Sustainability Metrics and Market Behavior: ESG's Effect on Stock Prices Post-M&A Announcements

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Abstract:

This thesis investigates the relationship between Environmental, Social, and Governance (ESG) metrics and stock market behaviors following a merger or acquisition (M&A) announcement, focusing on cumulative abnormal returns (CAR) and normalized standard deviation (SD). By analyzing the largest M&A transactions from 2023 and 2024, the study applies a statistical regression model in order to examine how ESG components influence market dynamics, both in aggregate and individual form. This is done while controlling for company specific, deal-related and macro variables in order to ensure robustness of the results.

Our findings indicate an insignificant correlation of aggregate ESG scores and CAR following a M&A announcement. However, improvement on the Environmental factor seems to be positively correlated with greater CAR, indicating excess return to environmental practices. In addition, we also find that both the aggregate and individual components of ESG have a significant effect on stock price SD, ultimately demonstrating that ESG metrics influence M&A evaluations.

This research advances the understanding of ESG's role in shaping market reactions by building upon pre-pandemic findings and adding a dimension of volatility, offering a more nuanced perspective on the dynamics of risk and returns. Our findings underscore the importance of disaggregating ESG metrics, accounting for industry fixed-effects and considering external factors in order to accurately evaluate the impact on market dynamics.

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Table of Contents:

Abbreviations
1. Introduction **1**
2. Background **3**
2.1 Introduction to Mergers and Acquisitions 3
2.2 ESG Scores 4
2.3 ESG in Businesses 4
2.3.1 Legal Requirements and Issues 5
2.3.2 Impacts on Financial Performance 5
2.3.4 Complexities in Stock Market Returns 6
2.3.5 ESG in Different Industries 6
3. Literature Review **8**
3.1 M&A Announcement Event Studies 8
3.2 Additional Remarks on the Literature Review 9
4. Theory **10**
4.1 Shareholder and Stakeholder theory 10
4.2 CAPM 11
4.3 Market Behaviour 11
4.3.1 Efficient Market Hypothesis 11
4.3.2 Behavioural Finance Theory 12
4.4 Hypotheses 13
5. Data & Methodology **14**
5.1 Data Collection 14
5.1.1 Sample Selection 14
5.1.2 Financial Data 14
5.1.3 ESG Data 14
5.2 Method 15
5.2.1 Research Design 15
5.2.2 Model Selection and Introduction 16
5.2.2 Variables and Measures 16
5.2.3 Final OLS Models 19
5.2.4 Robustness Checks 20
6. Results and Analysis **21**
6.1 Descriptive Statistics 21
6.2 Regression Results 23
7. Discussion **31**
7.1 Implications of Results 31
7.1.1 Hypothesis 1 - Acquirers with low ESG scores will experience larger cumulative abnormal returns following a M&A announcement 31
7.1.2 Hypothesis 2 - Acquirers with high ESG scores are correlated with higher levels of merger announcement stock price volatility 33
7.1.3 Link Between Results and General Expectations 34
7.2 Limitations of Study 35
7.3 Recommendations for Future Studies 37

8. Conclusion **38**
9. References **39**
10. Appendix **44**

Abbreviations

CAPM - Capital Asset Pricing Model
CAR - Cumulative Abnormal Returns
ESG - Environmental, Social and Governance
E - Environmental Factor
S - Social Factor
G - Governance Factor
M&A - Mergers and Acquisitions
SD - Normalized Standard Deviation

1. Introduction

In the last few decades, society has experienced profound changes with increased demands on businesses, individuals, and communities regarding how they operate. The shift has been prominent across all businesses, emphasizing the importance of sustainable practices beyond financial sustainability. In this era of increasing focus on sustainability, Environmental, Social, and Governance (ESG) metrics have become pivotal in business environments (Friede et al., 2015; Galpin & de Vibe, 2020; Matos, 2020; Ung & Urfe, 2021). While widely accepted as a term, especially among investors, the actual meaning and content of ESG varies based on a multitude of factors.

Due to this, Matos (2020) argues that ESG best serves as an umbrella term, containing metrics that are regularly used to evaluate a company's commitment to a sustainable future. While varying between companies depending on materiality, ESG typically includes known and accepted environmental factors such as carbon emissions and resource efficiency, social factors including employee welfare and customer satisfaction, and governance metrics like board diversity and executive pay.

Designed to provide insights beyond financial metrics, ESG helps assess a company holistically, such as by evaluating exposure to risk, operational resilience, and societal impact. So despite not being a financial term per se, Matos (2020) remarks that ESG is commonly used for identifying sustainable investment opportunities and mitigating risks in finance. Institutional investors often incorporate ESG factors into decision-making to align portfolios with ethical principles, taking corporate responsibility while simultaneously looking for long-term value creation. Hu et al. (2023) in their studies argues that the main effect of ESG as a concept is that it introduces more private information to be available to the general market. Something that ultimately creates better opportunities for information transmission to the public and thus enables better and more fair investment decisions.

The emergence of ESG has reshaped traditional finance and has given both investors and companies themselves perspectives to consider due to this new information. For instance, a company can not only take its own sustainability into considerations, but needs to consider the entire supply chain. That change has raised critical questions about ESG's role in high-stakes corporate decisions, e.g. mergers and acquisitions (M&A) as well as the financial risks and returns following such activity (Caiazza et al., 2021; Galpin & de Vibe, 2024; Kyei-Mensah et al., 2017).

Although not conclusive, research from previous decades indicates that a good ESG score has a positive effect on both the performance of a company and the success rate on M&A activity (Andrade et al., 2021; Caiazza et al., 2021; Chen & Xie, 2022; Galpin & de Vibe, 2024; Kranias et al., 2024; Kyei-Mensah et al., 2017). However, it remains to be understood to what degree ESG affects the stock market and investor behaviour in today's business environment, especially after the Covid-19 pandemic. Consequently, this study aims to understand any significant relationship between a strong ESG score and cumulative abnormal returns as well as normalized standard deviation for an asset on the stock market. Any finding would offer fresh perspectives on the interplay between sustainability and instantaneous market reactions.

To assess this, the study investigates the largest global M&A transactions for the financial years of 2023 and 2024. The ambition is to find the underlying variables that influence the market reaction, by primarily studying the acquiring companies' fundamentals. The study employs a statistical regression model based on ESG scores and key financial variables retrieved from publicly available sources. The

analysis consists of an event study that compares the outcomes during the event window to a constructed CAPM prediction of the same period. The CAPM indicates the expected return of the asset during the event window, which is compared to the actualized returns. In addition, each acquiring company is assessed by their normalized standard deviation during the same period, giving an idea of the dynamics of risk and return.

The implications of an analysis constructed this way can become twofold: it could illustrate the impactful effect of ESG scores on market reactions following merger announcements. Thus proving it to be a critical factor in financial analysis and M&A evaluation, following the hypothetically superior results and less risk of such assets compared to the CAPM predictions. It could also suggest a more passive relationship, where market speculation is not affected by ESG metrics. Similar studies in the past have come to different conclusions. Research from Caiazza et a., (2021), Deng et al., (2013) and Kyei-Mensah et al. (2017) suggest that there are significant findings to be made of superior performance for good ESG scoring companies after M&A. Meanwhile, Tampakoudis et al., (2021) show that during the pandemic of Covid-19, no expected value gain from sustainability investing could outweigh its cost, indicating the opposite.

Our research finds that ESG scores in aggregate form are uncorrelated with increased returns following M&A but correlated to normalized standard deviation. However, our analysis reveals that there is a positive correlation between an improvement in the environmental factor and returns. This holds even after taking into account effects largely driven by systematic differences across industries. Once industry fixed effects and financial control variables are accounted for, the significant correlations disappear for both the social and governance factor. While not significant, there is still a pattern in the coefficients' values indicating the relationship outlined in the developed hypotheses. This finding underscores the need for a more nuanced examination of the relationship between ESG and abnormal returns, emphasizing the importance of carefully addressing confounding factors in future research.

Following this section, the study is divided into chapters. First, in chapter 2, a background introduction to related literature is made for the reader to get acquainted with the subject. Chapter 3 contains the literature review, analyzing similar studies and what they conclude. Thereafter, chapter 4 introduces the relevant theory underlying the study, followed by chapter 5 where data and methodology is presented. Chapter 6 discloses results of the study, together with analysis of said results. Chapter 7 revolves around a discussion of the findings, and also a note on recommendations for further studies. Chapter 8 finishes the study by providing the reader with the final conclusions of the authors. For references and appendix, see chapter 9 and chapter 10 respectively.

2. Background

This section serves to introduce similar research and topics relevant for this study. First, a general introduction to M&A is made followed by an explanation of ESG scores as a concept. The latter is then related to business environments, and its impact on market expectations and reactions.

2.1 Introduction to Mergers and Acquisitions

Mergers and acquisitions represent crucial corporate strategies that involve the consolidation of companies or assets to achieve certain objectives.

According to Faulkner et al. (2012) a merger refers to the combination of two firms of roughly similar size into a single legal entity, typically under mutual agreement, while an acquisition involves one larger company taking control of another smaller company, often by purchasing a majority stake. Faulkner et al. (2012) also disclose that the primary motives behind M&A can be improving operational efficiency, achieving economies of scale, entering new markets, acquiring innovative technologies or responding to competitive pressures. However, the realised success of M&A relies on the strategic alignment of the involved firms and the effectiveness of the post-merger integration process.

Research by Andrade et al. (2001) reveals that there are several challenges behind each M&A transaction, and that although target firms generally benefit, acquirers often only break even economically. The reason behind this can be, among other things, integration difficulties, cultural misalignment, and incoherent strategy (Sudarsanam, 2003). Due to this complexity, the outcome of M&A actions are riddled with uncertainty. In fact, research shows a rather weak success rate of M&A activity of around 50% (Calipha et al., 2010; Cartwright & Schoenberg, 2006), while leading global consultancy firms claim that only about 20-30% of M&A deals initiated can be considered successful (EY, n.d.; McKinsey, 2010).

Some research indicates that a good ESG score influences the success rate of M&A strategies to the better (Caiazza et al., 2021; Galpin & de Vibe, 2024; Halbritter & Dorfleitner, 2015; Ung & Urfe, 2021) as well as the financial returns and risks (Andrade et al., 2021; Chen & Xie, 2022; Galpin & de Vibe, 2024; Kranias et al., 2024; Kyei-Mensah et al., 2017). At large, Caiazza et al. (2021) proposes that companies prioritizing ESG may possess competitive advantages, like improved reputation, operational efficiencies and resilience through regulatory change.

However, to measure these competitive advantages in real economic value is a complex task. One method used in previous research is to focus on short term economic profitability measures, which will be heavily biased as a result of accounting measures. Depending on the deal structure of the merger there can be large changes in depreciation and amortization expenses, which would have a strong impact on profitability measures. These accrual based expenses, driven largely by estimates, can distort the profitability measure and lead to a misinterpretation of the economic substance (Albuquerque et al., 2023). To mitigate this issue, researchers often use versions of cash flow to determine the change in profitability of the combined firm (Martynova et al., 2006). Although a better alternative for understanding the economic value of a merger, the calculation of cash flows can be an extensive task when dealing with large sample sizes and varying accounting standards.

Another approach to estimate value is to use the stock price or market value of equity as a proxy, implicitly assuming that markets interpret the information correctly and are efficient. In using this measure, markets are left to evaluate each independent M&A based on the individual circumstances, discounting based on the appropriate risk in order to determine the value of the event. This measure does not eliminate bias and is still subject to investor sentiment and errors in human judgement. However, the effect won't see as much bias as looking at the same accounting based metrics for large samples of firms (Albuquerque et al., 2023). Event studies are a commonly used tool in this context, assessing the expected value creation by analyzing market reactions to merger announcements.

2.2 ESG Scores

Originally developed for financial companies, ESG scores indicate a company's performance with regard to the subsets of environmental, social and governance aspects (Clement et al., 2023). ESG is a measurable framework, closely interlinked with corporate social responsibility (CSR) and viewed as a source of corporate information. According to Moir (2001), CSR refers to the ethical behavior of businesses toward society, including their commitment to contribute to economic development while also improving the quality of life for employees, local communities, and society at large. Historically, the original scope of CSR was the social aspect, but it developed over time to become more holistic. Today, CSR involves actions that go way beyond economic development, focusing instead on addressing broader social, ethical, and environmental concerns. Among other things, this can be concerns of materiality for human rights and environmental impact categories.

CSR developed into an integral part of today's business environment, and Clement et al. (2023) argues that the best proxy to determine a company's commitment to CSR, is to examine their quantified ESG scores. The quantification itself is dependent on *materiality*, which refers to the most relevant ESG factors to address for an individual company. Often, the relevance is measured in monetary value with the most stressful issue having the highest materiality (Sustainability Accounting Standards Board, n.d.). One major defect with this measure, is that any materiality metric only contains what it has been decided to contain. Clement et al. (2023) elaborates on the upsides and downsides of ESG as a proxy and notes that despite that it is the best possible option, if the materiality assessment is flawed and leaves out externalities it doesn't portray or resemble the true CSR.

A basic example follows:
Suppose a company assesses their environmental footprint with their carbon dioxide emission and makes direct efforts to decrease it. In the same process, the company alters another part of their operation which has a negative externality effect on the local ecosystem that in magnitude is objectively worse than their initial emissions. The ESG score would in this case reflect an improvement, since the assessed materiality only measures the carbon dioxide emission. However, the magnitude of the externality would be worse in terms of actual environmental impact.

2.3 ESG in Businesses

Following the introduction to ESG scores, this section serves as an illustration of the practical use cases. The following chapters disclose different perspectives and influences that ESG has in business.

2.3.1 Legal Requirements and Issues

ESG metrics as introduced earlier in this study have grown in popularity the last couple of years. However, in some regions, they have evolved from voluntary frameworks to mandatory compliance in terms of reporting, especially within the European Union (EU) under regulations like the Corporate Sustainability Reporting Directive (CSRD) (EU commission, n.d.; Galpin & de Vibe, 2024). The legal adoptions of the EU do not contain thresholds however. No law is enforced that mandates any company to have a certain level of ESG score, but the CSRD mandates that every company must report on their operations and be transparent about them. So while no thresholds are mandated in reporting, the transparency and accountability in itself might push concerned companies to integrate ESG strategies into their corporate ones as a way to mitigate reputational risks. The latter, although not entirely bound by the reputational risk per say, has intimate ties with Akerlof's (1970) market for lemons.

