,001
	text_carbon	,001	,001	,005	,978	,328
	text_energy	,000	,001	,001	,186	,853
	text_materials	-,001	,001	-,002	-,437	,662
	text_production	2,387E-5	,001	,000	,024	,981
	text_project	,004	,003	,008	1,660	,097
	text_recycling	,001	,001	,002	,510	,610
	text_solutions	,001	,001	,003	,687	,492
	text_supply	,001	,002	,003	,599	,549
	text_sustainable	,000	,001	,003	,616	,538
	text_technology	-7,687E-5	,002	,000	-,044	,965
	text_value	,001	,001	,003	,550	,582

a. Dependent Variable: CAR1

Figure 12: SPSS Output On Text Categories In Press Releases And Its Impact On The Stock Market

The results indicate that none of the 11 categories exhibits a significant influence on CAR1. The variable text_project achieves a p-value of 0.097 in the unrobust model (Figure 12), but this rises to 0.0616 in the robust model (Figure 13), thus no longer falling below the usual significance threshold of 0.05. It is also noteworthy that all other categories (text_carbon, text_energy, etc.) demonstrate a similar lack of significance. The key influencing factors that persistently exhibit a significant impact are the control variables CAR2 (for general market movements from the STOXX Europe 600 Index) and gas (for energy prices).

```
t test of coefficients:

                   Estimate  Std. Error t value  Pr(>|t|)
(Intercept)      -3.6170e-03  8.1309e-04 -4.4485 8.848e-06 ***
CAR2              9.1864e-01  1.0646e-02 86.2861 < 2.2e-16 ***
gas               3.1494e-05  1.0256e-05  3.0707  0.002148 **
text_carbon       7.8919e-04  8.2641e-04  0.9550  0.339645
text_energy       1.6398e-04  9.7175e-04  0.1687  0.866003
text_materials   -6.4397e-04  1.7140e-03 -0.3757  0.707152
text_production   2.3874e-05  1.0704e-03  0.0223  0.982206
text_project      4.3728e-03  2.3389e-03  1.8696  0.061603 .
text_recycling    5.9339e-04  1.2567e-03  0.4722  0.636809
text_solutions    5.9754e-04  8.5450e-04  0.6993  0.484406
text_supply       1.3737e-03  2.3720e-03  0.5792  0.562512
text_sustainable  4.4935e-04  7.7427e-04  0.5804  0.561703
text_technology  -7.6867e-05  2.6996e-03 -0.0285  0.977286
text_value        6.4727e-04  1.7927e-03  0.3611  0.718066
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Figure 13: R Output On Text Categories In Press Releases And Its Impact On The Stock Market

The absence of significant findings may be attributed to high fragmentation, with certain categories, such as text_project, occurring too infrequently to provide sufficient statistical power.

In order to assess whether multiple thematic mentions within a single press release are associated with stronger reactions from the capital market, the variable text_sum was introduced, and the following regression model was created based on the existing models in this thesis as defined in 3.5.3.1:

$$\mathrm{CAR}_i = \beta_0 + \beta_1 \cdot \mathrm{CAR2} + \beta_2 \cdot \mathrm{gas}_t + \beta_3 \cdot \mathrm{text\_sum}_i + \varepsilon_i$$

The variable was found to be insignificantly associated with the outcome in the uncorrected model ($p = 0.047$), yet its standardised coefficient ($\beta = 0.009$) indicated a negligible effect (Figure A - 20, Appendices).

Following the implementation of the Newey-West correction, the 0.05 significance level is not met ($p = 0.06428$), thereby corroborating the hypothesis that the presence of multiple categories, or their aggregate number, does not exert a significant influence on capital market reactions (Figure A - 21, Appendices).

Since mentioning multiple categories in a press release does not seem to have a significant impact on investor reactions, we examine whether too many categories (11 in total) lead to distortions. For this reason, these categories are grouped into four content clusters and operationalised in the following regression model, which was defined in 3.5.3.1:

$$\mathrm{CAR}_i = \beta_0 + \beta_1 \cdot \mathrm{CAR2} + \beta_2 \cdot \mathrm{gas}_t + \beta_3 \cdot \mathrm{text\_cluster\_emisionenergy}_i + \beta_4 \cdot \mathrm{text\_cluster\_circular}_i + \beta_5 \cdot \mathrm{text\_cluster\_innovation}_i + \beta_6 \cdot \mathrm{text\_cluster\_sustainvalue}_i + \varepsilon_i$$

As illustrated in Table 23, the number of press releases allocated to each cluster ranges from 370 (Circular) to 939 (Emissions & Energy), indicating a more equitable distribution than in the individual categories.

Variable	1 = including	0 = not including	Sum	text categories
text_cluster_emissionenergy	939	3751	4690	text_carbon, text_energy
text_cluster_circular	370	4320	4690	text_materials, text_recycling, text_supply
text_cluster_innovation	865	3825	4690	text_production, text_project, text_solutions, text_technology
text_cluster_sustainvalue	895	3795	4690	text_sustainable, text_value

Table 23: Number Of Press Releases Assigned To Each Cluster

Once more, no statistically significant effect on CAR1 was identified. The p-values of all cluster variables exceed the 0.05 threshold in both SPSS (Figure 14) and Newey-West-adjusted R outputs (Figure 15). The regression coefficients are found to be comparable across both tools. While the R output yields more precise t-values, it does not affect the interpretive outcome.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,950[a]	,902	,902	,01647415985

a. Predictors: (Constant), text_cluster_sustainvalue, CAR2, gas, text_cluster_circular, text_cluster_innovation, text_cluster_emissionenergy

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	11,746	6	1,958	7213,192	<,001[b]
	Residual	1,271	4683	,000		
	Total	13,017	4689			

a. Dependent Variable: CAR1

b. Predictors: (Constant), text_cluster_sustainvalue, CAR2, gas, text_cluster_circular, text_cluster_innovation, text_cluster_emissionenergy

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-,004	,000		-9,446	<,001
	CAR2	,919	,004	,952	207,718	<,001
	gas	3,134E-5	,000	,031	6,659	<,001
	text_cluster_emissionenergy	,000	,001	,004	,688	,491
	text_cluster_circular	,000	,001	,002	,492	,623
	text_cluster_innovation	,001	,001	,006	1,117	,264
	text_cluster_sustainvalue	,000	,001	,003	,652	,514

a. Dependent Variable: CAR1

Figure 14: SPSS Output Checking The Impact Of Text Clusters On The Stock Market Reactions

```
t test of coefficients:

                            Estimate  Std. Error t value  Pr(>|t|)
(Intercept)               -3.6290e-03  8.2170e-04 -4.4164 1.026e-05 ***
CAR2                       9.1899e-01  1.0694e-02 85.9317 < 2.2e-16 ***
gas                        3.1339e-05  1.0263e-05  3.0535  0.002274 **
text_cluster_emissionenergy 4.6522e-04  7.5114e-04  0.6193  0.535720
text_cluster_circular      4.4582e-04  1.0776e-03  0.4137  0.679111
text_cluster_innovation    7.4847e-04  7.1264e-04  1.0503  0.293647
text_cluster_sustainvalue  4.2597e-04  7.8076e-04  0.5456  0.585375
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Figure 15: R Output Checking The Impact Of Text Clusters On The Stock Market Reactions

The findings suggest that the specific content categories and broader thematic clusters (see Figure 14 and Figure 15) of sustainability-related press releases do not significantly affect investor reactions among the sample of STOXX Europe 600 Chemicals companies. The findings indicate that investors do not respond to the general sustainability topics mentioned in press releases, whether narrowly or broadly defined. The result thus contradicts the assumption formulated in Section 4.2.2.2, which, based on the literature, assumed that at least the content of press releases should influence share prices if ESG index membership alone has no effect. Instead, the investor responses are considered to reflect external macroeconomic factors, such as energy prices, and overall market trends.

In summary, the analysis of content-related characteristics reveals no statistically robust link between the specific sustainability topics communicated in press releases and abnormal stock returns. While the use of the individual categories or cluster groupings may reflect strategic communication priorities of companies, these distinctions are not reflected in the investor's behaviour. Moreover, the simultaneous presence of multiple sustainability categories within a single press release, operationalised by the variable text_sum, does not yield a statistically significant market response.

The subsequent analysis will focus on textual characteristics, such as text length, readability, and sentiment, to determine whether other communicative factors besides the content-related characteristics provide a more comprehensive explanation for variations in market response.

4.2.3.2.2. Textual Characteristics

As the preceding section focused on the content-related characteristics (categories and clusters) addressed in sustainability-related press releases, the subsequent analysis will discuss how these subjects are communicated through textual characteristics.

This section subsequently examines whether the textual characteristics of sustainability-related press releases contribute to abnormal market reactions.

To assess this, the following regression model was applied based on the definition in 3.5.3.2 and refined by the consolidated version in

$$\mathrm{CAR}_i = \beta_0 + \beta_1 \cdot \mathrm{CAR2} + \beta_2 \cdot \mathrm{gas}_t + \beta_3 \cdot \mathrm{text\_sus}_i + \beta_4 \cdot \mathrm{wordcount}_i + \beta_5 \cdot \mathrm{smog\_index}_i + \beta_6 \cdot \mathrm{text\_pos}_i + \beta_7 \cdot \mathrm{text\_neu}_i + \beta_8 \cdot \mathrm{text\_neg}_i + \varepsilon_i$$

To ensure the robustness of the findings, regressions are conducted using both OLS and Newey-West corrections.

The analysis demonstrates that none of the textual variables exerts a statistically significant influence on the dependent variable CAR1 (see Figure 16). The verbosity of a message, as measured by its word count, readability, and sentiment of the language used, does not provide additional explanatory power beyond the already established independent variables CAR2 and gas. This outcome was observed for all model specifications tested, including those used to control overall sustainability content via the text_sus variable.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,950[a]	,903	,902	,01646029618

a. Predictors: (Constant), text_pos, WordCount, CAR2, gas, smog_index, text_neg, text_sus

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	11,748	7	1,678	6194,425	<,001[b]
	Residual	1,269	4682	,000		
	Total	13,017	4689			

a. Dependent Variable: CAR1

b. Predictors: (Constant), text_pos, WordCount, CAR2, gas, smog_index, text_neg, text_sus

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	-,006	,002		-3,156	,002
	CAR2	,919	,004	,952	207,850	<,001
	gas	3,114E-5	,000	,031	6,650	<,001
	text_sus	,002	,001	,014	2,938	,003
	WordCount	-2,464E-7	,000	-,002	-,441	,660
	smog_index	8,964E-5	,000	,004	,907	,364
	text_neg	-,003	,014	-,001	-,201	,841
	text_pos	,005	,004	,005	1,012	,312

a. Dependent Variable: CAR1

Excluded Variables[a]

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics Tolerance
1	text_neu	-,718[b]	-1,241	,215	-,018	6,218E-5

a. Dependent Variable: CAR1

b. Predictors in the Model: (Constant), text_pos, WordCount, CAR2, gas, smog_index, text_neg, text_sus