In his work, Akerlof conveys the idea about two central concepts, namely quality and uncertainty. In uncertainty, there are substantial risks for a buyer of any good or asset to be misled by the seller and end up dissatisfied. The seller on the other hand, if not morally bound, stands to benefit on the very same deal. With ESG, one inherent risk is greenwashing, where companies can benefit by misleading the investors through their reporting. Greenwashing in short means for a company to exaggerate, lie or otherwise manipulate data to be perceived as more environmentally friendly than they are (Cambridge University Press, n.d.). According to Netto et al. (2020) greenwashing has been an emerging problem since the aggravation of environmental issues. The more stakeholder concern increases, the more companies have to benefit by indicating sustainable practices. This dilemma is part of a critique towards ESG's validity, but it can be partly solved by the standardized reporting practices outlined by the EU.

Regarding ESG in different geographic regions, the EU is a frontrunner in the legal adoption of ESG reporting, while the rest of the world is lagging behind (OECD, 2024). However, the Securities and Exchange Commission (SEC) in the USA has proposed an implementation of similar practices (U.S. Securities and Exchange Commission, 2022). Similarly, the China Securities Regulatory Commission (CSRC) developed a "Code of Governance for Listed Companies" in 2018, which was a first step to ESG disclosure in China (Hu et al., 2023).

These steps of increasing transparency globally may be due to the issues portrayed by the market for lemons dilemma. Should the world unite on conforming rules of reporting, similar to e.g. European current practices, we would expect consistent, comparable and reliable information. Other countries with current or pending implementations of standardized ESG disclosure include Australia, Canada and Japan (Worldfavor, n.d), which indicate a positive trend in legal implementation.

2.3.2 Impacts on Financial Performance

ESG's impact on the financial performance of a company has been studied extensively and shown to have an effect on cost savings, increased customer loyalty, and higher market valuations (Galpin & de Vibe, 2024; Ung & Urfe, 2021; Zhang & Guo, 2018). Additional empirical studies from Chen & Xie (2022) also show that ESG practices contribute by improving stakeholder relationships and mitigating risk. In their studies, Kranias et al., (2024) mentions that these benefits lead to increased investor confidence, particularly from the ESG-focused stakeholders, which they argue can create a positive feedback loop. Another positive feedback loop is presented in parts by Hu et al. (2023) but instead

related to reduced volatility. The stock price synchronicity detailed in their studies, which means the degree of correlation between average fluctuations of the market and the price fluctuation of an asset, is directly improved with ESG investment. This indicates that volatility is mitigated by information transmission, and that the market tends to be more efficient when information is available. Moreover, Kranias et al. (2024) also show that ESG initiatives can drive higher sales and profitability, as sustainable products and services align with some consumer preferences the same way sustainable practices resonate with investors. Such synergistic effects provide prominent companies with a competitive edge in increasingly sustainability conscious markets.

2.3.4 Complexities in Stock Market Returns

Despite the strong relationship between sound ESG practices and positive financial performance, the relation between ESG and stock market performance is not definitive. While operational and profitability metrics are generally a good indicator of a stock price, or at least positively affecting it, evidence suggests that the impact on stock returns is mixed.

For instance, the concept known as the "Green Premium" or “Sustainability Premium” reflects a trade-off for any investor, in the sense that they have to pay more for an asset in exchange for supporting environmentally responsible actions (Kranias et al., 2024; Ung & Urfe, 2021). The Green Premium is a mark-up on the price of an asset based on the fact that the asset is by itself considered sustainable or, in the case of an entire company, acts sustainably. This means that for the same financial risk held by the investor, the stock price of the “greener” asset will be higher than the less sustainable equivalent, ceteris paribus. Due to the green premium, a good scoring ESG company would be priced higher than a bad scoring company with identical operations and profits. Ung & Urfe (2021) argues that this premium is driven by improved reputation and alignment with investor preferences, which makes acquirers willing to pay more for target companies. In short, this highlights what could be seen as a liability of initial investments in ESG initiatives, both for investors and companies, as they may not immediately translate into added value (Barros et al., 2022). However, companies with good ESG scores tend to have superior post-merger performance. Not only with increased success rate, but also as sustainable practices correlate with a lower risk and greater resilience in the face of challenges (Caiazza et al., 2021; Deng et al., 2013).

Caiazza et al. (2021) goes so far as to structuring a hypothesis that expects a non-significant effect of ESG on the short term stock price after M&A. They argue that due to the inherent complexity of M&A activity, effects can only be expected in the long term. The main rationale behind their argument is that the underlying motive behind M&A must be to increase long term cash flow and consequently increase corporate value. However, the increase in corporate value relies on post merger success, which is unknown at announcement and counteracted by the complexity. This is supported by Deng et al. (2013) and Bruner (2002) who also claim long term goals are the dominant source of M&A activity and stock price market reactions.

2.3.5 ESG in Different Industries

A key distinction of ESG metrics is that different companies will have different characteristics. In this aspect, the term *sensitive industries* serve as an example of how these differ. Explained by Garcia et al. (2017) to be those with a common social taboo or moral dilemma in their core business operation, sensitive industries are those most scrutinized in the eyes of the public. Basic examples include mining, materials and fossil energy companies.

The reason the sensitive industries are more frequently subjected to stricter scrutiny is because of their significant environmental and social risks. For instance, fossil energy emits vast amounts of carbon dioxide and other pollutants, harming people by causing global warming and local smog. Mining exploits local nature and terrain, and in some poorer countries exploits the workforce with inhumane conditions. Traditionally, these sectors often invest relatively more in ESG initiatives to mitigate risks, comply with stringent regulations, and keep the stakeholders' trust. By doing so, a company in an sensitive industry might potentially achieve better ESG scores than expected relative to other industries, despite still having substantial negative impact (Garcia et al., 2017). In contrast, industries like technology or finance might face fewer environmental challenges but have more issues related to social or governance (Cheng et al., 2014). Despite different aptitudes to invest in ESG, the difference in impact between industries remains based on the characteristics they possess.

3. Literature Review

This section introduces and analyzes prior research and topics relevant for this study. The main focus is to capture earlier studies on stock returns following a merger announcement, particularly regressed through ESG scores. Additionally, it incorporates studies on stock price volatility from related fields in order to expand the context. Together, this creates a foundation for this research paper moving forward, and ties its relevance to M&A and ESG.

3.1 M&A Announcement Event Studies

In earlier studies investigating financial performance in the light of ESG, a common and extensively used metric is the cumulative abnormal return (CAR) (Deng et al., 2013; Hu et al., 2023; Kyei-Mensah et al., 2017; Tampakoudis et al., 2021). This is because CAR captures the aggregate difference between a firm's observed stock returns and expected market-adjusted returns over a specified event window, effectively isolating the impact of corporate events like M&A announcements (Deng et al., 2013; Tampakoudis et al., 2021). As able to showcase both short-term market reactions and long-term performance implications, CAR gives a holistic view of shareholder value creation.

The findings on ESG efforts and merger success are diverse and heavily dependent on both the time frame used for the analysis as well as the control variables included in the regressions. Kyei-Mensah et al. (2017) examined 8,945 merger announcements between the years of 1991 and 2013 using both OLS regression with varying event windows and found no significant returns on merger announcement. For the similar period of 1992-2007, Deng et al. (2013) examined the stock price synchronicity and found strong correlation between ESG performance and increased returns on announcement date. The research has since then developed and for the period of 2010-2019, Hu et al. (2023) found positive correlation between announcement returns and ESG efforts for the Chinese capital market. This result was however contradicted by the study of Tampakoudis et al. (2021) who found a significant negative effect to ESG efforts for US based firms during the covid-19 pandemic years of 2018-2021.

Some of the studies only consider the effects of ESG for a specific industry, while others control for industries in their models. Kyei-Mensah et al. (2017) treats a set of several thousands of mergers and acquisitions without controlling for any industries despite the inherent differences and expectations in ESG scores. Caiazza et al. (2021) controls for industry effects by only including M&A transactions in the hospitality sector, which partly means that their results are only valid for one industry. Hu et al. (2023) and Tampakoudis et al. (2021) however both control for industry in their studies. This is done by introducing dummy variables for each identified industry, which ultimately improves validity of the results. As argued by Garcia et al. (2017), the industries could have a great effect and might be an explanation for the varying results. In addition, the studies mentioned differ in their years of data, their markets and what control variables they use. After the Covid-19 pandemic, little to no research has been done to examine how the relationships might have changed. The pandemic has led to a change in the global business landscape, raising the question if expectations of M&A in relation to ESG efforts are different compared to negative findings of Tampakoudis et al. (2021).

To complement the study of returns following a merger announcement, the standard deviation associated with those returns is another important factor to consider. The findings for ESG related

volatility in connection to M&A are limited, leaving a gap in the existing literature. Previous studies have been made in order to relate ESG to financial risk, finding ties between better performing ESG and a lower beta (Sassen et al., 2016). Reber et al. (2022) has examined the effect of ESG disclosures on idiosyncratic risk and found that a better ESG score resulted in lower firm-specific volatility during IPOs. Although IPOs are not the same thing as M&A, both events are exposed to information asymmetry and can be argued to have plenty of similarities. In his research, Reber et al. (2022) argues that the reason behind the reduced volatility following an IPO for a ESG focused company is the consequential reduction of information asymmetry and improved reputation. The research of Zhu et al. (2014) examines the idiosyncratic volatility following merger announcement in emerging markets and finds similar arguments to be the reason for less volatility in IPOs. The volatility that accompanies a merger announcement is therefore something that could be pivotal to the ESG research, and something that needs to complement the existing literature regarding cumulative abnormal returns.

3.2 Additional Remarks on the Literature Review

Thus far, the material presented has showcased the importance, and continuous emergence, of ESG as a concept in business environments. However, there is still relatively weak evidence about its direct effects on market reaction in relation to big news. Research from Sun et al. (2024), investigates event studies related to ESG, but mainly focuses on news related to ESG in itself. Their results indicate that a high ESG score means a lower chance of negative events, denoted as scandals, but more vulnerability towards those that still happen. Other introduced authors emphasize how the financial performance is intimately tied to commitment to CSR or ESG strategies (Chen & Xie, 2022; Friede et al., 2015).

Additional research on the topic of finance was done in order to determine the appropriate variables to control for when examining a corporate event study. The research in finance promotes many of the variables that are already found in the studies presented in the literature review, however, they are rarely included in an exhaustive manner (Albuquerque et al., 2023; Capron & Shen, 2007; Damodaran, 2007; Husna & Satria, 2019; Nhleko & Schutte, 2024; Nukala & Prasada Rao, 2021).

The literature provided serves as a tool to understand what factors might influence the perception of both M&A deals in its entirety, as well as the role of ESG in current business environments. While the literature is informative and indicative about a superior performance of a good ESG score, it is not decisive what the actual market reaction of a substantial M&A announcement would be, especially not in today's environment. To aid in that pursuit, the following theory section outlines the behavioural forces at play in these events.

4. Theory

In this chapter, an introduction to the relevant theory is made. First comes an introduction to shareholder and stakeholder theory, which is the key pillar of the study. Second, a short introduction to the capital asset pricing model (CAPM) is made. Third comes economic theory about market behaviour and characteristics, which is explained according to two different but prevalent theories. Together, the three segments capture the essence of ideas influencing and aiding this study. Lastly, a segment about hypotheses based on the theory and earlier provided literature is presented. The hypothesis segment serves as the general guide for what the study investigates.

4.1 Shareholder and Stakeholder theory

Shareholder theory is a foundational concept in corporate governance which states that the primary obligation of a company is to maximize shareholder value. Originally from Milton Friedman's (1970) argument that "*the social responsibility of business is to increase its profits*" this theory emphasizes that a company exists primarily as a vehicle for generating returns for its owners. Under this view, management acts as an agent of the shareholders, and its primary responsibility is to focus on profitability and the efficient allocation of resources. Non-financial concerns, such as social and environmental issues, are deemed secondary unless they directly contribute to improving shareholder wealth (Freeman et al., 2010).

In the context of M&A, shareholder theory has traditionally seen corporate transactions as mechanisms for increasing company value through synergies, cost efficiencies, and market expansion. Studies such as Caiazza et al. (2021), Deng et al. (2013) and Tampakoudis et al. (2021) have all analyzed M&A outcomes largely through a shareholder-centric lens, measuring success via metrics like cumulative abnormal returns (CAR) and stock price reactions. This perspective assumes that maximizing shareholder wealth automatically aligns with wider economic efficiency, having less weight on the potential impact on other stakeholder groups.

Stakeholder theory, introduced as a modern alternative to the shareholder-centric view, is explained by Freeman et al., (2010) to be more holistic. They elaborate that since businesses operate within a broad network of relationships, they involve many stakeholders, including employees, customers, suppliers and investors. Rather than focusing solely on shareholders, this theory suggests that the interests of all stakeholders are important and must be considered in decision-making processes to ensure the long-term sustainability of the company.

Unlike shareholder theory, stakeholder theory, according to Freeman et al., (2010), advocates for balancing financial performance with social, environmental, and governance responsibilities. It suggests that companies have a duty to create value for all stakeholders, not just shareholders, and that addressing stakeholder interests can lead to enhanced trust, reduced risk, and greater long-term resilience. In the context of M&A, stakeholder theory highlights the importance of evaluating not only financial outcomes but also the broader impacts on affected groups. Deng et al. (2013) emphasize that firms with strong CSR practices tend to perform better during and after M&A, as they integrate stakeholder considerations into their strategies.

4.2 CAPM

The Capital Asset Pricing Model, developed by Sharpe (1964) and Lintner (1965), is an early framework in asset pricing theory which remains, to this day, one of the most used in finance. Building on Markowitz's (1952 & 1959) early *portfolio selection* work, the CAPM assumes risk-averse investors optimize portfolios based on mean-variance efficiency. The model suggests that an asset's expected return is proportional to its systematic risk, denoted as beta, and includes a risk premium that stems from the market portfolio. The CAPM equation for an asset *i* is as follows:

$$E(R_i) = R_f + \beta_i(E(R_m) - R_f)$$

The model indicates that an asset's expected return is equal to the risk-free rate (R_f) added with the market risk premium multiplied by the asset's beta, where the risk-free rate in many instances is embodied by a long-term treasury bond as a proxy.