Figure 16: SPSS Output On The Text Length, Sentiment and Readability

```
t test of coefficients:

               Estimate  Std. Error t value  Pr(>|t|)
(Intercept) -6.2913e-03  2.6608e-03 -2.3645  0.018097 *
CAR2         9.1859e-01  1.0085e-02 91.0809 < 2.2e-16 ***
gas          3.2026e-05  1.0330e-05  3.1004  0.001944 **
word_count  -2.3357e-07  7.4026e-07 -0.3155  0.752381
smog_index   1.3685e-04  1.2603e-04  1.0859  0.277582
text_neg    -3.6132e-03  1.5209e-02 -0.2376  0.812229
text_pos     5.8555e-03  5.5511e-03  1.0548  0.291554
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Figure 17: R Output With Newey-West On The Text Length, Sentiment And Readability

To summarise, textual characteristics such as length (p-value of variable word_count at about 0.75 is greater than 0.05), readability (p-value of variable smog_index at about 0.28 is greater than 0.05), and sentiment (p-value of variable text_neg at about 0.81 and text_pos at about 0.29 are both greater than 0.05) do not significantly impact short-term investor reactions to sustainability-related press releases after applying the Newey-West robust standard test (see Figure 17). These findings complement the results on content-related characteristics and suggest that neither the 'what' nor the 'how' of sustainability communication, when measured in isolation, has a discernible impact on capital market responses in the STOXX Europe 600 Chemicals Index.

This absence of statistical significance is particularly notable given prior research (see 2.3.3) suggesting that textual characteristics can influence investor response. In the context of the chemical industry, characterised by extensive regulation and technical complexity, it is conceivable that stylistic variation may be too limited to influence investor behaviour. Alternatively, macroeconomic factors may predominate over the potential impact of tone and clarity.

This concludes the analysis of RQ3. In the ensuing summary, all empirical findings are consolidated and interpreted in the light of the broader research objectives.

4.2.4. Summary

This thesis's empirical analysis is based on three research questions and follows a consistent two-step approach for each question: a descriptive evaluation followed by a regression analysis. The objective is to analyse the impact of sustainability-related press releases on share price reactions within the STOXX Europe 600 Chemicals Index.

RQ1 analyses whether sustainability-related press releases influence share prices. The descriptive data demonstrate high variability in the frequency of sustainability-related communication and stock returns, with no consistent trend emerging. The regression analysis confirms a significant, albeit negligible, effect of sustainability-related press releases (text_sus) on CAR1, whilst macroeconomic factors, such as CAR2 (general market movements) and gas (energy prices), are identified as even more significant predictors. The regression assumptions were tested, revealing heteroscedasticity. This was corrected using robust Newey-West standard errors. A reduced model – based on the principle of model parsimony – proved to be equally robust and enabled a precise interpretation with the same explanatory power.

RQ2 aims at determining whether the capital market's reaction to sustainability-related press releases depends on whether the publishing companies in the chemical industry are listed in recognised sustainability indices (DJSI and/or FTSE4Good). The descriptive analysis reveals significant variations in index membership. However, in the extended regression analysis, neither DJSI nor FTSE4Good membership is found to be significant when robust standard errors are used. This finding suggests that the content of the message has a greater influence on investors' responses to such communications than the sender's ESG ranking.

RQ3 examines specific content-related and textual characteristics. Regarding content-related characteristics, neither individual thematic categories nor overarching topic clusters (e.g., emissions, circular economy) have a significant impact on the investor’s reaction. Furthermore, the simultaneous mention of multiple sustainability subjects within a single communication (text_sum) exerts no influence. The findings indicate that neither the depth of content nor the thematic density of a research piece has a significant impact on investor reactions. The analysis of textual characteristics, encompassing text length, readability (SMOG index) and sentiment (positive, neutral, negative), does not reveal any significant effects on CAR1. The hypothesis can be proposed that either the textual characteristics are too insignificant or the macroeconomic factors are predominant.

This thesis provides unequivocal evidence that the content and textual design of sustainability-related press releases do not systematically influence share price reactions. Investor behaviour appears to be predominantly influenced by external conditions and tangible market indicators, rather than variations in sustainability communication. These findings provide a valuable perspective on the capital market implications of sustainability-related communication, which are often assumed, and offer a nuanced interpretation of industry-specific responses.

This summary of the empirical results concludes the analysis phase of this thesis. In the subsequent chapter, the key findings will be methodically discussed according to the three research questions, subjected to critical scrutiny, and integrated into the academic discourse. Furthermore, limitations will be addressed, and implications for research and practice will be derived.

5. Discussion

In the following discussion chapter, the key findings of this thesis are first summarised in alignment with the sequence of the research questions, as done in Chapter 5, and contextualised within the relevant academic discourse (5.1). This is followed by a structured derivation of theoretical and practical implications, to advance both scholarly understanding and managerial decision-making (5.2). The next section deals with the author's professional and personal reflection on that thesis (5.3). A critical reflection on the research design, methodological choices, and limitations is then undertaken, with the aim of highlighting the strengths and limitations of the study while providing avenues for future research and directions for further empirical exploration (5.4).

Nevertheless, the following step begins with the basis of this Discussion Chapter, namely the key findings organised according to research questions.

5.1. Discussion Of Key Findings

This section systematically summarises the key empirical findings of this thesis, structured by the research questions (Sections 5.1.1-5.1.3), and places them within the existing academic discourse on sustainability communication and capital market reactions. The aim is to present the results clearly, place them in a theoretical context and link them to existing research findings. This highlights the contribution this thesis makes to the existing literature and identifies any unanswered questions. At the same time, this analysis prepares the transition to the following chapters, which discuss the practical and theoretical implications (Chapter 5.2), reflect on professional and personal development during the thesis (Chapter 5.3), and outline limitations and potential research areas for future studies (Chapter 5.4). However, the discussion of the key findings begins with RQ1.

5.1.1. Discussion For RQ1

The research question of whether press releases on sustainability influence the share prices of companies in the European chemical industry can be answered affirmatively, thereby confirming assumption H1 from Section 2.3.2: Sustainability-related press releases positively affect the share prices of companies listed in the STOXX Europe 600 Chemicals Index.

According to the results, the model has a high explanatory power, primarily attributable to its methodology. The STOXX Europe 600 benchmark index exerts the strongest influence as an indicator of general market trends, followed by gas prices and finally sustainability-related press releases. Although sustainability-related press releases have a smaller impact, they exhibit a highly significant net effect on abnormal returns.

The correlation between investor sentiment and share indices suggests that when the index performs well, investor sentiment tends to be optimistic, which in turn can lead to further investment and market growth (Limongi Concetto and Ravazzolo, 2019; Song, 2023). The opposite applies to negative sentiment. This leads to sell-offs and increased volatility, as seen during economic downturns or crises (Song, 2023; Yu, 2021). Investors are increasingly aware of sustainability issues, and their investment decisions tend to reflect companies' sustainability commitments, particularly during stable market phases when investor sentiment is less sensitive to external shocks (Moroșan, 2024). In these stable market phases, aligning corporate sustainability practices with investor expectations can have a significantly positive impact on share prices (Ahmed et al., 2024).

On the other hand, scientific evidence suggests that during market volatility, external economic factors play a more significant role in influencing share prices than sustainability communication (Kumajas et al., 2024). In turbulent times, traditional market dynamics are primarily determined by fluctuations in share prices rather than sustainability communication (Nur Aji Cokro Darsono et al., 2023). Further critical reflection on this topic can be found in 6.3.3.

Beyond the presence of sustainability-related press releases, the effectiveness of their communication also plays a crucial role. Several studies demonstrate that environmental information affects investment decisions across different investor profiles (Chaudhary et al., 2024; Holm and Rikhardsson, 2008; Kim et al., 2025; Park and Jang, 2021). This supports this model's results, which indicate that sustainability-related disclosures have a significant impact on share price reactions, even at small levels. Furthermore, several publications emphasise that sustainability-specific initiatives elicit stronger market reactions than general sustainability efforts (Buertey et al., 2025; Lo and Kwan, 2017; Yang et al., 2024). This line of thought is explored in 5.1.3 through a discussion that shows text categories describing sustainability practices have a greater influence on share price than other text categories. However, they are not robustly significant.

In conclusion, sustainability-related press releases have a measurable, albeit subordinate, influence on share prices. Although capital markets predominantly respond to macroeconomic signals, they are receptive to sustainability-related messages, particularly when these align with investor expectations.

This finding also provides a foundation for further analysis of context-dependent mechanisms of action, such as inclusion in sustainability indices. The subsequent section will address the influence of these indices on the effectiveness of sustainability communication.

5.1.2. Discussion For RQ2

Several indications in the existing literature suggest that the inclusion criteria for the FTSE4Good and DJSI differ, and that the DJSI requirements may be stricter, as assumed in 2.2.3. The FTSE4Good Index is a tool developed to identify companies that demonstrate higher standards of corporate responsibility. It is based on a set of criteria that address social and environmental issues. However, it is generally considered less rigorous than the DJSI (Makarenko, 2023). FTSE4Good employs a transparent screening process to identify companies that meet its criteria. These companies are assessed at their existing practices and potential to enhance their sustainability performance (Schmutz et al., 2020). Moreover, the FTSE system typically encompasses a broader array of firms than the DJSI. This discrepancy may diminish the perceived rigour of the sustainability framework (Slager et al., 2021).

On the other hand, only the leading firms in sustainability practices are selected for inclusion in the DJSI (Arribas et al., 2019; Hawn et al., 2018; Papoutsi and Sodhi, 2020). The DJSI considers a broad portfolio of factors, including, but not limited to, environmental impacts, social policies, corporate governance practices, and overall sustainability strategies – far beyond environmental criteria (El Ouadghiri et al., 2021). This index is subject to periodic revisions of its selection criteria to reflect the evolving landscape of sustainability. For instance, the index has been updated to incorporate climate change and supply chain management issues into its assessments (Arribas et al., 2019; Papoutsi and Sodhi, 2020; Slager and Chapple, 2016). Index membership was also analysed annually, as adjustments to the DJSI and the FTSE4Good were made. Despite differences among these indices, no robust capital market reaction to index membership was demonstrated in this thesis.

The preliminary SPSS analysis indicates a negative association between DJSI membership and CAR1. However, this effect becomes negligible once robust standard errors, as per

Newey-West, are considered. Nevertheless, the initial SPSS model suggests a tendency towards a negative impact, indicating that the capital market does not consistently interpret mere index membership as a positive signal, as reflected in the share price. This could also be interpreted as indicating that investors already expect particularly high standards from companies with sustainability indices, such as DJSI members. In such cases, adding further sustainability disclosures may have a minor or even a counterproductive effect, as they are not perceived as a new or surprising signal. Indeed, they may even raise doubts about the substance or the novelty of the message.

Scientific literature also contains equivocal results regarding the impact of index affiliation. Some studies have demonstrated the long-term outperformance of companies with strong sustainability ratings (Chen et al., 2023; Eccles et al., 2014; Jiang and Vitenu-Sackey, 2025; Sandberg et al., 2023). However, other studies, particularly those conducted in resource-intensive sectors such as energy and chemicals, have revealed inconsistent or even negative effects on capital markets (Oberndorfer et al., 2013; Schmutz et al., 2020). It is particularly noteworthy that, according to Durand et al. (2019), Makarabhiromya (2022), and Yilmaz et al. (2020), index inclusion often attracts increased analyst attention without necessarily influencing the share price in the short term.

This finding suggests that market participants are less influenced by sustainability indices or external ratings and primarily focus on the content and context of the specific communication. The relevance, therefore, lies not in formal affiliation with an index but in the credibility and strategic framing of sustainability-related press releases.

Notwithstanding the absence of any substantial findings concerning communicative characteristics, including content, text length, readability and sentiment, the ensuing section addresses the findings and observations deemed highly pertinent.

5.1.3. Discussion For RQ3

As demonstrated in the preceding section, a pure index affiliation does not elicit a substantial response in the capital market. Consequently, the subsequent inquiry concerns specific content or textual characteristics within sustainability communication that may nevertheless exert influence.

RQ3 examines whether the content, sentiment, readability, and length of sustainability-related press releases coincide with companies' share price movements in the STOXX Europe 600 Chemicals Index, thereby addressing the broader question of how specific communication characteristics influence investor reactions. There are no significant findings here: neither specific sustainability-related text categories (in total, 11) nor sustainability-related terms grouped into larger clusters (in total, four) influence the share price The methodology's analysis of content-related characteristics, as described in Section 3.5.3.1, and the results in 4.2.3.2.1 indicate that referencing multiple sustainability-related text categories concurrently within a text does not have a significant influence either. This is also in line with the literature. Even if this field of study remains relatively underexplored, some publications indicate that disclosing non-material sustainability information does not improve companies' share price performance (Jyothika Grewal et al., 2017; Miralles-Quirós et al., 2021).

The textual characteristics, including text length, readability, and sentiment, of the press releases do not influence either. Consequently, there are no significant influences on the share price from the qualitative patterns, which were measured quantitatively and analysed.

The assumption that text length influences investor sentiment cannot be confirmed. The analysed press releases, on average (539 words), fell within the range estimated by Catenaccio (2022) of 300 to 800 words. However, this compactness of information seems to be appreciated mainly by journalists (Catenaccio, 2022; Maat, 2007; Schafraad et al., 2016), but not by investors, as this study suggests.

Additionally, none of the sentiments, positive, neutral or negative, in the press releases influences the share price of the companies examined. Accordingly, positive corporate press releases in the European chemical industry inspire confidence but do not act as a catalyst to stimulate investor interest (Birindelli and Chiappini, 2021; Cicchiello et al., 2023; Jeong et al., 2025; Schafraad et al., 2016).

The assumption that readability, as considered in H3, influences investor sentiment and, consequently, the share prices of the companies analysed must also be rejected. Investors do not allow themselves to be influenced by limited readability; therefore, the effectiveness does not seem to suffer (Adhariani and Du Toit, 2020). This also refutes the assumption that sustainability reports and messages with a high degree of complexity pose challenges for stakeholders in understanding the texts (Lin et al., 2023; Smeuninx et al., 2020). Accordingly, investors also appear better equipped to process more complex sustainability messages, presumably because they are perceived as experts in this field.

Based on SPSS output without the application of a robustness test using the Newey-West method, the results suggest that reports referencing concrete sustainability-related implementation practices within companies are more likely to appeal to investors than other text categories and clusters analysed; the findings from the literature research in Section 2.3 and the summary in Section 2.4 complement this. Many authors confirm the assumption that corporate sustainability practices and their communication have a positive influence on long-term financial performance (Ahmad et al., 2021; Alshehhi et al., 2018; Eccles et al., 2014; Madison and Schiehll, 2021; Shobhwani, 2023; Tekin and Burgazoğlu, 2022; Torre et al., 2020). In contrast to previous literature research, the results partially confirm that this appears to be the case in communication. Two crucial additions are: 1. Investors seem interested in practices, particularly in implementing sustainability practices. In the context of sustainability practices, a further publication can confirm that companies that apply and implement sustainability practices receive more positive investor sentiment and a better corporate reputation than those that do not (Abideen, 2025). Corporate governance attributes also play a crucial role in promoting comprehensive sustainability practices. This indicates that investors value companies with robust governance structures that actively pursue sustainability (Gold and Taib, 2023).

In conclusion, this analysis finds that the content-related and textual characteristics of sustainability-related press releases do not have a statistically significant influence on abnormal stock returns. This main finding confirms some of the assumptions outlined in 2.3.3: the absence of significant effects provides the empirical evidence demanded by Kräussl et al. (2024) and confirms the uncertainty noted by Zhang (2024) regarding which specific linguistic elements in technically complex sectors actually trigger market reactions. However, there is an essential addition to the existing research: Whereas earlier studies primarily focused on the long-term effects of sustainability practices, this thesis shows that some benefits can already materialise in the short term (Bassetti et al., 2021; Eccles et al., 2012; Pacini et al., 2025). Specifically, when strategically timed, sustainability communication can lead to measurable market responses within the event window of just 11 days. This observation is supported by recent research showing that environmental disclosures can reduce information asymmetry (Wang, 2023), positively impact financial performance (Harmadji et al., 2020), and decrease stock synchronicity by increasing transparency (Feryan and Amin, 2024).

These results suggest that it is not the external form but rather the strategic context and substance of sustainability communication that determine its impact on the capital market. Building on these findings, the theoretical and practical implications of this thesis are analysed in more detail in the following section.

5.2. Implications For Theory And Practice

So far, the results serve as the empirical basis for broader theoretical and practical reflections. This chapter discusses the implications of the thesis's findings along two dimensions. Section 5.2.1 explores the theoretical implications of communication effectiveness, investor behaviour and capital market theory. Section 5.2.2 provides practical recommendations for companies in the European chemical industry. These insights are derived from the observed relationships and are intended to support both academic discourse and managerial decision-making. The aim is to assess the findings and determine their implications for the role of sustainability communication in influencing market dynamics.

5.2.1. Theoretical Implications

This section examines the thesis's theoretical contributions, drawing on the established literature on sustainability communication and signalling theory. It considers how the empirical findings contribute to academic debates about how information is processed, what signals are effective, and how market context influences communication outcomes.

The findings of this thesis offer some theoretically significant insights into the impact of sustainability communication on capital market reactions in the European chemical sector. Firstly, the thesis demonstrates that the content-related and textual characteristics of press releases, including sustainability categories and clusters, text length, readability and sentiment, do not significantly impact short-term share price changes. The findings suggest that the signal quality of sustainability communication, as measured by quantitative textual characteristics, is limited (Hossain et al., 2024; Huang et al., 2024; Loughran and McDonald, 2011). This prompts further scrutiny of the established validity of formal communication metrics. This view is further reinforced by the emergence of sceptical voices, as articulated by Smeuninx, De Clerck and Aerts (2020).

Concurrently, the findings emphasise the significance of external factors. Control variables such as general market developments (CAR2) and energy prices (gas) have been found to explain a significant portion of the variation in capital market behaviour, more than communication variables. This pattern is consistent with the basic principles of financial research, which states that investors do not process information in isolation, but rather in the context of their current situation and cognitively constrained by their abilities (Ahmad, 2024; Barberis and Thaler, 2003; Shiller, 2003; Yang et al., 2025). In this context, macroeconomic

signals often supersede sustainability information, which also explains the limited response pattern to linguistic features such as positivity or comprehensibility.

The observation that sustainability communication does not have a linear, additive effect but is influenced by the respective market environment is also theoretically compatible. In an interaction lacking robustness between sustainability communication (text_sus) and general market development (CAR2), it is found that the influence of sustainability issues in press releases diminishes during periods of economic growth. Despite the lack of statistical significance after applying robust standard errors, this correlation underscores fundamental tenets of signalling theory (Connelly et al., 2011; Kumar, 2023; Mangani, 2021; Spence, 1978). During stable market phases, the signalling strength of sustainability communication diminishes as other indicators, such as financial key figures, assume predominance. Conversely, during periods of turbulence, CSR can serve as a signal of trust, thereby mitigating the impact of uncertainties (Azimli and Cek, 2024; Du et al., 2010). Ultimately, the conclusion that sustainability communication is only important in times of crisis should be critically examined and contextualised in Section 5.4.3 of ‘Limitations And Future Research’.

Additionally, sustainability communication is subject to varying interpretations of the term ‘sustainability’. The definition of sustainable practices varies across cultures and regions (Virtanen et al., 2020; Weder and Milstein, 2021; Zheng et al., 2021). As a result, marketing, which is fundamentally concerned with conveying value propositions to consumers, raises the question: Whose conceptualisation of value is being advanced? Depending on their consumer culture, a consumer in an economically developed region may perceive sustainability very differently from a consumer in an emerging economy with immediate livelihood concerns.