The CAPM has been critiqued for empirical shortcomings, especially in modern times. Studies, such as Fama and French (2004), highlight its frequent failure to predict asset returns accurately. Primarily due to unrealistic assumptions like perfectly efficient markets and unrestricted risk-free borrowing. Many economists have developed other models to address these shortcomings, like Fama and French who also developed the three factor model (1992) or the arbitrage pricing theory by Ross (1976). Despite these models' arguably improved predictive ability, the CAPM remains as one of the most used models. Partly due to the complexity required to efficiently use the newer models. In this study, the CAPM serves as the basic prediction of what trajectory a stock is predicted to have over the event window. Considering the large variance in characteristics of e.g. company size, industry and geography, a simple model suffices as a baseline.

4.3 Market Behaviour

In this chapter, we present two relevant bodies of theory behind market reaction, each detailing expectations on reactions based on certain assumptions.

4.3.1 Efficient Market Hypothesis

The first theory, the efficient market hypothesis (EMH) is a crucial concept of expected market behaviour in the constructed event studies. The hypothesis, generally credited to Nobel laureate Eugene Fama (1970), says that financial markets efficiently incorporate all available information into prices. In its strongest form, an assumption of the hypothesis is that no one can expect excessive or abnormal gains from trade over time. This is argued since any profitable opportunity to e.g. invest in an asset, that according to new information will perform well in the future, would already be known by others as well. Therefore, its opportunity would already be reflected in the price of the asset.

Burton Malkiel (1989) elaborates on the implications of this hypothesis, emphasizing that if markets are efficient, it is impossible to achieve consistently higher-than-average returns through either technical analysis of historical prices (weak form), public information analysis (semi-strong form), or insider information (strong form). Which is the same three categories Fama (1970) also used in his work.

These categories follow a strict hierarchy. In its weak form, the hypothesis states that current prices already incorporate past price information, making strategies based on patterns or trends useless in theory. The semi-strong form extends this, suggesting that all publicly available information, such as financial statements and announcements, is instantly reflected in stock prices upon their release as well as the patterns or trends of the weak form. Finally, the strong form claims that even private information, also known as insider information, is embedded in market prices. The latter implies a level of efficiency where no systemic advantage can be gained by any participant at all (Fama, 1970; Malkiel, 1989).

Overall, while the EMH remains a cornerstone of financial economics, empirical studies show mixed results, revealing that while markets are semi-strong-form efficient, small anomalies occasionally persist. These might often be too insignificant to exploit profitably after accounting for transaction costs and market dynamics.

4.3.2 Behavioural Finance Theory

Related to EMH but in principle a critique towards it, behavioural finance theory questions the strong assumptions of the proposed rational investor and instead looks at the events on the stock market under the lens of human psychology. Common and relevant subsets of behavioural finance theory in modern economics consists of the overreaction hypothesis, herding behaviour and prospect theory (Chiang & Zheng, 2010; De Bondt & Thaler, 1985; Kahneman & Tversky, 1979). These provide key insights into financial market anomalies and investor psychology.

Overreaction refers to a phenomenon where investors respond too much to unexpected news, causing asset prices in the short term to deviate significantly from their fundamental values. De Bondt and Thaler (1985) shows in their study that stocks that are experiencing extreme price movements after new information eventually tend to “reverse”. Suggesting that the market had overreacted to short-term information, and that there will be some predictable price corrections over time. Kahneman and Tversky (1977) explains the overreaction as a naive behaviour, where investors put too much weight on new information in relation to old information. Somehow believing, or hoping, radical change is imminent.

Meanwhile, **prospect theory**, a concept introduced by Kahneman and Tversky (1979), emphasizes that investors value gains and losses asymmetrically. Specifically, individuals exhibit loss aversion, meaning losses weigh heavier psychologically than equivalent gains. This behavioral pattern often contributes to risk-averse behavior in gains and risk-seeking tendencies when faced with potential losses. In practice, and related to the stock market, this can translate to asymmetric investor behaviour. For instance, investors may have a tendency to quickly embrace a significant win and sell, while holding on to losing stocks longer than rationality should allow, hoping for a rebound.

Herding behavior, discussed by Chiang and Zheng (2010), is the last concept included for behavioural finance theory in this study. The behaviour, if strong enough, suggests an amplification of already present market trends and momentum, intimately linked with the prospect theory (Kahneman & Tversky, 1979). The behaviour emerges when investors follow the large crowd rather than relying on information, leading to correlated trading and prices that eventually deviate from the assets' fundamental values. This behavior is often in some form related to crises, as uncertainty drives participants to mimic others. It can lead to systemic market risks and often reinforce price bubbles or crashes. The link to prospect theory is that any momentum like that is influenced by groupthink, and

the individual flaw in rationality proposed by prospect theory is amplified in the group. In general, the studies of Chiang and Zheng (2010) indicate that mature financial markets are less susceptible to this kind of behaviour compared to emerging markets. However, any trend or movement that has wide acceptance among investors can cause herding behaviour.

Together, these concepts highlight how human psychology and social dynamics deviate from market efficiency assumptions. They indicate the limitations of traditional models with too strong assumptions, and that to understand real-world market behavior, one needs to understand human behaviour first (Fama, 1998; Subrahmanyam, 2007).

4.4 Hypotheses

Based on the earlier research, a good ESG score for a company is expected to create strong financial improvement over time following a merger or acquisition. One primary argument for why there should be an effect is the efficient market hypothesis, which theorizes that the market will react to new information instantaneously and reflect that in the stock prices. Furthermore, the behavioural characteristics of investors outlined in behavioural finance theory make a strong case that short term effects should occur. I.e., the investors on the market tend to overreact to news they expect to be important, they fall for herding behaviour and they react asymmetrically to good or bad events. In light of the development of ESG's importance and how it inevitably affect the public consensus, the first hypothesis is thus:

1. *Hypothesis 1: Acquirers with low ESG scores will experience larger cumulative abnormal returns following a M&A announcement*

Another finding is that a vast amount of studies indicate that good ESG scores can mitigate risks, whether it's financial, reputational or legal. With stakeholder theory as the main basis, ESG improvements or investing signals a balance between financial performance and corporate responsibility. A key aspect in this sense is the availability of information to stakeholders, a result from the following transparency of such actions. Readily available information reduces information asymmetry. The second hypothesis is related to these findings of improved stakeholder relationships and is consequently:

2. *Hypothesis 2: Acquirers with high ESG scores are correlated with higher levels of merger announcement stock price volatility*

By exploring these dimensions, the study aims to inform any stakeholders - including investors, policymakers, and corporate leaders - as well as other researchers, on whether ESG metrics should be integral to M&A evaluations.

5. Data & Methodology

In this section, we provide the underlying dataset for the study while also introducing the adapted OLS model for which the data will be subject to analysis.

5.1 Data Collection

5.1.1 Sample Selection

This study is based on public data available on the internet of historic mergers and acquisitions conducted within the financial years of 2023 and 2024, retrieved from *Intellizence* (Intellizence, n.d.). The dataset contains global deals ranging from sizes of $200M to $59.6B and therefore excludes any small mergers or acquisitions. By doing so, the focus for this study is on transactions where there is complete ESG information, which is in line with the research of Tampakoudis et al. (2021). The study's goal is to elaborate on the possible correlation between ESG-scores and stock price returns on announcement day post the Covid-19 pandemic. As the concept and metrics of ESG is in a phase of rapid development, the sample of mergers and acquisitions was chosen from a time horizon as current as possible. This is to ensure that investor sentiment is similarly affected by ESG metrics, and that harmonized data for ESG-scores is readily available. Furthermore, the macro environment currently is, and has been, under several stresses since the pandemic. Among them wars, energy shocks and extraordinary inflation, creating uncertainty and possible irregularity in the data during the preceding years. The year of 2023 was therefore chosen as the first year of gathered data, under the assumption that the macro environment to a certain extent has stabilized after these shocks, further accounted for by year fixed effects. This is in itself one of the points to examine the development of ESG significance, contributing and complementing findings of previous periods.

5.1.2 Financial Data

The corporate and financial data was acquired from Capital IQ and Yahoo Finance, and in cases where data were unavailable on the aforementioned sites, we used manual collection from annual reports of individual companies. Stock prices were primarily retrieved from Yahoo finance and were to a large extent available for the companies in the dataset. Any lack of information on the financial metrics led to us dropping the transaction from analysis. From focusing on the largest mergers, we could however mitigate the need for data dropping, as the companies are under more stringent reporting standards.

The data for all of the variables was collected from the last full fiscal year of the company prior to the merger announcement. The only exception to this was the growth rate of EBITDA which used a three year average in order to add a dimension of the historical performance within the model and reduce the risk of year specific outliers.

5.1.3 ESG Data

ESG data was retrieved from the Morningstar Sustainalytics website (Sustainalytics, 2024). With over 13 000 company ratings, primarily for large companies that are subject to analysis through this study, Sustainalytics is a leading provider of ESG data. Compared to other third party assessors, like S&P Global ESG or MSCI Research ESG, the Sustainalytics database proved the best fit for the investigated deals, having the majority of required data points. For the alternatives, more data would have to be dropped in the analysis.

The ratings from Sustainalytics are two-dimensional, measuring a firm's exposure to ESG risks and subsequently its ability to manage them, with lower scores indicating lower sustainability risks (Sustainalytics, 2024). The scores are based on materiality of companies within the three different subsets: Environmental, Social and Governance. The total score is the aggregated sum of the three, and thus measure total risk and exposure. Each subset, and consequently total score as well, is harmonized in order to create comparability between different companies but also between different industries. As previously mentioned, additional description of Sustainalytics ESG scores can be found in the appendix.

5.2 Method

This section gives an extensive overview of the method used to arrive at the results. First, the research design is presented. We then go through an introduction of the selected model as well as the dependent, independent and control variables used. Lastly, a segment on the robustness checks utilized in the study is described.

5.2.1 Research Design

To investigate the relationship between the acquiring companies ESG scores on post-merger stock price performance and risk, this study makes use of an event study. In the event study, we use a regression on the cumulative abnormal returns and stock price standard deviation during an event window around the announcement date of the M&A. The regression is done in multiple models with varying event windows using univariate and multivariate Ordinary Least Squares (OLS) regression, explained in principle below. The regression is first a simple univariate one, which is then complemented with models with increasingly controlling variables. The reason for this is the goal of creating comparability to previous research using varying OLS models, and illustrate the effect of omitting critical variables.

To answer hypothesis 1, we start by doing a simple univariate OLS regression on CAR with aggregate ESG score to establish a basic relationship without any control variables. We then continue by breaking up ESG into its components (Environmental, Social, and Governance) and regressing on CAR. Both of these regressions are denoted as model 1. In the second model, we add control variables known to affect the market expectations of an acquiring firm involved in M&A. These variables are used to mitigate biases, controlling for things such as the companies' financial performance, liquidity ratios, solvency ratios and deal structural information (Tampakoudis et al., 2021). This is a critical factor for the model to determine the true economic substance of ESG efforts on market expectations, as previous research has found a severe risk of confounding and omitted variable bias (Deng et al., 2013; Hu et al., 2023; Kyei-Mensah et al., 2017; Tampakoudis et al., 2021). In model 3, we investigate this further, by controlling for the acquiring companies' industry in order to mitigate any potential biases with regard to M&A activity, skewness or inaccuracy of ESG scores. This process with the respective models is then repeated to answer hypothesis 2. The event study is completed by conducting the same regressions with the normalized standard deviation of the stock prices as dependent variables.

5.2.2 Model Selection and Introduction

The previous research on M&A and corporate performance has heavily relied on linear regression models, particularly OLS (Kyei-Mensah et al., 2017; Rashid & Naeem, 2017). Mathematically, OLS seeks to minimize the sum of squared differences between the observations and the model's prediction. In doing so, OLS creates a model predicting the expected value of the dependent variable based on the independent observations (Baddeley & Barrowclough, 2009).

The OLS model can easily be simplified to a univariate regression, and easily extended to a multivariate regression. Having either a single independent variable or several. Some studies also employ other models. Kyei-Mensah et al. (2017), which uses a version of Glosten et al. (1993) asymmetric GARCH specification that improves testing for time-varying volatility in time-series. However, the induced complexity in adjusting such a model refrains us from using it because of the risk of errors. The simplicity of OLS allows for the required management of the model and stays in line with the majority of previous research.

In the used OLS model, control variables are added progressively in order to avoid the effects of potential confounding, which would skew the results. For any OLS regression, there are some key assumptions or criteria that need to be fulfilled in order for the model to be considered reliable and unbiased. These assumptions include: linearity relationship, independence of errors, homoscedasticity, and variable exogeneity (Baddeley & Barrowclough, 2009).

$$\textit{Univariate regression: } Y = \beta_0 + \beta_1 x_1 + \epsilon$$

$$\textit{Multivariate regression, for k variables: } Y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k + \epsilon$$

5.2.2 Variables and Measures

Dependent Variables:

The event study uses cumulative abnormal returns as the measure of the market's expectations for the expected net present value of the merger, taking careful consideration to the underlying market as a major factor for stock price fluctuations (Bruner, 2002). This is in line with previous research on the subject, using the market based model for comparing actual and expected returns (Deng et al., 2013; Hu et al., 2023; Kyei-Mensah et al., 2017; Tampakoudis et al., 2021). The important implicit assumption in evaluating the economic value of a merger using this measure is that the market is somewhat efficient and adequately adjusts to the new information (Fama, 1970).

CAR (Cumulative Abnormal Returns): A measure of the difference between the actualized and expected return according to CAPM during a specified event window. The measure seeks to understand the abnormal performance of the stock relative to expectations, in order to isolate the effect of the specific event. The beta used is a 3-year daily as argued by Zhang (2017), with the market return set to be the index on which the equity is listed and the risk free rate being the period adjusted 10-year treasury bond.

$$CAR_{i(t_1,t_2)} = \sum_{t=t_1}^{t_2} [R_{it} - E(r_{it})]$$

$$E(R_i) = R_f + \beta_i(E(R_m) - R_f)$$

SD (Normalized Standard Deviation): The second dependent variable used in the study is the normalized standard deviation of the stock price during the event window around the announcement. The SD is interchangeably referred to as volatility and has ties to the mentioned portfolio theory of Markowitz's (1952 & 1959). The measure builds upon financial economics' classical proxy for risk, and normalizes it in order to create a percentage deviation, and hence comparability between varying stock prices. This is a relevant addition of dependent variables, as the information availability due to ESG effort and its subsequent reporting might mitigate volatility (Kim & Park, 2022). Furthermore, similar corporate event studies has found relations between volatility and ESG (Reber et al., 2022; Sassen et al., 2016; Zhu et al., 2014) Standard deviation is computed as:

$$\sigma = \sqrt{\sum_{-t}^{t}(x_t - \bar{x})^2/(N-1)}$$

Where σ denotes the standard deviation, x_t is the value in the data distribution, $\bar{x}$ is the sample average and N is the total number in the sample. The sample data collected was the closing price for each subsequent trading day in order to prevent the analysis of intra day noise in the stock price.

To normalize the standard deviation, the equation needed to reflect a percentage change instead of absolute values. For any stock, dividing the standard deviation of the event window by the average stock price over the same period provides the percentage standard deviation of the stock price. This ensured that stocks with vastly different prices can still be compared in relative volatility.

$$\sigma_{i,t,normalized} = \sigma_{i,t} / ASCP_{i,t}$$

Where:

- $\sigma_{i,t,normalized}$ is the normalized standard deviation for asset *i* during time period *t*,
- $\sigma_{i,t}$ the standard deviation for asset *i* during time period *t*, and
- $ASCP_{i,normalized}$ the average stock closing price for asset *i* during the time period *t*

Independent Variables:

To determine the effect of ESG score on cumulative abnormal returns and stock price volatility following the announcement of a merger, the OLS regression needs ESG score as an independent variable. The regression was done using both its aggregated and individual form in order to find the significance of each factor within the score. This is in line with previous research on the topic, using various types of ESG scores for proxies of performance (Brunner-Kirchmair & Wagner, 2024).

For the following independent variables, the information has been drafted from the Sustainalytics ESG risk scoring methodology (2024).

ESG: The Environmental, Social, and Governance score of the acquiring company, which indicates its sustainability performance and commitment to responsible business practices. The score itself is an aggregated sum of three different assessments, one for the environmental aspect, one for social and

one for governance. The different scores are based on the most material factors for a company, thus serving as a proxy for each categorical performance and also varying between industries. A more elaborate explanation of the ESG scores can be found in the appendix, but worth noting is that a lower ESG score indicates lower ESG risk for both aggregate and individual scores.

E (Environmental): In the environmental aspect, materiality primarily contains resource use and efficiency, waste management, pollution and climate change. These are subsequently part of how much a company impacts natural ecosystems, global warming and e.g. water resources, ultimately leading to how sustainable their practices are.

S (Social): The main focus of the score concerns how companies address their societal impact of business operations and how well they manage related risks and opportunities. These risks and opportunities can be attributed to large resource categories like human capital, product responsibility, or community relations, and therein contain information about materiality like e.g. labor practices, human rights and diversity.

G (Governance): The score indicates the efficiency of the rules and practices used for alignment between owners and managers, promoting transparency and accountability. In total, a good governance score indicates a fair alignment between all the different stakeholders and mitigated financial and reputational risks.

Control Variables:

Previous studies suggest a strong correlation between ESG efforts and financial performance of companies (Friede et al., 2015; Zhang & Guo, 2018). As previously mentioned, not controlling for financial variables has the risk of leading to omitted variable bias. In order to isolate the effect of ESG activity, this study bases its control variables on previous studies conducting similar regressions, indicating the most relevant financial ratios and macro economic factors (Caiazza et al., 2021; Galpin & de Vibe, 2024; Theuerkorn & Meckl, 2015; Ung & Urfe, 2021). The control variables are based on deal size, accounting based profitability ratios, cash flow ratios, liquidity ratios, solvency ratio and growth, used in order to capture the underlying economic substance of the firm. By controlling for the mentioned factors, we mitigate the risk of confounding. For example, a profitable company could have the capacity to invest in ESG and consequently have a better ESG score, potentially creating biased results.

When analyzing previous studies on merger announcement returns, the findings vary depending on both the period and control variables used. In order to include the most relevant control variables we analyzed both the existing studies on the topic, but also turned to other research that illustrates the importance of financial ratios and deal specific factors. Below is a summary and brief explanation of the control variables used in this study.

EV/EBITDA: The ratio of the deal size to the acquiring company's EBITDA (Earnings Before Interest, Taxes, Depreciation and Amortization). This measures the relative size of the deal compared to the company's overall financial capacity which is argued to be an important factor for the merger success expectation (Alexandridis et al., 2013).

Private: Dummy variable indicating if the target company is public or privately owned. The variable is used as a proxy for premium paid and market expectations as previous research found private

companies to be accompanied by a lower premium and better post merger performance (Capron & Shen, 2007).

ROC (Return on Capital): A profitability metric calculated as after tax EBIT divided by the sum of debt and shareholders' equity. It indicates how efficiently a company generates accounting profit available to all funding stakeholders relative to its capital base (Damodaran, 2007).

CF (Unlevered Free Cash Flow Margin): The ratio of unlevered free cash flow (cash flow before interest income/expenses and debt issuance/repayment) to revenue, reflecting how much cash flow a company generates from operations without considering financing costs. The metric is commonly used in fundamental cash flow based valuation of a firm and is shown to have a more significant effect on stock prices compared to accounting profit (Albuquerque et al., 2023).

Current Ratio: A liquidity ratio calculated as current assets divided by current liabilities, which measures the company's ability to meet short-term obligations (Husna & Satria, 2019).

D/E (Debt-to-Equity Ratio): A leverage ratio that compares the company's total debt to its shareholders' equity, providing insights into the company's financial risk and capital structure. This metric is shown to heavily impact the value of the firm, since it has an effect on the firm's cost of capital (Nukala & Prasada Rao, 2021).

Growth: The percentage increase in EBITDA over the past 3 years, reflecting growth in the company's operating profitability over a longer period, shown to have an significant effect on firm value (Nhleko & Schutte, 2024).

Industry Dummies: Dummy variables were used for 11 broad industry categories. This effectively incorporates the industry specific effects and dynamics for each merger or acquisition, making estimates more comparable and the results less confounding (Garcia et al., 2017; Hu et al., 2023; Tampakoudis et al., 2021).

Firm Value: Inspired by a study of Deng et al., (2013), firm value represents the book value of total assets, or alternatively, the sum of equity and liabilities.

5.2.3 Final OLS Models

Following the construction of the model, this section illustrates the formulas used. Note that the dependent variable in each formula is denoted as Dep. Dep is subsequently adjusted to CAR or SD in the same order as the progressive list, depending on which result is sought.

Model 1: Aggregated & separated ESG score univariate regression

$$\textbf{(1)}\ Dep = \beta_1 ESG + \epsilon$$

$$\textbf{(2)}\ Dep = \beta_1 E + \beta_2 S + \beta_3 G + \epsilon$$

Model 2: Aggregated & separated ESG score multivariate regression incl. financial variables

$$\textbf{(3)}\ Dep = \beta_1 ESG + \beta_2 EVEBITDA + \beta_3 Private + \beta_4 ROC + \beta_5 CF + \beta_6 CurrentRatio + \beta_7 DE + \beta_8 Growth + \epsilon$$

$$\textbf{(4)}\ Dep = \beta_1 E + \beta_2 S + \beta_3 G + \beta_4 EVEBITDA + \beta_5 Private + \beta_6 ROC + \beta_7 CF + \beta_8 CurrentRatio + \beta_9 DE + \beta_{10} Growth + \epsilon$$

Model 3: Aggr. & separated ESG score multivariate regression incl. financial and industry variables

$$\textbf{(5)}\ Dep = \beta_1 ESG + \beta_2 EVEBITDA + \beta_3 Private + \beta_4 ROC + \beta_5 CF + \beta_6 CurrentRatio + \beta_7 DE + \beta_8 Growth + \sum_{i=9}^{20} \beta_i Industry_i + \epsilon$$

$$\textbf{(6)}\ Dep = \beta_1 E + \beta_2 S + \beta_3 G + \beta_4 EVEBITDA + \beta_5 Private + \beta_6 ROC + \beta_7 CF + \beta_8 CurrentRatio + \beta_9 DE + \beta_{10} Growth + \sum_{i=11}^{23} \beta_i Industry_i + \epsilon$$

5.2.4 Robustness Checks

To ensure robustness of the results, the event window was designed to be adjusted in order to capture any potential information leakage. Previous research on market efficiency indicates that insider trading and rumors often affect stock prices before the information is revealed to the general public (Caiazza et al. 2021), which is a counterargument to a strong form of market efficiency in the EMH (Fama, 1970). The event window was thus varied between ±1, ±3, ±5, ±7, since similar methods and studies have been constructed so previously (e.g., Caiazza et al. 2021; Tampakoudis et al., 2021). In addition to the varying event window, the gradual extension showcases a more accurate model while significance decreases for the investigated ESG metrics.

Similarly, the final model was adjusted by adding the variable *firm value* in order to test for robustness. Firm value has been used in several earlier studies, e.g. Deng et al., (2013), and is argued to be relevant due to the characteristics enabling a larger firm to invest more in ESG endeavours and improvements. Results on that regression can be seen in the appendix, where no effect can be seen affecting the ESG significance either in aggregated or divided form. An important financial variable that has no further effect on the study, means a conclusion can be made that a majority of confounding financial variables have already been controlled for.

6. Results and Analysis

The results of the study will be presented and analyzed below. The data sample is first described and presented through a variety of measures. We then move on to the results of the regressions, showing the outcome of the different models and event windows, creating comparability to previous research and highlighting the effect of omitting variables.

6.1 Descriptive Statistics

All of the variables used in the study are presented below in table 1. The table contains the number of observations, mean, standard deviation as well as minimum and maximum for each variable. The table is conclusive and includes variables only used in robustness checks, as well as those included in the final multivariate regression model. For improved visibility, they have been grouped by company, deal and macro characteristics.

Table 1: Summarizing statistics for independent and control variables

Category	Variable	Obs	Mean	Std. Dev.	Min	Max
Company-Related Variables						
	ESG	291	22.571	8.395	7.600	52.300
	E	252	6.394	6.451	0.100	28.600
	S	252	9.723	3.339	1.400	22.200
	G	252	6.288	2.931	0.900	14.100
	ROC	269	0.084	0.116	-0.506	0.559
	CF	269	0.103	0.252	-1.780	1.626
	DE	259	1.108	3.300	0.000	50.863
	Current Ratio	270	1.722	3.027	0.000	41.566
	Growth	252	0.190	0.406	-0.638	3.693
	FirmValue	268	82.571	142.499	0.001	1479.549
Deal-Related Variables						
	EVEBITDA	233	-345.073	5027.483	-76666.670	1209.564
	Private	291	0.419	0.494	0.000	1.000
	DealSize	288	5.302	8.384	0.200	59.500
Macro-Related Variables						
	Beta	291	0.999	0.595	-0.250	4.350
	Rf	291	0.041	0.004	0.033	0.049

Table 1 summarizes each of the dependent and control variables. The variables are presented in their raw form, from the initial data collected before outliers are removed. What should be noted is the skewness of the EV/EBITDA which has a minimum of -76666.670. This value indicates an acquiring company with low and negative EBITDA making a deal. This creates a mean value of -345,073 which is far below the realized value excluding the outliers. The data is regressed using robust regression, ultimately removing the extreme values in order to get a more accurate sample.

Since the study is based on the vital importance of the ESG variables, both in its entirety but also separated into E, S and G variables, histograms are presented to indicate the distribution of values they contain.

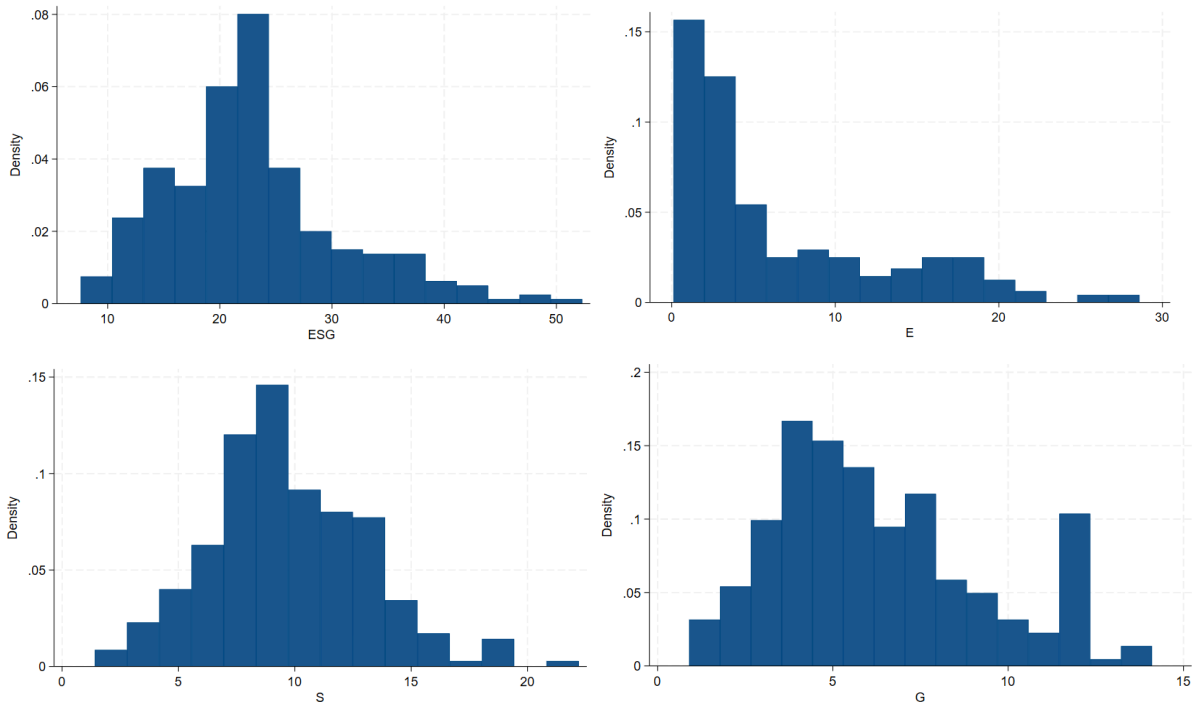

Figure 1: ESG distribution by aggregate and sub-factor

Notably, the ESG metric appears close to normally distributed, while E shows what could be described as a logarithmic decline. Considering the value stakeholders have begun showing for environmentally sound practices, it might be a consequence of overinvestment in green strategies instead of having a holistic view on all of the pillars. This illustrates a skewness in the ESG rating of the independent ESG factors for the current sample.