Taken together, the theoretical implications of this thesis underscore a central insight: the impact of sustainability communication is highly context-dependent. Rather than relying solely on, e.g. the press release’s structure or sentiment, the broader economic and market environment shapes investor response. This reinforces the importance of adopting a dynamic understanding of sustainability communication, one that accounts for external signals and behavioural limitations of market participants. Based on these findings, the following section discusses how these insights can be translated into practical implications for the corporate strategies of chemical companies.

5.2.2. Practical Implications

Having explored the theoretical relevance of this thesis's findings, this section turns to their practical application. Based on the observed capital market responses, several strategic recommendations emerge for companies within the European chemical industry. These recommendations pertain to the formulation, timing, and positioning of sustainability-related communication, as well as the consideration of external visibility through sustainability indices. The practical implications are discussed across three core aspects.

The findings of this thesis have several practical implications for the European chemical industry. One of the most fundamental practical outcomes is that sustainability-related press releases have a notable impact on the share prices of companies in the European chemical industry. The degree of influence is statistically significant but relatively low: Assuming a press release is categorised as sustainability-related, the share price increases by 0.16 percentage points. For example, if a company's share price is 50 euros and the company then publishes a sustainability-related press release, the price rises by 0.08 euros to 50.08 euros. Depending on the volume, the price can fluctuate accordingly.

What could be concluded from this is that the more sustainability-related press releases a company publishes, the more its share price rises linearly, i.e. by 1,6% for ten sustainability-related releases, for example. Research suggests that an increasing number of releases is no guarantee of a proportional share price. They can reduce the risk of stock market crashes and cause short-term increases in share prices, which usually normalise again (Badr et al., 2024; Tarek Ahmed Hafez and Ahmed Ibrahim Moawad, 2024; Yang, 2024). Consequently, it is not recommended to publish an increasing number of press releases to steadily raise the share price. This assertion is further substantiated by the descriptive analysis conducted in this study, which indicates that companies that disseminate a high volume of sustainability-related announcements will not experience enhanced stock returns from 2020 to 2023 (see 4.2.1.1).

Additionally, investors seem to appreciate sustainability-related press releases that mention specific sustainability practices. This suggests that it is worthwhile to invest in sustainability and implement specific projects. After all, companies can only communicate about specific sustainability projects if they have implemented them. In turn, this confirms the assumptions about sustainability-related press releases in the context of sustainability practices from Sections 1.1.3 and 2.4, which have been documented by various scientific sources, including Agrawal et al. (2025), Guillamón-Saorín, Isidro and Marques (2017), Yang and Basile (2022), and Zhang, Djajadikerta and Zhang (2018). Even if this assumption is based solely on non-

robust results for text categories in sustainability-related press releases from RQ3, this thesis at least provides indications that investments in specific sustainability projects could also be reflected in share prices, albeit with a higher probability than in other text categories that have not been investigated. Nevertheless, further research would be necessary to substantiate this assumption.

Furthermore, companies should strategically evaluate the sustainability indices in which they seek inclusion, to the extent that such decisions are within their control. Again, even if no statistically significant robustness could be demonstrated, the thesis's results suggest that, for example, the DJSI appears to have a rather negative influence on the company's share price. The literature also provides a mixed picture of stock returns. Academic research shows that inclusion in the DJSI can lead to positive ARs, particularly for firms with lower investor recognition (Rudkin and Cai, 2023). Still, some studies suggest that sustainability indices may not or even negatively impact CARs, especially for the DJSI World (Durand et al., 2019; Oberndorfer et al., 2013).

Different indices also apply different criteria and standards, as discussed in 5.1.2. This aspect raises questions about the credibility and transparency of sustainability indices. The credibility of sustainability data is influenced by stakeholders' perceptions regarding the sources' trustworthiness, track record, and expertise. Assurance-related factors and the comprehensiveness of disclosures are particularly significant (Xiao and Shailer, 2022). Their construction influences the credibility of sustainability indices. The inclusion and exclusion criteria of these indices impact their perceived credibility. It has been demonstrated that some indices strongly emphasise sustainability criteria, while others are more influenced by company size (Vilas et al., 2022).

It is also a question of index performance and how well sustainability indices are trusted compared to traditional ones. Despite increasing attention from investors and companies, sustainable indices have frequently underperformed traditional indices, though there have been exceptions (Arias Fogliano De Souza Cunha and Samanez, 2013; Fowler and Hope, 2007; Gurrib et al., 2023). Other external factors, such as oil prices and global economic development, also influence performance. An examination of green bond indices reveals sensitivity to volatility in oil prices, which can also negatively impact their performance (Baltas and Mann, 2024).

Furthermore, companies should consider that sustainability communication may be particularly effective during periods of economic uncertainty. Despite the interaction effect between

text_sus and CAR2 no longer being statistically significant following robust adjustment, the observed negative coefficient suggests that sustainability-related press releases have a stronger impact on share prices in weak or declining markets than in booming ones (Ng and Rezaee, 2020). This aspect will be discussed further in 5.4.3.

Zhao and Sahari (2025) demonstrate that corporate social responsibility (CSR) engagement mitigates the negative impact of economic policy uncertainty. This is achieved by reducing information asymmetry and strengthening investor trust. This effect is especially pronounced during volatile market conditions. In a similar vein, Wan et al. (2024) demonstrate that firms which exhibit inconsistencies between communicated and actual CSR practices (termed ‘CSR decoupling’) encounter a substantially elevated risk of share price crashes, particularly during periods of market stress. The findings of this thesis demonstrate that the provision of reliable and timely sustainability communication can indicate operational resilience, crisis preparedness, and long-term stability.

Consequently, companies could deduce that strategically placed sustainability communication can be particularly effective in uncertain market phases. A more robust correlation between the initiatives communicated and factors such as crisis resistance, liquidity, and business continuity could further enhance the relevance of these messages to capital markets. This insight provides a pragmatic perspective on how sustainability reporting and its reputational value can function as a tool for investor reassurance during periods of diminished macroeconomic confidence.

In summary, the thesis provides important insights into both theory and practice. Theoretically, it challenges the assumption that the textual characteristics of sustainability communication alone are sufficient to elicit investor reactions, highlighting the dominance of contextual factors. In practice, this thesis demonstrates that even small, statistically significant effects can be relevant in investor environments. It also highlights the strategic potential of sustainability communication in times of economic uncertainty, where it can serve as a stabilising signal of resilience and trust. These findings offer a differentiated perspective on sustainability-related press releases, underscoring the importance of context-sensitive communication strategies.

Based on these implications, the next section highlights the author’s personal reflections about the professional and personal development experienced with writing this thesis.

5.3. Professional and Personal Reflection

Writing this thesis was a demanding yet rewarding project that provided valuable personal and professional experience. The author’s goal was to bridge practical industry knowledge with rigorous academic analysis.

5.3.1. Professional Development

The project began with the practical expertise the author had acquired in the chemical industry. During the teaching phase and as the author progressed in writing this thesis, it became clear that the practical knowledge the author had gained needed to be transformed into a measurable, data-driven analytical form. Accordingly, it was challenging to find an approach to process the 4,690 press releases from the various companies and to operationalise them using computer-aided methods such as NVivo or SPSS. The author’s knowledge of strategic marketing, which was further refined throughout the thesis, proved invaluable. This skill refinement became necessary due to the complex communication flows and the diverse structural and content-based presentation methods employed by the companies under investigation. Neither the structure of the press releases on the respective company websites nor the categories and subpages in which they were organised was identical. Naturally, the content analysis was also highly diverse and proved challenging, especially in quantifying the content and its textual characteristics. Particularly from this stage onward, the ability to develop standardised processes was cultivated, which proved very valuable for professional practice and will undoubtedly benefit future careers.

5.3.2. Personal Development

On a personal level, this thesis also represented a developmental process. This research project was closely framed within personal life planning. This inherently created a need for discipline that was already present. The experience of balancing perfection and efficiency will remain deeply ingrained and also represent a developmental step. In this regard, a particular relationship to resiliently managing one's own resources and those of one's immediate environment has emerged. This also fosters resilience, as the results and assumptions were subject to a dynamic process. From the initial search for scientific publications to the testing of initial hypotheses, many self-critical cycles were necessary. It required courage to discard

established hypotheses that had been taken for granted, or to modify them. This was especially true when regression models, in the context of content and textual characteristics, could not be classified as non-significant as expected. Knowing that even non-significant results can offer added value for research and practice is a skill that, in retrospect, proved valuable. Accordingly, this critical thinking also changed everyday practice—sometimes even beyond its boundaries—so that it is a lesson in keeping the big picture in mind and in fundamentally trusting the chosen path.

Despite sometimes insignificant results, it is encouraging to see that targeted communication about real-world sustainability projects can add at least some value in the context of this thesis. However, it has also become clear that reality can only be represented to a limited extent by scientific models. They serve as a way to recreate and understand reality, and it is precisely this curiosity that makes science and life so unique.

5.4. Limitations And Future Research