To indicate a final relationship between variables included in the full multivariate regression model, Table 2 was developed. The table is a covariance matrix indicating each relation, and is based on 234 observations that were subject to analysis.

Table 2: Covariance matrix between ESG and control variables

	ESG	E	S	G	EV/EBITDA	Private	ROC	CF	CurrentRatio	DE	Growth
ESG	1.0000										
E	0.8032	1.0000									
S	0.5433	0.0163	1.0000								
G	0.3139	-0.1335	0.3185	1.0000							
EV/EBITDA	-0.0815	-0.0733	0.0154	-0.0940	1.0000						
Private	-0.0299	0.0194	-0.0576	-0.0691	0.1008	1.0000					
ROC	0.0301	-0.0597	0.1386	0.0622	0.2439	0.1560	1.0000				
CF	-0.0306	-0.1604	0.1100	0.1838	0.0701	0.0391	0.0876	1.0000			
CurrentRatio	-0.0526	-0.0678	0.0077	0.0069	-0.0020	0.0772	-0.0455	-0.0124	1.0000		
DE	-0.1222	-0.0861	-0.0561	-0.1024	0.0163	0.0879	0.1658	0.0123	-0.0654	1.0000	
Growth	0.2869	0.3661	-0.0427	-0.0004	0.0216	-0.0120	0.1435	-0.1142	0.0475	-0.0813	1.0000

Noteworthy, we see a weak negative correlation (-0.1335) between E and G implying that they are most likely treated differently within companies. The inverse relationship suggests that an environmentally harmful company will have relatively better governance. The relationship aligns with the sensitive industry analysis, where publicly scrutinized companies make substantial improvements where they can to keep stakeholder trust. Meanwhile, the companies not primarily harmful for the environment may deal with larger social or governance issues.

Lastly, a last table of the covariance between ESG and Industry variables are presented in table 3.

Table 3: Covariance matrix between ESG and industries

	ESG	E	S	G	Engy	Hlth	Cons	Telc	Ind	Mda	Mtrl	Finc	Tech	RE	Util
ESG	1.000														
E	0.756	1.000													
S	0.549	0.010	1.000												
G	0.241	-0.292	0.223	1.000											
Engy	0.540	0.697	-0.023	-0.139	1.000										
Hlth	-0.190	-0.365	0.284	-0.014	-0.217	1.000									
Cons	-0.009	0.003	0.104	-0.145	-0.132	-0.166	1.000								
Telc	-0.035	-0.075	0.105	-0.047	-0.075	-0.095	-0.057	1.000							
Ind	-0.040	0.068	-0.032	-0.201	-0.147	-0.185	-0.112	-0.064	1.000						
Mda	-0.057	-0.074	-0.012	0.033	-0.046	-0.057	-0.035	-0.020	-0.039	1.000					
Mtrl	0.210	0.338	-0.037	-0.172	-0.108	-0.136	-0.083	-0.047	-0.092	-0.029	1.000				
Finc	-0.079	-0.359	-0.074	0.680	-0.212	-0.266	-0.162	-0.092	-0.180	-0.056	-0.133	1.000			
Tech	-0.292	-0.124	-0.249	-0.182	-0.128	-0.162	-0.098	-0.056	-0.109	-0.034	-0.081	-0.158	1.000		
RE	-0.154	-0.049	-0.210	-0.043	-0.065	-0.082	-0.050	-0.028	-0.055	-0.017	-0.041	-0.080	-0.048	1.000	
Util	0.007	0.071	-0.037	-0.097	-0.046	-0.057	-0.035	-0.020	-0.039	-0.012	-0.029	-0.056	-0.034	-0.017	1.000

The table illustrates that the dummy variables of the industries have a high explanatory power of the aggregate ESG scores, particularly for certain industries like Energy, Materials and Technology.

6.2 Regression Results

In a progressive order, the results of the models will now be presented. Both dependent variables are shown in the same tables to simplify illustration. Beginning with model 1, which only contains ESG information but in two separate versions. First, a univariate OLS regression on ESG and secondly, a multivariate regression on E, S and G.

Model 1

Table 4: Univariate OLS regression aggregated ESG

	Cumulative Abnormal Returns (CAR)				Normalized Standard Deviation (SD)			
Variable	CAR1	CAR3	CAR5	CAR7	SD1	SD3	SD5	SD7
ESG Coefficient	-0.00021	0.00034	0.00052	0.00040	0.00005	0.00023**	0.00029***	0.00034***
Std. Error	0.00034	0.00047	0.00057	0.00065	0.00006	0.00009	0.00010	0.00011
t-statistic	-0.62	0.73	0.92	0.62	0.86	2.50	2.78	3.16
P-value	0.534	0.467	0.358	0.539	0.389	0.013	0.006	0.002
Constant	-0.00103	-0.01121	-0.01583	-0.01058	0.00857***	0.01284***	0.01578***	0.01672***
Std. Error	0.00806	0.01122	0.01353	0.01544	0.00141	0.00224	0.00253	0.00259
t-statistic	-0.13	-1.00	-1.17	-0.69	6.08	5.73	6.23	6.45
P-value	0.899	0.319	0.243	0.494	0.000	0.000	0.000	0.000

Notes: Results are from robust regressions with cumulative abnormal returns (CAR) and normalized standard deviation (SD) as dependent variables. Significance levels are indicated as follows: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 5: Multivariate OLS regression ESG factors

	Cumulative Abnormal Returns (CAR)				Normalized Standard Deviation (SD)			
Variable	CAR1	CAR3	CAR5	CAR7	SD1	SD3	SD5	SD7
E Coefficient	-0.000725	-0.000120	-0.000678	-0.002143**	0.000057	0.000429***	0.000501***	0.000547***
Std. Error	0.000460	0.000652	0.000785	0.000888	0.000079	0.000121	0.000138	0.000149
t-statistic	-1.58	-0.18	-0.86	-2.41	0.72	3.56	3.62	3.68
P-value	0.116	0.854	0.389	0.017	0.473	0.000	0.000	0.000
S Coefficient	0.001064	0.001954	0.003637**	0.004864**	-0.000147	-0.000282	-0.000426	-0.000374
Std. Error	0.000894	0.001263	0.001516	0.001710	0.000154	0.000233	0.000268	0.000287
t-statistic	1.19	1.55	2.40	2.84	-0.96	-1.21	-1.59	-1.30
P-value	0.235	0.123	0.017	0.005	0.340	0.228	0.113	0.194
G Coefficient	0.000647	0.000742	0.000391	-0.001373	0.000038	0.000558**	0.000760**	0.000708**
Std. Error	0.001013	0.001426	0.001734	0.001974	0.000183	0.000278	0.000319	0.000342
t-statistic	0.64	0.52	0.23	-0.70	0.21	2.01	2.38	2.07
P-value	0.524	0.603	0.822	0.488	0.836	0.046	0.018	0.040
Constant	-0.014162	-0.025051	-0.036407**	-0.029362	0.009841***	0.013279***	0.017336***	0.019370***
Std. Error	0.010471	0.014870	0.017869	0.020144	0.001854	0.002817	0.003233	0.003476
t-statistic	-1.35	-1.68	-2.04	-1.46	5.31	4.71	5.36	5.57
P-value	0.178	0.093	0.043	0.146	0.000	0.000	0.000	0.000

Notes: Results are from robust regressions with cumulative abnormal returns (CAR) and normalized standard deviation (SD) as dependent variables. Significance levels are indicated as follows: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Model 1 indicates no significance of aggregate ESG on CAR, but does show significance on a 5% and 1% significance level for SD in the event windows exceeding ±3-days. For the multivariate regression, both E and G coefficients show significance on SD during the same time period of ±3-7 days, with the significance level of 1% for E and 5% for G. For the regression on CAR, E and S show significance and yet again only over the longer event windows. Notably, S, which had no significance on standard deviation, shows significance on a 5% level for the CAR over both ±5 and ±7-day event window. The regression indicates that the variables constituting the aggregated ESG score have different characteristics, and give better detail to analysis when separated.

In this separation, an important pattern is that the negative and decreasing E coefficient value indicates that an increase in CAR tends to correlate with a decrease in E. Due to the scoring methodology used, this refers to an improvement in environmental aspects which supports the hypothesis on increased CAR with better ESG scores. Interestingly though, is that the coefficient values for S and G on CAR are mostly positive, with the sole exception of G on ±7-days event window. This implies that the CAR tends to increase with worse S and G scores, which contradicts the CAR hypothesis. For the SD, there is a pattern of positive values of both E and G under the SD regression, indicating that increased SD tends to correlate with increase in E and G. This is in line with the hypothesis of increased volatility following worse ESG performance, and suggests that there is more associated risk. But for S, there is an inverse correlation which implies less volatility with worse score, contradicting the suggestion.

Model 2:

Table 6: Multivariate OLS regression aggregate ESG and control variables

	Cumulative Abnormal Returns (CAR)				Normalized Standard Deviation (SD)			
Variable	CAR1	CAR3	CAR5	CAR7	SD1	SD3	SD5	SD7
ESG Coefficient	-0.000391	-0.000030	-0.000204	-0.000390	0.000073	0.000208**	0.000258**	0.000287**
Std. Error	0.000362	0.000522	0.000656	0.000793	0.000059	0.000105	0.000119	0.000125
t-statistic	-1.08	-0.06	-0.31	-0.49	1.22	1.98	2.17	2.29
P-value	0.281	0.955	0.756	0.623	0.223	0.049	0.032	0.023
EV/EBITDA Coefficient	-0.000077***	-0.000101***	-0.000106**	-0.000006	0.000100	0.000032***	0.000028***	0.000023**
Std. Error	0.000025	0.000035	0.000044	0.000052	0.000066	0.000007	0.000008	0.000009
t-statistic	-3.11	-2.86	-2.40	-0.11	1.51	4.31	3.33	2.62
P-value	0.002	0.005	0.017	0.911	0.133	0.000	0.001	0.010
Private Coefficient	0.001697	-0.005581	-0.001417	0.003159	-0.001161	0.001132	0.001330	0.001328
Std. Error	0.006680	0.009601	0.012161	0.014318	0.001127	0.001989	0.002248	0.002363
t-statistic	0.25	-0.58	-0.12	0.22	-1.03	0.57	0.59	0.56
P-value	0.800	0.562	0.907	0.826	0.304	0.570	0.555	0.575
ROC Coefficient	0.050112	0.101347*	0.120512*	0.207772**	0.009452	-0.038246***	-0.043120***	-0.037117**
Std. Error	0.038103	0.054609	0.068453	0.080382	0.007373	0.012463	0.014084	0.014826
t-statistic	1.32	1.86	1.76	2.58	1.28	-3.07	-3.06	-2.50
P-value	0.190	0.065	0.080	0.011	0.202	0.002	0.003	0.013
CF Coefficient	-0.033052**	-0.030427	-0.018013	0.017166	-0.009397***	-0.002689	-0.001506	0.002767
Std. Error	0.015997	0.022990	0.029037	0.034306	0.003305	0.005902	0.006670	0.006979
t-statistic	-2.07	-1.32	-0.62	0.50	-2.84	-0.46	-0.23	0.40
P-value	0.040	0.187	0.536	0.617	0.005	0.649	0.822	0.692
Current Ratio Coefficient	0.000609	-0.004610	-0.006909	-0.007412	0.000485	0.000302	-0.000188	-0.000313
Std. Error	0.002588	0.003710	0.004646	0.005463	0.000437	0.000767	0.000867	0.000900
t-statistic	0.24	-1.24	-1.49	-1.36	1.11	0.39	-0.22	-0.35
P-value	0.814	0.216	0.139	0.177	0.269	0.694	0.829	0.728
DE Coefficient	0.001054	0.001433	0.003133	0.001265	0.000794*	0.001094	0.001078	0.000401
Std. Error	0.002775	0.003984	0.005002	0.006028	0.000437	0.000772	0.000873	0.000293
t-statistic	0.38	0.36	0.63	0.21	1.82	1.42	1.24	1.37
P-value	0.705	0.719	0.532	0.834	0.071	0.158	0.218	0.172
Growth Coefficient	-0.017733**	-0.022907**	-0.020003	0.000392	-0.000637	0.002713	0.002846	0.003155
Std. Error	0.007909	0.011484	0.014605	0.017181	0.001379	0.002352	0.002658	0.002801
t-statistic	-2.24	-1.99	-1.37	0.02	-0.46	1.15	1.07	1.13
P-value	0.026	0.048	0.173	0.982	0.645	0.250	0.286	0.262

Notes: Results are from robust regressions with cumulative abnormal returns (CAR) and normalized standard deviation (SD) as dependent variables. Significance levels are indicated as follows: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

In model 2, where all the financial control variables are included, the aggregated ESG score continues to show insignificance on CAR during all event windows. In addition, the significance on SD is reduced to from 5% to 10% for the ±3-days and from 1% to 5% for the ±7-days event window. Instead, there is major significance to the variables EV/EBITDA and ROC, indicating that some of the previously found correlation could be explained by the profitability metrics or other control variables.

Table 7: Multivariate OLS regression ESG factors and control variables

	Cumulative Abnormal Returns (CAR)				Normalized Standard Deviation (SD)			
Variable	CAR1	CAR3	CAR5	CAR7	SD1	SD3	SD5	SD7
E Coefficient	-0.00141**	-0.00106	-0.00254**	-0.00395***	-0.00001	0.00066***	0.00076***	0.00091***
Std. Error	0.00056	0.00081	0.00099	0.00115	0.00009	0.00014	0.00018	0.00020
t-statistic	-2.53	-1.31	-2.57	-3.44	-0.10	4.84	4.12	4.49
P-value	0.013	0.193	0.011	0.001	0.924	0.000	0.000	0.000
S Coefficient	0.00037	0.00029	0.00141	0.00269	-0.00006	-0.00055**	-0.00086**	-0.00086**
Std. Error	0.00113	0.00164	0.00201	0.00233	0.00016	0.00025	0.00034	0.00038
t-statistic	0.33	0.17	0.70	1.16	-0.38	-2.18	-2.51	-2.25
P-value	0.745	0.862	0.484	0.249	0.702	0.031	0.013	0.026
G Coefficient	0.00164	0.00440*	0.00320	-0.00141	-0.00035	0.00037	0.00097*	0.00112*
Std. Error	0.00162	0.00238	0.00299	0.00347	0.00026	0.00039	0.00052	0.00057
t-statistic	1.01	1.85	1.07	-0.41	-1.38	0.97	1.87	1.95
P-value	0.313	0.067	0.286	0.685	0.170	0.335	0.063	0.053
EV/EBITDA Coefficient	-0.00007***	-0.00009***	-0.00010**	-0.00001	0.00016*	0.00001	0.00003***	0.00002***
Std. Error	0.00002	0.00003	0.00004	0.00005	0.00009	0.00001	0.00001	0.00001
t-statistic	-2.93	-2.67	-2.33	-0.24	1.89	1.25	3.56	2.88
P-value	0.004	0.008	0.021	0.808	0.060	0.212	0.000	0.005
Private Coefficient	0.00194	-0.00244	0.00053	0.01955	-0.00105	0.00016	0.00141	0.00222
Std. Error	0.00679	0.00981	0.01211	0.01405	0.00107	0.00168	0.00226	0.00250
t-statistic	0.29	-0.25	0.04	1.39	-0.98	0.09	0.62	0.89
P-value	0.776	0.804	0.965	0.166	0.329	0.926	0.533	0.377
ROC Coefficient	0.02783	0.07628	0.06873	0.14824*	0.01281*	-0.00853	-0.02935**	-0.02572*
Std. Error	0.03825	0.05520	0.06725	0.07792	0.00686	0.01037	0.01395	0.01540
t-statistic	0.73	1.38	1.02	1.90	1.87	-0.82	-2.10	-1.67
P-value	0.468	0.169	0.309	0.059	0.064	0.412	0.037	0.097
CF Coefficient	-0.05632***	-0.07822***	-0.09627***	-0.06316	-0.00885**	0.01093*	0.00379	0.00763
Std. Error	0.01879	0.02715	0.03326	0.03862	0.00413	0.00657	0.00884	0.00980
t-statistic	-3.00	-2.88	-2.89	-1.64	-2.14	1.66	0.43	0.78
P-value	0.003	0.005	0.004	0.104	0.034	0.098	0.669	0.437
Current Ratio Coefficient	-0.00027	-0.00449	-0.00428	-0.00853	0.00056	0.00018	-0.00018	0.00057
Std. Error	0.00262	0.00377	0.00460	0.00533	0.00040	0.00064	0.00086	0.00146
t-statistic	-0.10	-1.19	-0.93	-1.60	1.39	0.28	-0.21	0.39
P-value	0.917	0.236	0.354	0.111	0.165	0.779	0.836	0.695
DE Coefficient	0.00131	0.00312	0.00561	0.00573	0.00076*	0.00125*	0.00146*	0.00145
Std. Error	0.00279	0.00404	0.00495	0.00574	0.00041	0.00064	0.00086	0.00096
t-statistic	0.47	0.77	1.14	1.00	1.85	1.95	1.69	1.51
P-value	0.639	0.441	0.258	0.320	0.067	0.053	0.092	0.132
Growth Coefficient	-0.00991	-0.01046	0.02291	0.05705*	0.00101	-0.00675*	-0.00443	-0.00507
Std. Error	0.01408	0.02093	0.02657	0.03077	0.00234	0.00347	0.00467	0.00520
t-statistic	-0.70	-0.50	0.86	1.85	0.43	-1.94	-0.95	-0.98
P-value	0.483	0.618	0.390	0.066	0.667	0.054	0.345	0.331

Notes: Results are from robust regressions with cumulative abnormal returns (CAR) and normalized standard deviation (SD) as dependent variables. Significance levels are indicated as follows: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

A large change between the first and second model for the separated ESG score, is that E shows significance over more event windows for CAR. Specifically for CAR1, CAR5 and CAR7. The pattern of negative and decreasing E coefficient value is still apparent. However, the size of the coefficients has changed drastically. The size of the E coefficient in the first model for the 1-day event window has changed with a multiple close to 20, from -0.000725 to -0.00141, while for the 7-day event window being twice the absolute size in model 2. While the multiple appears to decay when the event window is extended, it implies that the inverse relationship between E and CAR is stronger with additional control variables.

For the normalized standard deviation in model 2, the separation of E, S and G shifted the results compared to the first model. While separated, SD were shown to be significant over ±3, ±5 and ±7-day event windows for E and S for model 2, instead of E and G. Once control variables are introduced, S is shown to have a negative correlation to SD. In contrast to S and similar to the first model, the positive and growing coefficients for E and G in the SD regression imply that an increase in volatility is correlated with a higher E and G score.

Worth noting is that the most significant variables, on a 1% level on almost all of the first 3 event windows for CAR, is the cash flow and EV/EBITDA. Illustrating that the profitability and relative deal size have a high correlation with CAR following the M&A announcement.

Model 3:

Table 8: Multivariate OLS regression aggregate ESG, control variables, industry and year fixed effect

	Cumulative Abnormal Returns (CAR)				Normalized Standard Deviation (SD)			
Variable	CAR1	CAR3	CAR5	CAR7	SD1	SD3	SD5	SD7
ESG Coefficient	-0.000097	0.000464	0.000305	-0.000861	0.000116*	0.000190**	0.000346**	0.000368**
Std. Error	0.000453	0.000674	0.000817	0.000917	0.000069	0.000095	0.000143	0.000161
t-statistic	-0.21	0.69	0.37	-0.94	1.69	2.00	2.43	2.29
P-value	0.831	0.492	0.709	0.350	0.094	0.047	0.016	0.024
EV/EBITDA Coefficient	-0.000055**	-0.000084**	-0.000079*	0.000043	0.000060***	0.000006	0.000009	0.000012
Std. Error	0.000027	0.000039	0.000047	0.000052	0.000006	0.000006	0.000008	0.000009
t-statistic	-2.05	-2.13	-1.68	0.82	9.64	1.04	1.08	1.29
P-value	0.041	0.034	0.095	0.413	0.000	0.299	0.284	0.198
Private Coefficient	0.002189	-0.009529	-0.006134	-0.003542	-0.002272**	0.000405	0.000969	0.001672
Std. Error	0.006997	0.010316	0.012601	0.013886	0.001066	0.001451	0.002187	0.002464
t-statistic	0.31	-0.92	-0.49	-0.26	-2.13	0.28	0.44	0.68
P-value	0.755	0.357	0.627	0.799	0.035	0.780	0.658	0.498
ROC Coefficient	0.012305	0.080106	0.085092	0.167234**	0.015343**	-0.008944	-0.018514	-0.018703
Std. Error	0.040809	0.060161	0.072688	0.080128	0.007034	0.009359	0.014109	0.015911
t-statistic	0.30	1.33	1.17	2.09	2.18	-0.96	-1.31	-1.18
P-value	0.763	0.185	0.243	0.038	0.031	0.341	0.191	0.242
CF Coefficient	-0.038915**	-0.055631**	-0.044589	0.069614*	-0.013616***	-0.007927*	-0.011754	-0.006108
Std. Error	0.018464	0.027445	0.033698	0.037347	0.003458	0.004777	0.007201	0.008087
t-statistic	-2.11	-2.03	-1.32	1.86	-3.94	-1.66	-1.63	-0.76
P-value	0.037	0.044	0.188	0.064	0.000	0.099	0.105	0.451
Current Ratio Coefficient	-0.001242	-0.003405	-0.004418	-0.008824*	0.000719*	0.000637	0.000748	0.000449
Std. Error	0.002702	0.003979	0.004811	0.005304	0.000404	0.000553	0.000833	0.000930
t-statistic	-0.46	-0.86	-0.92	-1.66	1.78	1.15	0.90	0.48
P-value	0.646	0.393	0.360	0.098	0.077	0.251	0.370	0.630
DE Coefficient	0.001204	0.001713	0.004211	-0.003097	0.000999**	0.002031***	0.002277***	0.000446
Std. Error	0.002764	0.004063	0.004924	0.005596	0.000420	0.000575	0.000867	0.000310
t-statistic	0.44	0.42	0.86	-0.55	2.38	3.53	2.63	1.44
P-value	0.664	0.674	0.394	0.581	0.019	0.001	0.009	0.152
Growth Coefficient	-0.013057	-0.021863*	-0.019478	0.014426	-0.000728	-0.000226	0.000380	0.000684
Std. Error	0.008467	0.012529	0.015281	0.016855	0.001268	0.001735	0.002615	0.002951
t-statistic	-1.54	-1.75	-1.27	0.86	-0.57	-0.13	0.15	0.23
P-value	0.125	0.083	0.204	0.393	0.567	0.896	0.885	0.817
Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Results are from robust regressions with cumulative abnormal returns (CAR) and normalized standard deviation (SD) as dependent variables. Significance levels are indicated as follows: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Model 3 shows no significant correlation between ESG and CAR in aggregate form when controlling for industry. It does however, compared to model 2, show varying positive and negative ESG coefficients. The mix of values indicate that no apparent relationship between aggregate ESG score and CAR can be made.

The significant coefficient in model 3 now appears to be the financial and industry related metrics of the firms. The latter is heavily supported by the ESG and Industry covariance matrix presented in the descriptive statistics, where the industry is shown to be a very strong predictor of ESG score. Several dummy variables explained more than 20% of the ESG score, with a particular high note for Energy with more than 55%. Notably, there is also a major change in the significance of the control variables, indicating that some of the previous correlation is due to the specific industry in which the company operates.

For the SD, the aggregate ESG score continues to show significance with a newly found significance level of 10% on the ±1-days and an increase from 10% to 5% level for the ±3-days event window. This indicates that there is more evidence supporting the second hypothesis, where an increase in ESG score (higher ESG related risks) would hypothetically lead to increased merger announcement volatility.

Table 9*:* Multivariate OLS regression ESG factors, control variables, industry and year fixed effect

	Cumulative Abnormal Returns (CAR)				Normalized Standard Deviation (SD)			
Variable	CAR1	CAR3	CAR5	CAR7	SD1	SD3	SD5	SD7
E Coefficient	-0.000995	-0.001639	-0.002081	-0.005523**	-0.000075	0.000295	0.000976***	0.001031***
Std. Error	0.001031	0.001495	0.001823	0.001944	0.000132	0.000204	0.000297	0.000339
t-statistic	-0.97	-1.10	-1.14	-2.84	-0.57	1.45	3.29	3.05
P-value	0.336	0.275	0.256	0.005	0.569	0.150	0.001	0.003
S Coefficient	0.000854	0.000619	0.001448	0.002685	0.000310*	0.000046	-0.000296	-0.000426
Std. Error	0.001497	0.002169	0.002637	0.002815	0.000165	0.000255	0.000371	0.000424
t-statistic	0.57	0.29	0.55	0.95	1.88	0.18	-0.80	-1.01
P-value	0.569	0.776	0.584	0.342	0.062	0.858	0.427	0.316
G Coefficient	0.001143	0.004124	0.001586	-0.000099	-0.000839***	-0.000093	0.000288	0.000816
Std. Error	0.002027	0.002917	0.003547	0.003782	0.000238	0.000366	0.000533	0.000608
t-statistic	0.56	1.41	0.45	-0.03	-3.52	-0.25	0.54	1.34
P-value	0.574	0.160	0.656	0.979	0.001	0.800	0.590	0.182
EV/EBITDA Coefficient	-0.000045*	-0.000079**	-0.000078	0.000055	0.000084	0.000005	0.000011	0.000010
Std. Error	0.000027	0.000039	0.000048	0.000051	0.000077	0.000005	0.000008	0.000009
t-statistic	-1.66	-2.01	-1.64	1.09	1.09	0.89	1.39	1.14
P-value	0.099	0.046	0.102	0.276	0.278	0.377	0.166	0.256
Private Coefficient	0.003815	-0.005859	-0.000675	0.009262	-0.002393**	0.000748	0.001804	0.002296
Std. Error	0.007397	0.010646	0.013022	0.013898	0.000955	0.001448	0.002109	0.002404
t-statistic	0.52	-0.55	-0.05	0.67	-2.51	0.52	0.86	0.96
P-value	0.607	0.583	0.959	0.506	0.013	0.606	0.394	0.341
ROC Coefficient	0.005440	0.081258	0.072517	0.127262	0.020092***	-0.001301	-0.011677	-0.008998
Std. Error	0.042212	0.060892	0.073743	0.078746	0.006118	0.009228	0.013436	0.015321
t-statistic	0.13	1.33	0.98	1.62	3.28	-0.14	-0.87	-0.59
P-value	0.898	0.184	0.327	0.108	0.001	0.888	0.386	0.558
CF Coefficient	-0.050524**	-0.096877***	-0.103827***	0.030452	-0.017314***	-0.008223	-0.021426**	-0.016811
Std. Error	0.021581	0.031216	0.038342	0.040938	0.003969	0.006157	0.008966	0.010223
t-statistic	-2.34	-3.10	-2.71	0.74	-4.36	-1.34	-2.39	-1.64
P-value	0.021	0.002	0.008	0.458	0.000	0.184	0.018	0.102
CurrentRatio Coefficient	-0.0016	-0.0028	-0.0037	-0.0081	0.0008**	0.0003	0.0003	0.0004
Std. Error	0.0028	0.0041	0.0049	0.0053	0.0004	0.0005	0.0008	0.0009
t-statistic	-0.57	-0.68	-0.76	-1.53	2.40	0.50	0.37	0.42
P-value	0.573	0.499	0.450	0.129	0.018	0.621	0.713	0.676
DE Coefficient	0.0016	0.0040	0.0064	-0.0019	0.0010***	0.0018***	0.0023***	0.0019**
Std. Error	0.0029	0.0042	0.0051	0.0054	0.0004	0.0006	0.0008	0.0009
t-statistic	0.56	0.96	1.27	-0.36	2.83	3.21	2.84	2.02
P-value	0.573	0.336	0.207	0.721	0.005	0.002	0.005	0.046
Growth Coefficient	-0.016581	-0.013326	0.012566	0.050358	0.003668*	-0.003247	-0.003807	-0.003443
Std. Error	0.015690	0.023114	0.029000	0.030934	0.002091	0.003074	0.004476	0.005104
t-statistic	-1.06	-0.58	0.43	1.63	1.75	-1.06	-0.85	-0.67
P-value	0.292	0.565	0.665	0.106	0.082	0.293	0.397	0.501
Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Results are from robust regressions with cumulative abnormal returns (CAR) and normalized standard deviation (SD) as dependent variables. Significance levels are indicated as follows: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

In the individual ESG model 3, there are major changes with regard to the significance of E on CAR, and both S and G on SD. To begin with, the significance level of E on CAR disappears for the event windows ±1, ±3 and ±5-days, and decreases from a 1% to a 5% significance level for the ±7-days event window. Regarding the SD, we see a disappearance of the significance for S and G on SD for all event windows except ±1-days. In addition, the significance of E ceases for the ±3-days, but continues for the ±5 and 7-days event window. Besides the independent variables, many of the control variables change in significance. Indicating that as argued for the aggregate model, the industry is a major factor for the correlation of returns and standard deviation following a merger announcement.