This chapter offers a critical reflection on the methodological, temporal, strategic, and normative dimensions of the thesis's findings and derives implications for future research. While the empirical results confirm that sustainability-related press releases can influence investor behaviour, the underlying mechanisms and their context-dependent effects require further scrutiny. The section begins by assessing the methodological suitability of event studies for capturing complex communication phenomena (5.4.1). It then explores the time horizon over which market reactions unfold and questions whether observed price changes reflect short-term fluctuations or signals of long-term valuation (5.4.2). The following section analyses the varying effects of sustainability communication across market environments and discusses its strategic positioning in stable versus volatile phases (5.4.3). Subsequently, the discussion shifts to the conceptual and normative ambiguity of sustainability as a communicative construct and its implications for capital market research (5.4.4). The final section synthesises the key insights and outlines a research agenda to advance understanding of sustainability communication in capital markets (5.4.5).

5.4.1. Measuring Communication Effects

A fundamental point of departure for the present discourse concerns the methodological design of the thesis. Even though event studies remain a well-established instrument for gauging short-term capital market responses to new information (Fama, 1970), their application to sustainability-related press releases reveals particular limitations. It is essential to note the strong correlation between the CARs stemming from the STOXX Europe 600 Chemicals Index (CAR1) and those from the benchmark index, the STOXX Europe 600 Index (CAR2). This observation makes it difficult to distinguish between company-specific and market-wide effects. Consequently, the model's validity is relativised, thus showing that the effects are less attributable to methodological weaknesses than to the fundamental complexity of the phenomenon under investigation.

Additionally, the present thesis considered the fact that the study period (2020–2023) encompasses the transition between two EU ETS phases (Phase III/IV) (cf. 1.1.1). Given the implication of a potential temporal change of the cost and risk signals associated with emissions, explicit modelling of a prospective phase change was not undertaken. In this context, future studies could use sub-sample analyses or examine interactions across these phases to investigate the stability of communication effects across multiple ETS phases.

Furthermore, the allocation of ARs is affected by external factors, including geopolitical events (Agung et al., 2023; Ortiz, 2023) and media stimuli via platforms like X (Nishimura et al., 2021; Šević et al., 2023). The influence of such factors is short-term and emotionally charged, posing significant challenges in isolating narrative, trust-based content, such as sustainability.

It is evident that the issue does not lie primarily in the model design, but rather in the question of whether conventional financial and economic methodologies remain sufficiently appropriate for adequately representing the effects of complex, long-term communication. It should be noted that the event study method is founded on Fama's EMH, which dates back to the 1970s (see Section 3.2.1). This thesis finds that the model's effectiveness is reduced when geopolitical and economic frictions are included in the analysis. This finding raises some significant questions about the future development of research into the impact of capital markets, particularly regarding the apparent conflict between economic rationality and behaviour-based signal processing (Barberis and Thaler, 2003; Tversky and Kahneman, 1974).

In light of the aforementioned, it is essential to recognise the importance of sustainability communication within a context-sensitive framework, rather than an isolated approach (Barberis and Thaler, 2003). A fundamental question for future research concerns the temporal prevalence of the phenomenon. Specifically, it is necessary to ascertain whether it manifests predominantly during economic downturns or also plays a substantial role in investor communication during periods of relative stability. This question will be subjected to detailed analysis in the subsequent section.

5.4.2. Time Horizon Of Capital Market Reactions

Alongside the issue of context dependency in sustainability communication, there is an additional pivotal methodological consideration: the present thesis seeks to ascertain the period over which capital market reactions unfold and whether they can be categorised as short- or long-term. This discussion is particularly pertinent for studies with short event windows, such as those employed in the present thesis.

Another aspect that warrants further consideration concerns the timing of capital market reactions to sustainability communication. In this thesis, an event window of 11 trading days was chosen to capture short-term deviations in stock returns following the publication of press releases. Although this period was methodologically justified and is in line with standard practice in event studies (3.2), it raises a fundamental question: Are reactions within 11 days short-term effects, or do they already represent initial signs of long-term valuation expectations?

There is growing evidence in the literature that investors react to immediate signals and incorporate anticipatory assessments of future developments into their decisions. Investors have been shown to respond considerably to reliable signals of the market, which may be perceived as immediate and which focus on the here and now, for instance, in the form of current earnings announcements or other such present-focused news (Almaskati et al., 2023; Atiase et al., 2005; Brière et al., 2023; Z. Yan et al., 2020). News and signals about the future, including earnings guidance, management forecasts and anticipated events, have been shown to elicit market reactions of a magnitude greater than those elicited by present or past news. This phenomenon is especially pronounced when the news concerns the near future, such as reports about sustainability projects aiming at reducing emissions (Brière et al., 2023; Campbell et al., 2020; Warren and Sorescu, 2017). The existing literature defines investor reactions, whether short- or long-term, in terms of specific time horizons. However, the exact

boundaries of such horizons may vary depending on the specific study under consideration. Many studies agree that short-term reactions manifest within a period of days to several months (Cremers et al., 2017; Kannadas, 2021; Mahata and Nurujjaman, 2020; Sashikala and Chitramani, 2018), while long-term reactions extend over several months to years (Mahata and Nurujjaman, 2020; Sashikala and Chitramani, 2018; Sun et al., 2025; Warren, 2016). If sustainability communication is intended not only to convey factual information but also to serve as an indicator of future stability, even short-term price movements could mark the beginning of a long-term revaluation of the company's value.

This interpretation is supported by studies demonstrating that environmental information can reduce information asymmetries and promote transparency (Ordóñez-Castaño et al., 2021; Y. Wang et al., 2024; Yu et al., 2018; Zhang and Yang, 2023). Nevertheless, the methodological and conceptual distinction between short-term signal effects and the initial phases of long-term effects remains unclear. Future research should therefore also include more extended observation periods or longitudinal designs to determine whether the observed effects are merely temporary market reactions or already indicate the beginning of more sustainable value development.

In summary, even if the methodology employed is chiefly oriented towards short-term price fluctuations, these may nevertheless serve as the initial indications of longer-term valuation processes, particularly if they are accompanied by strategically positioned and consistent sustainability communication. To enhance comprehension of this discord between signalling and sustainable performance, future research endeavours must encompass extended observation periods, multiple events within a single company, and comparative studies across diverse market phases.

Based on this discussion of the event window, including the distinction between short- and long-term timing, the following section examines the timing perspective in the context of market conditions.

5.4.3. Timing And Market Conditions

One indicator of market conditions is the CAR2 of the benchmark index, the STOXX Europe 600 Index. This benchmark can be investigated in conjunction with sustainability-related press releases to determine what correlation exists between the two independent variables, text_sus and CAR2. The interaction term text_sus × CAR2, which was not explicitly considered in the

research questions, has already been explained and discussed in Sections 4.2.1.6 and 5.2.2. Even though this term did not pass the Newey-West robustness test and is therefore not statistically significant, it nevertheless points to a key follow-up question that is particularly relevant for future research: Does sustainability communication also have an impact in stable market phases, or is its effectiveness particularly linked to periods of weakened confidence in the capital markets?

In the initial SPSS analysis, the interaction term shows a significant negative correlation. This means that the positive influence of sustainability-related press releases on the dependent variable, CAR1, decreases as market impact (CAR2) increases. Conversely, sustainability communication appears to have a stronger effect in phases of weak or negative market movements. This could indicate that sustainable messages can have a stabilising effect in uncertain times.

This interpretation is corroborated by extant research: As Azimli and Çek (2024) demonstrate, sustainability reporting can mitigate the deleterious effects of economic policy uncertainty on company value. Effective communication of sustainability matters can foster trust during crises, thereby strengthening a company's market position and promoting sustainable investment (Abideen, 2025; Chen et al., 2024).

Conversely, during periods of market stability, investors tend to prioritise short-term performance indicators such as sales growth, profitability, and market performance (Ahmad, 2021; Sood et al., 2025). Consequently, sustainability is often perceived as a long-term perspective, leading to its relative irrelevance in the immediate valuation process.

At the same time, it would be short-sighted to view sustainability communication solely as a tool for times of crisis. Even if the interaction term does not exceed the significance threshold in robust estimates, the results of the overall analysis indicate that a slightly positive, and in some cases significantly positive, correlation exists between sustainability-related communication and capital market reactions across all market phases.

Overall, this paints a more differentiated picture: in stable phases, sustainability communication contributes less to short-term returns but can enhance reputation and contribute to long-term positioning. In phases of economic uncertainty, on the other hand, it can build trust and play a stabilising role rather than contributing to growth measured by stock market movements. The key finding of this section is therefore that sustainability communication is not exclusively a crisis tool, but a strategic element whose impact depends

heavily on the market environment. Companies could be well-advised to pursue proactive, consistent, and context-aware ESG communication that is effective in both stable and volatile market phases.

Further studies could investigate whether this effect can be replicated in other crisis scenarios, such as geopolitical tensions or energy crises. The present findings show a correlation but do not provide a causal explanation. Regardless of the economic situation, it remains to be seen whether the observed effects reflect short-term reactions or are already signs of long-term valuation processes.

While this section focuses on the relationship between sustainability-related press releases and different market phases, the question in the following section is whether it is appropriate to measure sustainability to improve share prices.

5.4.4. Normative Assumptions And Interpretation Boundaries

It is evident that sustainability communication, along with its empirical effects and measurable indicators, raises fundamental conceptual and normative questions (Fischer et al., 2021; Golob et al., 2023; Newig et al., 2013). Given the equivocal outcomes observed in this thesis, it is worthwhile to consider the underlying intentions and interpretability of sustainability narratives briefly. The subsequent section thus transitions the analytical focus to the philosophical conceptualisation of sustainability as a communicative construct and its ramifications for capital market research.

The effort to enhance the objectivity of sustainability communication faced significant challenges, as the quantitative metrics used were insufficient to capture the complexities of the communication. Any attempt to objectify communication would require criteria that capture its essence while accounting for global consumer heterogeneity, as communication is intrinsically linked to a wide range of human perceptions, beliefs, and behaviours (Barnes and Bloch, 2019; R. W. Liu et al., 2022; Welch, 2020). However, a universal set of criteria is complicated by the vast differences in consumer behaviour, expectations, and perceptions across diverse contexts.

While investor response appears to be quantifiable, its interpretation is not without controversy. Should investor response, in the form of market movement, include not only immediate profit

indicators but also long-term growth trajectories, stakeholder value, and socio-environmental contributions?

Considering these intricacies, the methodological approach to scrutinising the interplay between sustainability communication and investor response warrants flexibility and iterative refinement. This thesis prioritises empirical rigour to develop and operationalise communication within a sustainable paradigm, while simultaneously acknowledging the multifaceted and contested nature of this construct, as mentioned earlier in this chapter.

The findings demonstrate the intricacy and context-dependence of sustainability-related communication, both in terms of methodological recording and its practical impact on capital markets. Future research should take a more differentiated approach to examining the temporal, content-related, and situational framework conditions.

This reflection highlights the notion that quantitative patterns and market reactions do not solely influence sustainability communication but are also shaped by a myriad of expectations and interpretations, which are often diverse and conflicting (Lee et al., 2024; Voci and Karmasin, 2024). Consequently, their evaluation tends to require a more context-sensitive, interdisciplinary research agenda that integrates empirical precision with conceptual nuance.

The following conclusion synthesises the thesis's key findings and offers strategic and academic recommendations for future communication practices in the European chemical industry, building on the aforementioned perspective.

5.4.5. Synthesis And Research Agenda

The present discussion demonstrates that sustainability-related press releases can influence investor reactions but should not be viewed as an isolated instrument. The following three key findings can be summarised:

1. Methodological

The findings highlight the limitations of conventional capital market-oriented methodologies in quantifying complex communication phenomena. While event studies have been shown to capture short-term market reactions, it remains unclear whether these reactions signal the onset of long-term reputation and valuation processes. The lack of significance of some

interaction terms after robust error correction underscores the pronounced influence of contextual factors (e.g., market phase, crisis) on the informative value of communication signals.

2. Normative

The term 'sustainability' is not universally defined; its communicative impact is heavily dependent on cultural, regional and industry-specific values. This has led to a range of interpretations and expectations among shareholders, making it challenging to establish objective communication standards. Companies operate within a dynamic interplay of forces, oscillating between the imperatives of social responsibility and the expectations of investors, as reflected in the capital market.

3. Practical

In the context of corporate practice, it is noteworthy to recognise that sustainability communication is most effective when strategically embedded, authentically justified and context-sensitive – a principle that is especially salient in times of economic uncertainty. Textual characteristics, such as text length, readability, and sentiment, are insufficient in isolation. Of paramount importance is the substance of the content and its correlation with credible corporate measures.

To summarise, the efficacy of sustainability communication is not automatic, nor is it uniform across all market contexts. The impact of this phenomenon is attributable to the interplay of context, content and strategic relevance. The following chapter is dedicated to concluding this thesis by highlighting the most relevant results from each of the research questions RQ1-RQ3.

6. Conclusion

This thesis aims to determine whether sustainability-related press releases affect the share prices of 20 companies listed on the STOXX Europe 600 Chemicals Index and to identify the conditions under which such effects occur. An event study methodology was applied to analyse 4,690 press releases issued between 2020 and 2023. The results offer definitive answers to research questions RQ1 through RQ3.

Regarding RQ1, which examines the impact of sustainability-related press releases on share prices, the findings demonstrate a statistically significant, albeit relatively modest, positive effect. Specifically, the release of sustainability-related information has increased company share prices by approximately 0.16 percentage points $(p < 0.01)$. However, the results highlight the dominance of systematic market movements (CAR2), which explain around 90% of the variance in abnormal returns. Within this model, a 1% increase in the market benchmark (STOXX Europe 600) corresponds to a 0.919% change in the value of individual shares. Similarly, energy price fluctuations demonstrate a minimal yet significant impact. An increase of €1/MWh results in a 0.00312% rise in share prices. The findings of this thesis indicate that sustainability-related messages are recognised by investors, albeit within the constraints imposed by broader market dynamics.

The results were inconclusive regarding RQ2, specifically whether the market reaction differs for companies that are also listed in sustainability indices, such as FTSE4Good and DJSI. Rigorous statistical analysis determines that neither index membership exhibited a significant short-term effect on share prices. Although an initial negative impact was observed on CARs (CAR1) for DJSI-listed companies (-0.1%), this effect proved statistically unstable after a robustness test using the Newey-West method. The findings suggest that a company's presence in sustainability indices does not translate into a significant short-term valuation signal for investors. Followingly, this indicates that sustainability indices may primarily function as longer-term indicators.

The analysis of RQ3 regarding content, sentiment, readability and length of sustainability-related press releases also yields no statistically significant effects. However, there is a notable, albeit statistically unverified, indication that press releases explicitly referencing sustainability projects, such as concrete measures for decarbonisation and emission reductions, may have a positive impact on share prices. This observation highlights investors' preference for tangible and specific sustainability actions over generic sustainability statements, as discussed in Section 5.2.2. It is recommended that future studies further

investigate this finding, employing broader methodological frameworks or longitudinal approaches.

This thesis synthesises these results, contributing to a refined understanding of how sustainability-related communication operates in capital markets. Investors prioritise macroeconomic signals and concrete evidence of project-related sustainability efforts over abstract sustainability narratives or index affiliations. Consequently, sustainability communication appears most effective when substantiated with explicit, actionable details and strategically positioned within the broader context of market conditions and investor expectations. These findings advance theoretical perspectives on investor behaviour and signal interpretation, offering practical guidance for corporate communication strategies within the European chemical sector.

In summary, this thesis provides robust empirical evidence and sophisticated insights into the capital market effects of sustainability communication, thereby laying a foundation for further research and refined corporate communication strategies.

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Tables

Appendices

Company	Year	FTSE4 Good	DJSI	SXI Switzerland Sustainability 25 Index	Euronext Vigeo Europe 120	DAX 50 ESG	STOXX ESG Leaders Index	DAX ESG Target Index
Air Liquide	2020	1	0	0	0	0	0	0
	2021	1	0	0	0	0	0	0
	2022	1	1	0	0	0	0	0
	2023	1	1	0	0	0	0	0
Akzo Nobel	2020	1	0	0	0	0	0	0
	2021	1	0	0	0	0	0	0
	2022	1	0	0	0	0	0	0
	2023	1	0	0	0	0	0	0
Arkema	2020	0	1	0	0	0	0	0
	2021	0	1	0	0	0	0	0
	2022	0	1	0	0	0	0	0
	2023	0	1	0	0	0	0	0
BASF	2020	0	0	0	0	0	0	0
	2021	0	0	0	0	0	0	0
	2022	0	0	0	0	0	0	0
	2023	0	0	0	0	0	0	0
Brenntag	2020	0	0	0	0	1	0	
	2021	0	0	0	0	1	0	1
	2022	0	0	0	0	1	0	1
	2023	0	0	0	0	1	0	1
Clariant	2020	1	1	1	1	0	0	0
	2021	1	1	1	1	0	0	0
	2022	1	1	1	1	0	0	0
	2023	1	1	1	0	0	0	0
Covestro	2020	1	0	0	0	0	0	0
	2021	1	0	0	0	0	0	0
	2022	1	0	0	0	0	0	0
	2023	1	0	0	0	0	0	0
Croda	2020	1	0	0	0	0	0	0
	2021	0	0	0	0	0	0	0
	2022	0	0	0	0	0	0	0
	2023	0	0	0	0	0	0	0
Evonik	2020	1	1	0	1	0	1	0
	2021	1	1	0	1	0	1	0
	2022	1	1	0	1	1	1	0
	2023	1	0	0	1	0	1	0
Fuchs Petrolub	2020	0	0	0	0	0	0	0
	2021	0	0	0	0	0	0	0
	2022	0	0	0	0	0	0	0
	2023	0	0	0	0	0	0	0
Givaudan	2020	1	0	1	0	0	0	0
	2021	1	0	1	0	0	0	0
	2022	1	0	1	0	0	0	0
	2023	1	0	1	0	0	0	0
IMCD	2020	0	0	0	0	0	0	0
	2021	0	0	0	0	0	0	0
	2022	0	0	0	0	0	0	0
	2023	0	0	0	0	0	0	0
Johnson Matthey	2020	1	0	0	0	0	0	0

	2021	1	1	0	0	0	0	0
	2022	0	1	0	0	0	0	0
	2023	1	1	0	0	0	0	0
K+S	2020	0	0	0	0	0	0	0
	2021	0	0	0	0	0	0	0
	2022	0	0	0	0	0	0	0
	2023	0	0	0	0	0	0	0
LANXESS	2020	1	1	0	0	0	0	0
	2021	1	1	0	0	0	0	0
	2022	1	1	0	0	0	0	0
	2023	0	1	0	0	1	0	0
OCI	2020	0	0	0	0	0	0	0
	2021	0	0	0	0	0	0	0
	2022	0	0	0	0	0	0	0
	2023	0	0	0	0	0	0	0
Symrise	2020	1	0	0	0	0	0	0
	2021	1	0	0	0	0	0	0
	2022	0	0	0	0	0	0	0
	2023	0	0	0	0	0	0	0
Umicore	2020	1	0	0	0	0	0	0
	2021	0	0	0	0	0	0	0
	2022	1	0	0	0	0	0	0
	2023	1	0	0	0	0	0	0
Wacker	2020	0	0	0	0	0	0	0
	2021	0	0	0	0	0	0	0
	2022	0	0	0	0	0	0	0
	2023	0	0	0	0	0	0	0
Yara	2020	0	0	0	0	0	0	0
	2021	0	0	0	0	0	0	0
	2022	0	0	0	0	0	0	0
	2023	0	0	0	0	0	0	0

Table A - 1: Descending Order By The Mentions Of Sustainability Indices With At Least Three Mentions

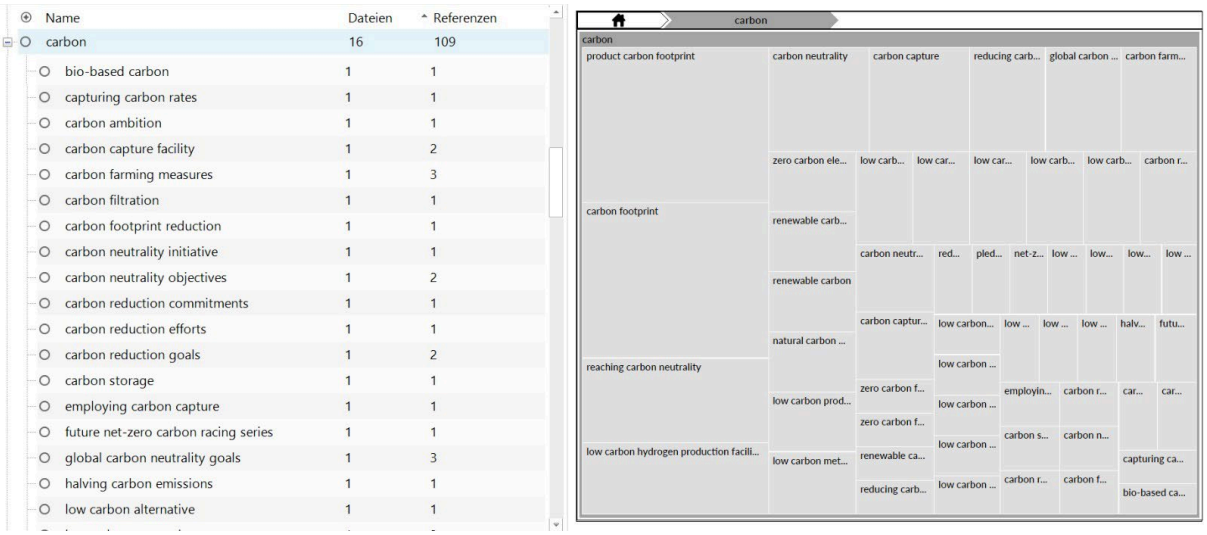

Figure A - 1: Screenshot NVivo With Hierarchical Chart Displaying Overarching Themes And Nested Subtopics On The Example Category 'Carbon'.

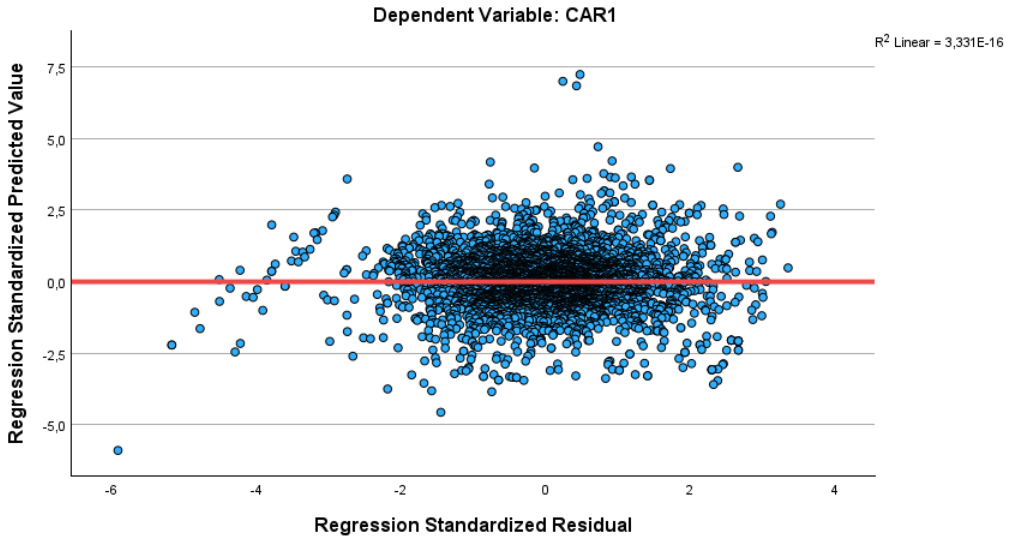

Figure A - 2: Scatterplot Of The Distribution Of Standardised Predicted Values And Residuals To Test The Linearity Of The Model

Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	-,2987141907	,35879579186	-,0035705582	,05005684981	4690
Residual	-,0973241851	,05526899546	,00000000000	,01644222971	4690
Std. Predicted Value	-5,896	7,239	,000	1,000	4690
Std. Residual	-5,914	3,359	,000	,999	4690

a. Dependent Variable: CAR1

Figure A - 3: Residual Statistics To Check The Unbiasedness Of Errors

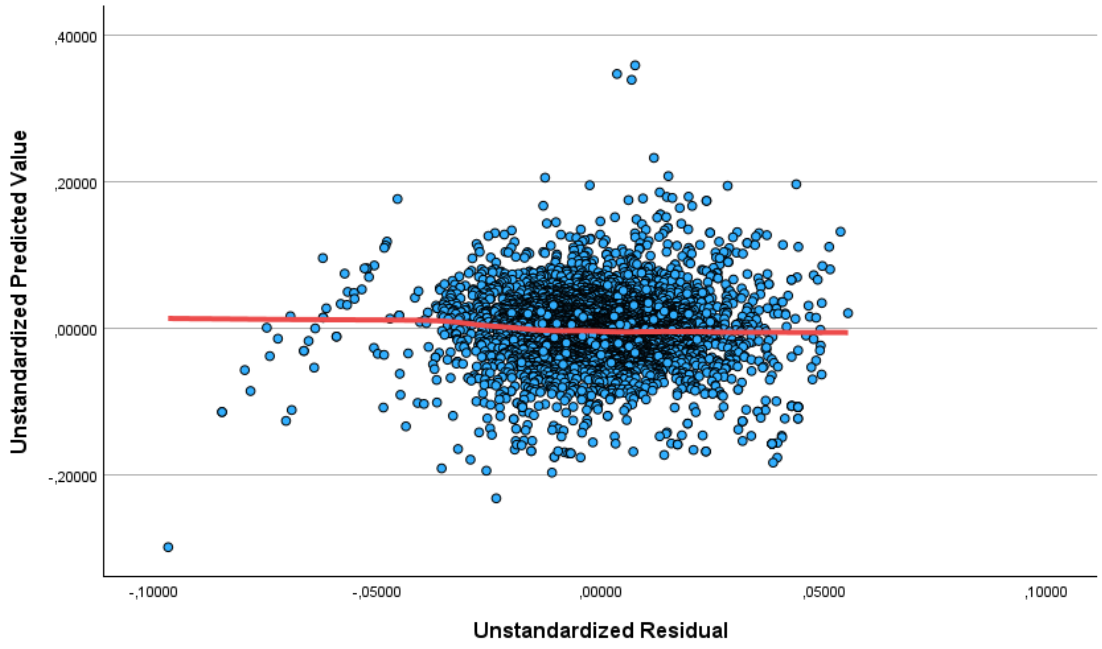

Figure A - 4: Scatter Diagram Of Predicted Values And Standardised Residuals To Check For Heteroscedasticity

Tests for Heteroskedasticity

Breusch-Pagan Test for Heteroskedasticity[a,b,c]

Chi-Square	df	Sig.
15,088	1	<,001

a. Dependent variable: CAR1

b. Tests the null hypothesis that the variance of the errors does not depend on the values of the independent variables.

c. Predicted values from design: Intercept + CAR2 + intrate + gas + cap + eps + pe_ratio + inflate + text_sus

Figure A - 5: Breusch-Pagan Test Results From SPSS

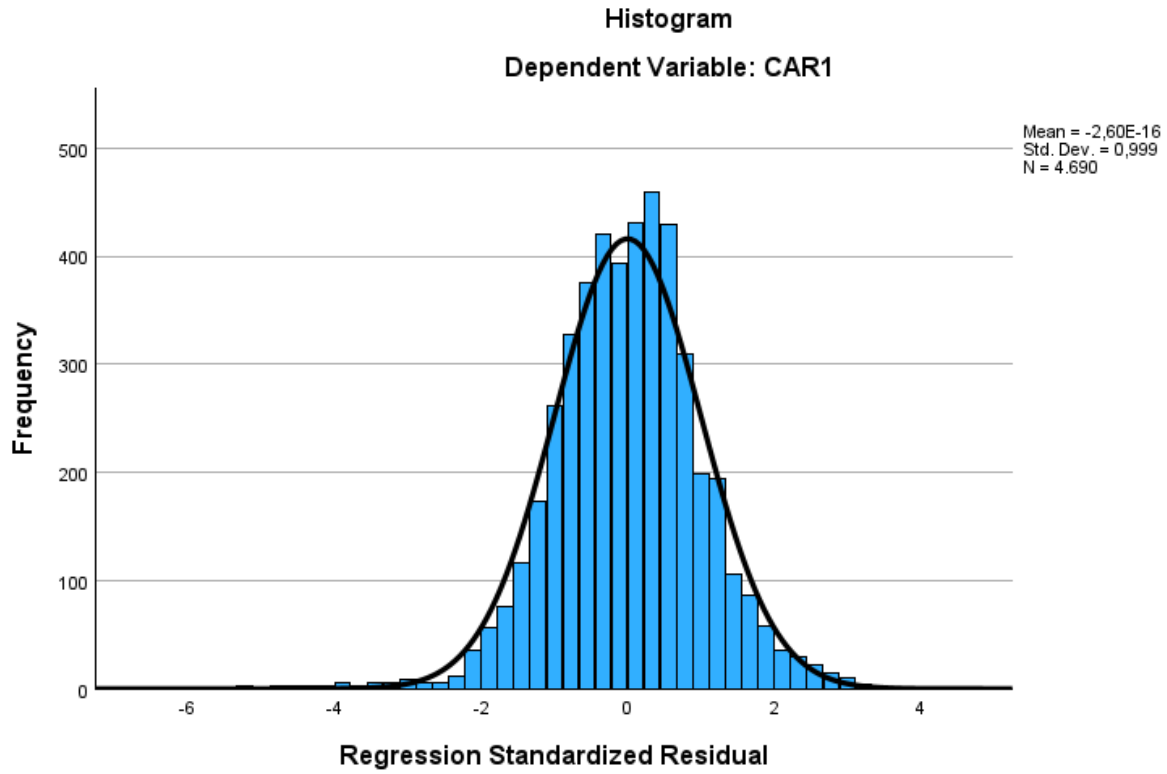

Figure A - 6: Histogram For Normal Distribution

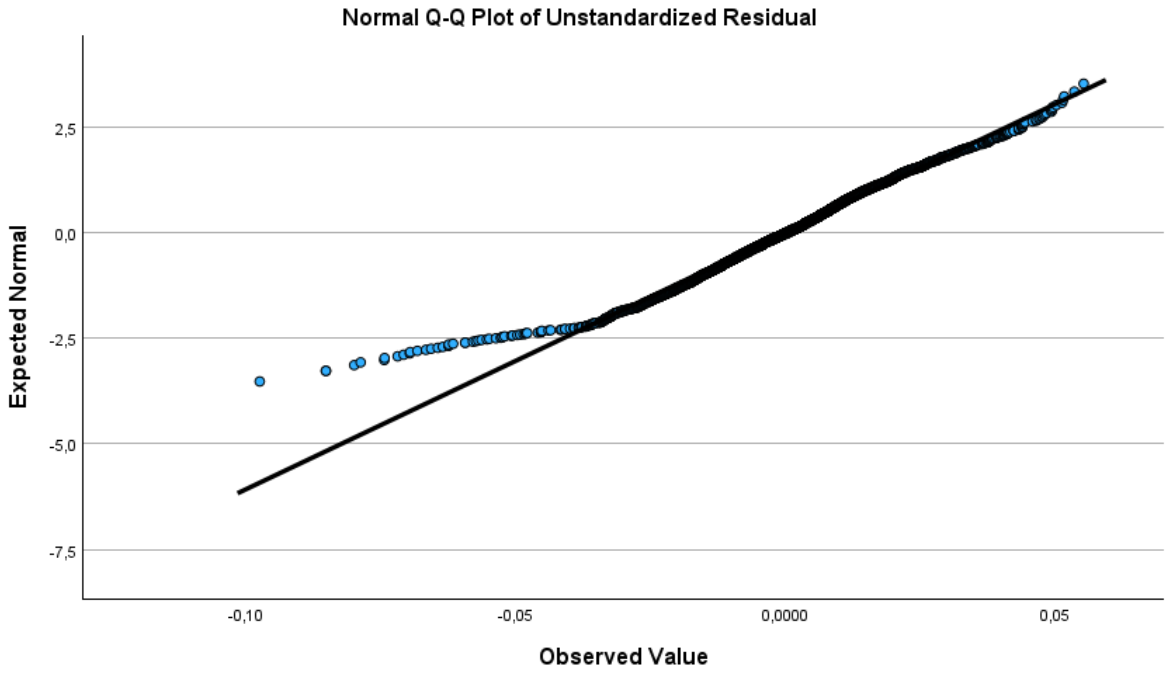

Figure A - 7: Q-Q-Plot For Normal Distribution

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Unstandardized Residual	,027	4690	<,001	,985	4690	<,001

a. Lilliefors Significance Correction

Figure A - 8: Shapiro-Wilk And Kolmogorov-Smirnov Tests

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	,950[a]	,902	,902	,01645780625	1,736

a. Predictors: (Constant), text_sus, CAR2, gas

b. Dependent Variable: CAR1

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	11,748	3	3,916	14457,171	<,001[b]
	Residual	1,269	4686	,000		
	Total	13,017	4689			

a. Dependent Variable: CAR1

b. Predictors: (Constant), text_sus, CAR2, gas

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics
		B	Std. Error	Beta			Tolerance
1	(Constant)	-,004	,000		-9,848	<,001	
	CAR2	,919	,004	,952	207,977	<,001	,992
	gas	3,123E-5	,000	,031	6,673	<,001	,988
	text_sus	,002	,000	,015	3,280	,001	,994

Figure A - 9: SPSS Output For The Reduced Model in RQ1