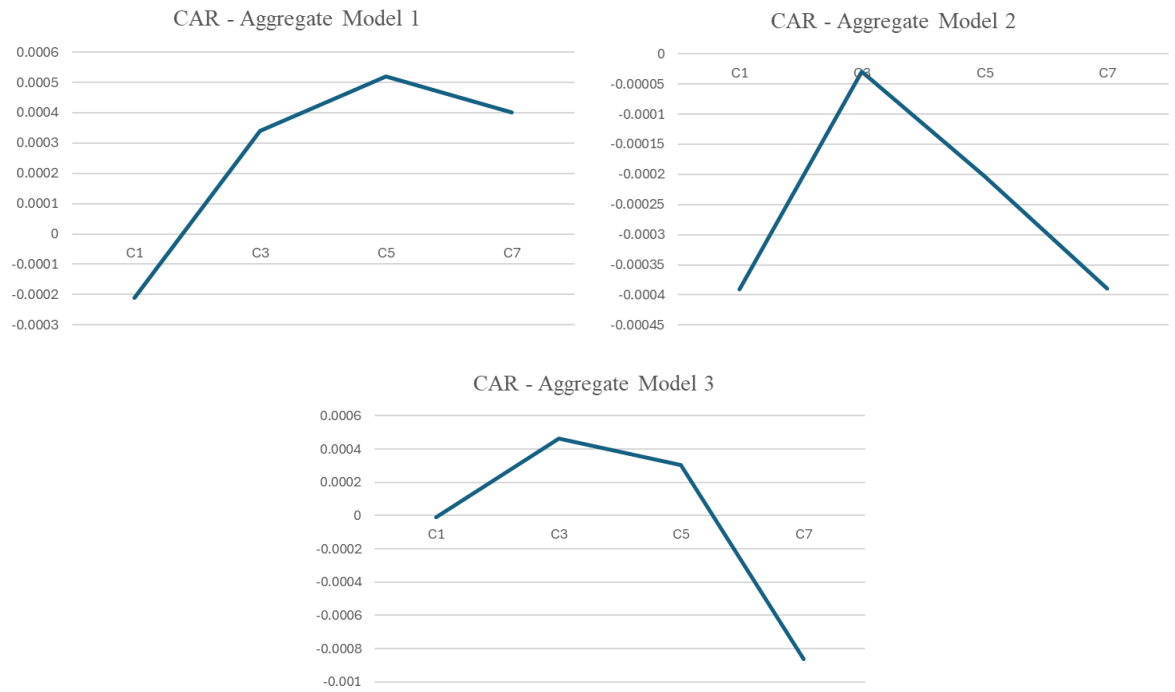

Figure 2: Illustration of aggregate ESG coefficients on cumulative abnormal return

The change in aggregate coefficient has been plotted for each of the event windows. The result shows a trend and pattern of reverting CAR for all models when comparing between the event windows. The trend begins with negative correlation, shows improvements, and finally reverts back.

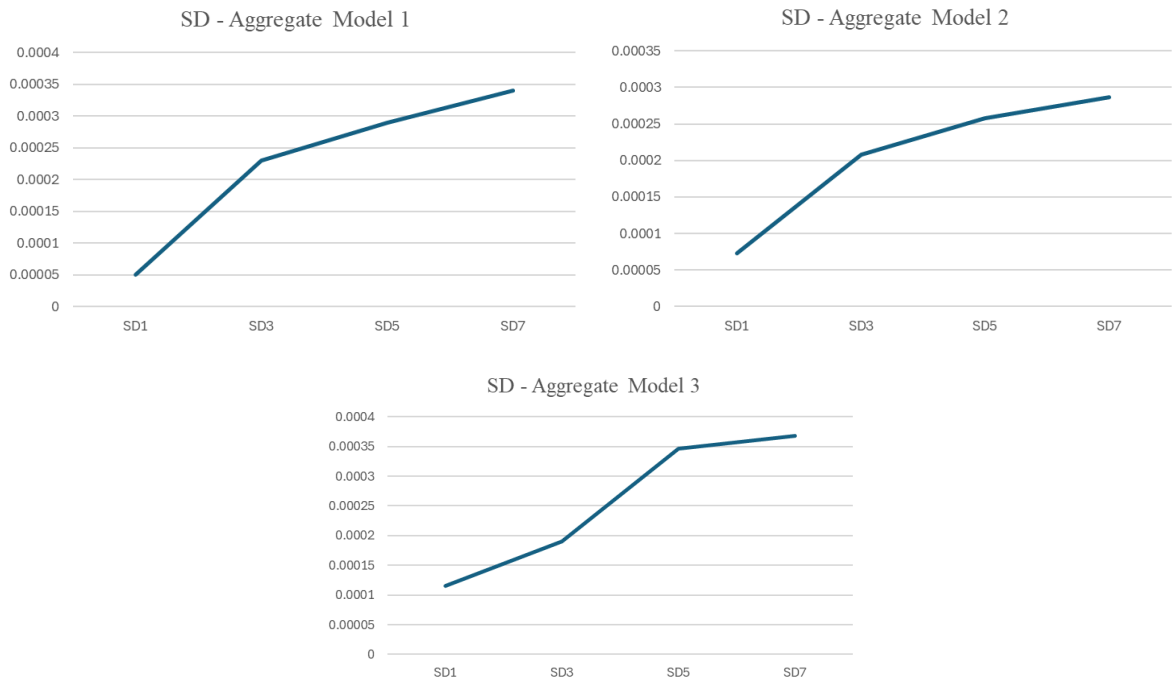

Figure 3: Illustration of aggregate ESG coefficients on normalized standard deviation

The SD is also plotted against the aggregate ESG, showing a steadily increasing SD as the event window is expanded. This indicates increased volatility in relation to their mean at larger event windows.

The plots of CAR and SD against aggregate ESG highlights the characteristics which in turn influence the results. This will later be revisited in the discussion, where analysis of the implications will be put into perspective of the presented theories and literature. For further disclosure of the pattern, the separated ESG scores are plotted similarly in the appendix.

To summarize, the results vary with regard to the significance of aggregate and independent ESG as well as for the different event windows for both CAR and SD. In model 1 the aggregate ESG shows no significance for CAR and lower significance levels for SD. When the ESG factors are analyzed independently, both E and S show significance at different windows with a tendency for greater significance at larger event windows. As control factors are introduced in model 2, the significance level of the E increases for both CAR and SD, although still remaining insignificant in aggregate form for CAR. As the control variables are introduced, the significance of S ceases to show significance. An important detail is the change of coefficient values between the two models, further cementing the importance of relevant control variables. In model 3, industry dummy variables and year fixed effects are introduced. In this model aggregate ESG regressed on CAR continues to show insignificance whilst E now shows a 5% significance level on the ±7-day event window. The ±5-day and ±7-day event window for SD now show a 1% significance level for E during but loses the significance for S.

7. Discussion

In this chapter, a complete discussion about the study will be conducted in parts. First, a discussion of the results will be made, followed by limitations of the study. Lastly, a recommendation for further studies is presented.

7.1 Implications of Results

In our three different models, we incrementally increase the amount of variables that are controlled for in the OLS regression. This means that the results are subject to change when the models are changed per design. Consequently, there are different perspectives on the results and this discussion will treat several of them. First, the two listed hypotheses are discussed separately.

7.1.1 Hypothesis 1 - *Acquirers with low ESG scores will experience larger cumulative abnormal returns following a M&A announcement*

In our initial model 1, we find no significant effect of aggregate ESG and some effect for the individual E and S factors on CAR. We also notice how the coefficients are larger for the separated ESG score compared to the aggregate. The model is at this stage very simplistic and omits many of the variables which are deemed important by previous studies (Deng et al., 2013; Hu et al., 2023; Kyei-Mensah et al., 2017; Tampakoudis et al., 2021). While relevant to showcase the importance of extended models, the model is by itself weak in credibility to prove the hypothesis. The primary takeaway from the first model is the initial appearance of the pattern for the E and S coefficients, where E is negatively correlated and S is positively correlated with a higher CAR.

As we introduce more control variables in model 2, we continue to see insignificance for the aggregate ESG score, while E shows significance on multiple event windows. As mentioned in the results, there is still a large factor being omitted, namely the industries. Earlier research had different approaches to this issue. Caiazza et al. (2021) only controlled for industry by exclusively examining data from the hospitality sector, while Hu et al., (2023) and Tampakoudis et al., (2021) grouped their data into low and high scoring quartiles. Compared to Kyei-Mensah et al. (2017) who didn't control for industry in their OLS-regression, model 2 can be seen as a proxy. But as shown in the covariance matrix, the industry is a strong predictor of the final ESG score of a company. Between model 2 and 3, our firm stand is that the inclusion of industry is the most reasonable option, and that the loss of significance is a reasonable consequence of us removing confounding effects.

Despite the loss of statistical significance in the regression, the patterns of values for the coefficients are the same which implies that the hypothesis is still relevant. In model 3, the negative correlation of E coefficient and the positive correlation of S coefficient with regard to CAR remains, although insignificant for S. For M&A, the market appears to show weak interest in the social aspects of ESG, and higher value on the environmental aspects. Although ESG is supposed to be a holistic scoring system, the findings of this relationship coupled with the ESG score distribution of Figure 1 indicates that the relevance of each factor is not equally weighted. This will be further explained in the link between results and general expected behaviour, but it could be an indication of herding behavior. In this sense, herding behaviour would suggest that since the environmental factor gets a lot of media attention, it is increasingly perceived as important for both corporate strategies and investors.

The diminishing effect in significance of aggregated ESG, and our final result that there is none, is in line with the research of Kyei-Mensah et al. (2017), who came to the same conclusion when using an OLS regression. From the covariance table, it is evident that ESG is not largely correlated with any of the control variables introduced in the model. Furthermore, the covariance between the dependent factors are relatively small, ranging between -0.292 and 0.223. Although there is some correlation between for example growth in EBITDA and the Environmental factor, the other variables do not have significant explanatory power for ESG. Due to this, the final model should not be negatively affected by multicollinearity. Instead, the models' increasing complexity only highlights the risk of omitting important variables that could increase the accuracy of the study.

Although aggregate ESG shows insignificance, it is still interesting to analyze the pattern it shows when regressed on CAR for the different event windows. The trend shows a negative correlation starting point with an increase towards the middle period and finally a decline in the later event windows. This could indicate that even though the result is not significant, there is a slight tendency of overreaction from the market in the analyzed data. This would be in line with the research of Kahneman and Tversky (1977), and not be too far fetched when considering the subjective nature of ESG scores.

The underlying reason for the industry fixed-effects can be many, but the rationale can be simplified. The primary argument is that companies with good ESG scores operate within industries that generally have better expectations on M&A. This could be a consequence of lower regulations imposed on those industries, stemming from less potential harm of the associated ESG risk. Ultimately, this enables better conditions for M&A activity. An industry such as utilities or energy have high regulations and barriers to entry, creating a completely different dynamic compared to the consumer industry. Dobers & Halme (2009) argues that ESG measures and improvements are oftentimes a result of external pressures within an industry rather than a direct strategic ambition. This is in line with the explanation that the industry specific factors weigh heavier than the company specific scores. It also aligns with Garcia et al., (2017) and the reflections about how sensitive industries under scrutiny have to compensate for the, primarily environmental, damage they cause in order to gain stakeholders' trust.

A final important note is that improvement in the E coefficient is positively correlated with CAR in all the event windows, for all of the models. This is in contrast with the opposite findings of Tampakoudis et al. (2021) during the Covid-19 pandemic. The negative effect during the pandemic was reasoned to be due to companies and individuals prioritizing ESG less when exposed to financial turmoil. Even though the macro-environment has experienced other major disturbances since then, such as wars, inflation and political conflicts, the value of the environmental factors seems to be restored in a M&A context. The findings do as previously mentioned align to some extent with the studies pre-pandemic, also finding a positive financial impact of ESG efforts (Deng et al., 2013; Hu et al., 2023). Compared to these studies however, we do not find any significant relationship between aggregate ESG score and CAR. The reasons could be many and potential explanations are the smaller sample, different control variables or a change in the public perception of ESG over the given time period compared to those studies. While certain control variables were the same, complementary sources such as Capron & Shen (2007) and Albuquerque et al. (2023) gave inspiration to expand on the financial metrics of the acquirer to reduce the amount of omitted variables. The literature in finance was researched in order to find the most relevant of these omitted variables, making the tradeoff of somewhat lower comparability to similar studies worthwhile to have.

7.1.2 Hypothesis 2 - *Acquirers with high ESG scores are correlated with higher levels of merger announcement stock price volatility*

Previous research suggests that ESG efforts increase information availability, reduces idiosyncratic risk and improves reputation (Reber et al., 2022; Zhu et al., 2014). All of these factors are testaments of transparency and will according to Freeman et al. (2010) contribute to improved stakeholder relationships. The improved stakeholder relationship reduces uncertainty, and consequently, the stock price should be less volatile after an announcement. A complementary study on M&A announcements in emerging markets have demonstrated that stock price volatility is closely linked to information availability (Zhu et al., 2014). Similar findings have been reported for IPOs, where good ESG scores are associated with reduced volatility (Reber et al., 2022). This makes it likely that the lower SD following merger announcements is also attributable to improved information availability stemming from ESG disclosures and reporting. It is also worth comparing these results to those of Sassen et al. (2016), who found a strong correlation between ESG efforts and a company's beta. Beta, which reflects a stock's exposure to systematic risk, is in part influenced by a company's resilience to regulatory risks. The decreased SD from aggregate ESG may therefore confirm the reduced risk associated with effective ESG efforts.