```
t test of coefficients:

              Estimate  Std. Error t value  Pr(>|t|)
(Intercept) -3.9228e-03  8.2273e-04 -4.7680 1.917e-06 ***
CAR2         9.1915e-01  1.0629e-02 86.4789 < 2.2e-16 ***
text_sus     1.6127e-03  5.8410e-04  2.7611  0.005783 **
gas          3.1231e-05  1.0247e-05  3.0479  0.002318 **
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Figure A - 10: R-Output For Reduced Model In RQ1 After Newey-West Test

```
        studentized Breusch-Pagan test

data:  model
BP = 37.109, df = 8, p-value = 1.099e-05
```

Figure A - 11: R Output On The Breusch-Pagan Heteroscedasticity Of RQ1's Reduced Model

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	,031[a]	,001	,000	,05267911487	,174

a. Predictors: (Constant), text_sus_cap, cap, text_sus

b. Dependent Variable: CAR1

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	,013	3	,004	1,533	,204[b]
	Residual	13,004	4686	,003		
	Total	13,017	4689			

a. Dependent Variable: CAR1

b. Predictors: (Constant), text_sus_cap, cap, text_sus

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	-,003	,001		-2,404	,016
	cap	2,303E-5	,000	,009	,442	,659
	text_sus	-,003	,002	-,031	-1,559	,119
	text_sus_cap	7,743E-5	,000	,025	1,011	,312

Coefficients[a]

Model		Collinearity Statistics Tolerance	Collinearity Statistics VIF
1	(Constant)		
	cap	,534	1,871
	text_sus	,523	1,913
	text_sus_cap	,346	2,890

a. Dependent Variable: CAR1

Figure A - 12: SPSS Output For Interaction Variable 'text_sus x cap'

```
t test of coefficients:

               Estimate  Std. Error t value Pr(>|t|)
(Intercept)  -3.2987e-03  2.2990e-03 -1.4349   0.1514
text_sus_cap  7.7430e-05  8.1372e-05  0.9516   0.3414
text_sus     -3.3833e-03  2.8432e-03 -1.1900   0.2341
cap           2.3032e-05  1.0186e-04  0.2261   0.8211
```

Figure A - 13: R Output With Newey-West For Interaction Variable 'text_sus x cap'

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	,054[a]	,003	,002	,05262916792	,177

a. Predictors: (Constant), text_sus_gas, gas, text_sus

b. Dependent Variable: CAR1

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	,037	3	,012	4,502	,004[b]
	Residual	12,979	4686	,003		
	Total	13,017	4689			

a. Dependent Variable: CAR1

b. Predictors: (Constant), text_sus_gas, gas, text_sus

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	,001	,001		,428	,669
	gas	-6,558E-5	,000	-,064	-3,375	<,001
	text_sus	-,004	,002	-,036	-1,640	,101
	text_sus_gas	4,330E-5	,000	,037	1,428	,153

Coefficients[a]

Model		Collinearity Statistics	
		Tolerance	VIF
1	(Constant)		
	gas	,586	1,705
	text_sus	,444	2,251
	text_sus_gas	,325	3,078

a. Dependent Variable: CAR1

Figure A - 14: SPSS Output For Interaction Variable 'text_sus x gas'

```
t test of coefficients:

               Estimate  Std. Error t value Pr(>|t|)
(Intercept)   6.1441e-04  2.4161e-03  0.2543  0.79927
text_sus_gas  4.3296e-05  3.2804e-05  1.3198  0.18695
text_sus     -3.8576e-03  2.6578e-03 -1.4514  0.14672
gas          -6.5579e-05  2.9313e-05 -2.2372  0.02532 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Figure A - 15: R Output With Newey-West For Interaction Variable 'text_sus x gas'

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	,950[a]	,902	,902	,01652367631	1,739

a. Predictors: (Constant), text_sus_CAR2, text_sus, CAR2

b. Dependent Variable: CAR1

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	11,737	3	3,912	14329,708	<,001[b]
	Residual	1,279	4686	,000		
	Total	13,017	4689			

a. Dependent Variable: CAR1

b. Predictors: (Constant), text_sus_CAR2, text_sus, CAR2

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	-,002	,000		-7,223	<,001
	CAR2	,926	,006	,959	164,008	<,001
	text_sus	,002	,000	,016	3,576	<,001
	text_sus_CAR2	-,024	,009	-,015	-2,624	,009

Coefficients[a]

Model		Collinearity Statistics Tolerance	Collinearity Statistics VIF
1	(Constant)		
	CAR2	,613	1,632
	text_sus	,996	1,004
	text_sus_CAR2	,611	1,637

a. Dependent Variable: CAR1

Figure A - 16: SPSS Output For Interaction Variable 'text_sus x CAR2'

```
t test of coefficients:

                Estimate  Std. Error t value  Pr(>|t|)
(Intercept)   -0.00225340  0.00057825 -3.8969 9.877e-05 ***
text_sus_CAR2 -0.02383699  0.01651308 -1.4435  0.148940
text_sus       0.00176372  0.00059310  2.9737  0.002957 **
CAR2           0.92597102  0.01210271 76.5094 < 2.2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Figure A - 17: R Output With Newey-West For Interaction Variable 'text_sus x CAR2'

```
        studentized Breusch-Pagan test

data:  model_fq2
BP = 19.268, df = 5, p-value = 0.001714
```

Figure A - 18: R Output On The Breusch-Pagan Heteroscedasticity Of RQ2

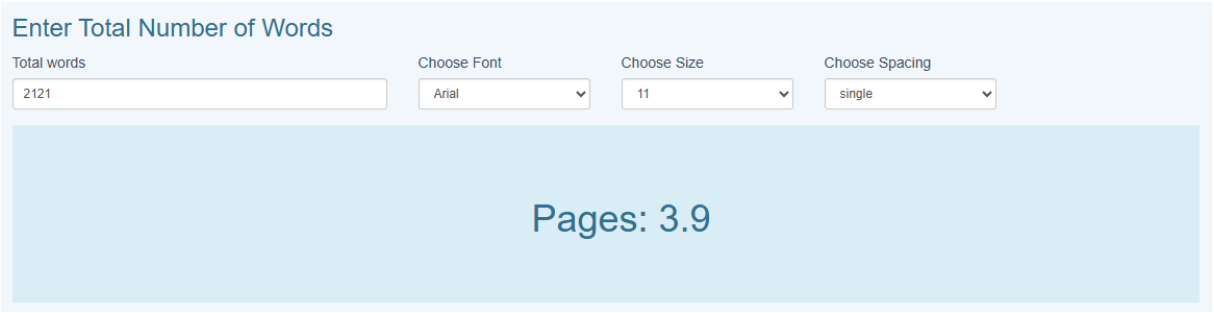

Figure A - 19: Calculation Of Total Number Of Words On A4 Pages

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,950[a]	,902	,902	,01646976259

a. Predictors: (Constant), text_sum, CAR2, gas

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	11,746	3	3,915	14433,921	<,001[b]
	Residual	1,271	4686	,000		
	Total	13,017	4689			

a. Dependent Variable: CAR1

b. Predictors: (Constant), text_sum, CAR2, gas

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	-,004	,000		-9,455	<,001
	CAR2	,919	,004	,952	207,806	<,001
	gas	3,145E-5	,000	,031	6,704	<,001
	text_sum	,000	,000	,009	1,986	,047

a. Dependent Variable: CAR1

Figure A - 20: SPSS Output About The 'text_sum' Variable

```
t test of coefficients:

              Estimate  Std. Error  t value  Pr(>|t|)
(Intercept) -3.6074e-03  5.0619e-04  -7.1266 1.185e-12 ***
CAR2         9.1895e-01  7.1143e-03 129.1682 < 2.2e-16 ***
gas          3.1452e-05  6.0709e-06   5.1808 2.302e-07 ***
text_sum     4.3995e-04  2.3773e-04   1.8507   0.06428 .
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Figure A - 21: R-Output For ‘text_sum’ After Newey-West-Test