An important detail about the second hypothesis is that in contrast to the first, ESG shows significant positive correlation to the dependent variable on all of the models. The positive correlation indicates that worse ESG scores are accompanied by higher SD following M&A announcement, which is in line with our hypothesis.

Just as for hypothesis 1, the first models are vague and unreliable due to the inherent confounding effects. However, there is the obvious pattern of correlation between a worse aggregate ESG score and higher SD, which holds throughout the extension of the models.

Notably, E exhibits an inverse correlation with SD for both ±1-day event windows in model 2 and 3. For each longer event window, the coefficients are growing, the correlation is positive and increasingly significant. This is true for aggregate ESG as well, as can be seen in the results section. In the figures the SD seems to follow an increasing pattern over the extended event windows. This increase is most likely the effect of individual trends. Each asset is subject to a particular trend, whether upwards, downwards or stagnant. In turn, the SD metric is in absolute values and will capture either movement and amplify the value of SD. It is therefore reasonable that the SD is increasing over longer event windows.

For the inverse correlation in the short event window, there is a possibility that it is related to CAR and to the efficient market hypothesis. The proposed relation is intuitive. In the case of a M&A announcement for an environmentally friendly company, the increase in standard deviation following announcement day might be a consequence of a surge in stock prices due to new information. SD would in that case be misleading, as the surge is not associated with an immediate risk but rather the market reaction to good news. With the same argument, a worse E scoring company would not experience the proposed one day surge. However, the subsequent longer event windows indicate for both model 2 and 3 that a higher score for E and G will lead to higher SD, although with very large P-values for G. While the efficient market hypothesis aligns with the surge, another explanation is the overreaction behaviours introduced by Kahneman & Tversky (1977). If media pressure forces corporate strategies and institutional investors to prioritize good E scoring companies, they probably

will. Subsequently, the instantaneous market reaction will cause the proposed pattern in the first day following announcement while the subsequent days will counteract it.

The actual results of model 3 are not explicitly in favor of the hypothesis. The S coefficients seem to contradict the patterns of E and G, but do so with smaller coefficients and high P-values. Coupled with similar observations from the first hypothesis, a fair assumption is that S in general has weak relevance to stock market reactions both for CAR and SD. Related to earlier remarks about unequal weighting, S appears to be the least relevant for predicting returns or volatility following M&A announcement. Notably though, both S and G are significant on a 10% and 1% level on the ±1-day event window, but with relatively small coefficients. What is very interesting is that the G factor has the opposite sign compared to what was initially expected. As a higher governance score indicates higher governance risks, the result implies that increased governance risk might lead to lower normalized standard deviation for the stock. The reasoning for the results can have multiple explanations, one is the interpretability and complexity of each metric. As markets seem to react almost instantaneously to S and G factors, it could be argued that information is more easily interpreted. Easier interpreted information leads to faster market reactions.

This result is especially intriguing when considering the distribution of ESG scores in aggregate and by individual components. Our data analysis, regressions and discussion has so far covered E, S and G. Between them, there is a strong argument that the most relevant impact for stock price SD is the E factor. The impact may be directly attributed to companies' focus on environmental aspects. This focus is evident in the concentration of companies in the better-scoring segment of the distribution as compared to the social or governance distribution. As seen in the results, there is a skewed distribution where most companies score well in E. Related to theory, this skewed distribution is likely explained by herding behavior applied to businesses, primarily driven by the growing trend of environmental emphasis in recent years. As companies are increasingly evaluated on environmental metrics in public opinion, the greater availability of related data reduces information asymmetry caused by insufficient data sharing. Consequently, it is reasonable that E is the primary cause behind significant findings and has the largest coefficients after the ±1-day event window among the ESG metrics.

7.1.3 Link Between Results and General Expectations

The results show weak relevance for parts of the hypotheses. Particularly for CAR, which is rather surprising considering the proposed research of ESG's positive impact on financial metrics. However, it's already been established that M&A is complex, and despite reliance on the best of economic theories, the market behaviour is hard to predict. One possible influence on the lack of CAR is the prospect theory of Kahneman & Tversky (1979). According to the theory, an investor receiving a sudden gain in the stock market is more likely to sell it quickly, while the same investor might hold on to a sudden loss and hope for a rebound effect. In relation to the theory, any sudden gains of CAR might be counteracted by the investors willingness to sell to realize the profit. Consequently, a sudden loss will not trigger the same response, and thus not cause the same turnover trading pattern. While this is not entirely embodied in the results, it might act as an anchor to the hypothesized outcome. Another important influence, in line with Tampakoudis et al. (2021), external events of a macro level magnitude can affect the impact of ESG in investor sentiment. When there is global turbulence in the financial market, people tend to show less appreciation to sustainability endeavours.

At the time of both the analyzed M&A announcements and the writing of this report, there is an ongoing war in Ukraine and Palestine creating unrest, as well as a presidential election in the U.S

where the victor admittedly cares less about the environment. These events correspond to a degree with the unrest experienced during the Covid-19 pandemic, and might hinder any significant findings for abnormal returns of good ESG scoring companies.

In this turbulent world, the rationales of stakeholder and shareholder theory become apparent. Related to the expectation on market behaviour of the investor, which was explained by the behavioural finance theory, the stake- and shareholder theory instead have the perspective of the company. If investor sentiment leads to pressure for ESG efforts, companies will likely abide. In the scenario of less market interest due to the external events discussed, the relevance of ESG will falter as there is no stake- or shareholder to satisfy by those efforts. In this sense, any eventual herding behaviour of investors or companies underlying the good environmental scores is a flaw in human behaviour that has led to a positive outcome.

What should be illustrated by the expansion of our models is that there is great risk of omitted variable bias. As we introduce control variables, industry dummies and year fixed effects, we can see a great change in the significance of the independent variables. This change is something very important to note, as some of the previous studies, such as Kyei-Mensah et al. (2017), fail to control for something as vital as the industry of the asset. When examining the definition of the ESG scores provided by Sustainalytics, they are said to be harmonized in order to create comparability between industries. This does however not translate to a reduction in the industry specific effects following a merger announcement. Other studies such as Caiazza et al. (2021) and Tampakoudis et al. (2021) also find varying results when grouping together quartiles based on ESG scores, and having the good scoring companies in one designated group as a dummy variable. One important implicit effect of doing so is the exclusion of the companies operating within sensitive industries that can be predicted by their ESG scores. In practice, this means that their studies systematically exclude certain bad scoring industries from analysis.

When analyzing the covariance matrix relating ESG to industry we can see that the covariance of ESG and the Energy sector is 0.54. Likely, based on the data for this study, no single Energy or Material company will be present in an analysis covering the highest scoring quartile. A fair assumption is that removing these companies from the analysis therefore creates a bias in the results. Should that not be the case, there still exists an issue where the high scoring companies might be subject to other biases. For instance, Zhang and Guo (2018) found an U-shaped relation to social efforts and financial performance of a company. Like many models in economics there should be diminishing returns to investments, making it holistically less optimal to be either a frontrunner or a laggard in ESG. This is of course something that can have a great impact on the model and its consequent results.

7.2 Limitations of Study

The study investigated the change of stock prices pre and post announcement dates for the largest deals conducted by global, listed companies in the financial year of 2023 to 2024. The decision to only investigate the largest deals was to ensure adequate ESG scores and control variables. However, it also meant a fairly limited data set. By constricting the timeframe to two years, external factors and effects on the global economy were already partly controlled for, but not entirely. Due to this, a fixed year effect variable was introduced, but it is still biased to the analyzed period.
What should be noted is that the results are heavily focused on the acquirers past performance, implying that they serve as a basis for future performance. There is also a great need to take additional

deal specifics into consideration when evaluating the M&A reaction, including things such as cash or stock deal, the premium paid and if the deal was hostile or not. Further focus on the target company would improve the quality of the results. Ideally considering the target ESG score, financial performance, culture, relatedness to acquiring company and geographical differences. Furthermore, ESG metrics are argued to be a core indication of current company risk. The acquisition and improvement of a target company with low ESG capabilities could therefore be seen as a source for incremental value beyond the financial (Caiazza et al., 2021; Galpin & de Vibe, 2024; Theuerkorn & Meckl, 2015; Ung & Urfe, 2021). In our search for data to improve the study and investigate this, we found that many of the acquired firms were either private or too small to have publicly available ESG scores. This meant that inclusion of target company ESG scores would drastically reduce available transactions for analysis, cascading the problem with the already limited dataset. As the implementation of ESG metrics develop and become more available for smaller companies, the dynamic of acquirer and target ESG is an excellent subject to research.

Another integral factor and implicit assumption made in the study is that markets are pricing stocks correctly based on the available information, tying to the efficient market hypothesis (Fama, 1970). Instead of the CAPM, the four factor model or daily return market model could have been used to contrast the expected returns. The research of Kyei-Mensah et al. (2017) uses varying economic models in order to ensure robustness and eliminate the model bias. Furthermore, all the models are building on market expectations that do not necessarily need to be correct, and only time will tell if the companies with better ESG scores are able to reliably outperform their competitors long-term.

Our study's focus on the measure of CAR and SD is effectively putting a lot of trust in shareholder theory. What should be noted is that even though the study finds some effect with regards to those measures, the additional utility for society is limited because of the narrow focus on shareholders. As argued by Zhang and Guo (2018), the financial performance of a company focusing on social responsibility follows an inverted U-shaped curve. Although this indicates a negative second derivative for the function of financial performance, it does not need to be true for the general utility of society. ESG metrics might continue to gain increased importance in society and people might value this higher than the financial performance. In that case, the "green-premium" can increase and subsequently shift the utility curve (Kranias et al., 2024; Ung & Urfe, 2021).

Another major limitation is the ESG measure by itself, where the data used was extracted from one single actor. Explained in the appendix, there are several strong actors in the ESG risk scoring market. While there are no apparent benefits or risks from either model, solely relying on one makes the study less robust, as different scoring methodologies might have different perspectives on the same set of companies and the materiality they consider. Ultimately, this flaw suggests that some companies might have been slightly favoured in their score compared to if a weighted and harmonized ranking system between different models were used.

The OLS regression does by itself have inherent flaws which were seeked to be reduced as much as possible by removing outliers and controlling the data. Despite those efforts, the model may still exhibit endogeneity and omitted variable biases for the uncontrolled variables. There could also be factors having a nonlinear relationship, which although tested could have been misinterpreted. Furthermore, OLS models have in some instances been shown to produce insignificant results when other models are more appropriate, at least according to Kyei-Mensah et al. (2017). Due to the incremental increase in variables used to investigate how the significance would vary, this study did not employ more advanced prediction models as OLS was the best viable option. Several other works

did similarly (Caiazza et al., 2021; Deng et al., 2013; Tampakoudis et al., 2021). However, Kyei-Mensah et al. (2017) found that the asymmetric GARCH specification tailored to their investigated variables showed significance while the OLS did not.

7.3 Recommendations for Future Studies

The study is, to the best of our knowledge, first in its kind to assess the normalized standard deviation in the event windows of M&A announcement. To further analyze the actual effect of ESG and its impact on M&A today, more consideration should be taken to deal structure, target companies and financial performance in comparison to expectations, preferably during a longer timeframe. To expand on the topic, a follow up of how the analyzed firms actually performed over time would be an excellent subject to evaluate.

Another interesting topic that would improve today's research would be to conduct a comparison progressively between years, fixing effects and seeing how the relationships develop over time with more available data. The previous research does show that there is an increased demand for ESG efforts, and we would ideally like to see this study as a potential benchmark for future research. The current investigated relation between CAR, SD and ESG will likely not be permanent, making further investigation in the subject important to capture any changes in e.g. investor sentiment. What should be noted however, is that the introduction of ESG remains an impactful force in the dynamics of risk and return models used in economics. Many other studies have analyzed how ESG could reduce risk and increase available information. Our study hopes to complement these findings from other researchers and bridge together subjects in financial economics. How ESG will affect the dynamics and predictability of risk and returns in the future is something we believe is very important and should be investigated.

8. Conclusion

This study has investigated the role of ESG metrics in influencing stock market reactions to M&A announcements, focusing on CAR and stock price SD in two separate hypotheses. While aggregated ESG scores showed limited significance in predicting CAR, the environmental component consistently emerged as a significant factor. With regard to SD, both aggregate ESG and the independent factors show significance. These results suggest that the environmental dimension of ESG plays a pivotal role in its relevance.

With this finding, the study indicates that increased information availability due to ESG efforts may mitigate volatility to some degree, aligning with prior research on the role of transparency in reducing uncertainty.

The study did not find any satisfying conclusive information about the hypothesis of increased CAR for good-scoring ESG companies, despite the underlying theory and literature suggesting it to be reasonable. The only consolidation is that the pattern of coefficients align with the stated hypothesis, which contradicts the earlier findings of similar research during the covid-19 pandemic. One explanation behind lack of significance might have been due to the studies limitations, such as the narrow time frame and the dataset. Another explanation might be the fact that there is currently none to be found due to global turmoil in financial markets. The limitations emphasize the need for caution when generalizing the findings. Future research could expand on this by exploring broader datasets, different economic environments, and more long-term implications of ESG on post-merger performance.

In conclusion, this thesis contributes to the growing body of literature on ESG and financial markets, reinforcing the importance of incorporating sustainability metrics into corporate strategies. In addition, we contribute by adding the dimension of normalized standard deviation related to M&A announcement, connecting to bordering research and deepening the understanding of the subject. Finally, we illustrate the importance of control variables, especially showing the relevance of industry-fixed effects as well as the difference between aggregate ESG scores and its independent parts. Hopefully, this will help in navigating the complexities of ESG and M&A, providing a solid foundation for further studies on the post-pandemic markets.

9. References

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10. Appendix

Industries:

1. Energy
2. HealthCare
3. Consumer
4. Telecom
5. Industrials
6. Media
7. Materials
8. Financials
9. Technology
10. RealEstate
11. Utilities

ESG SCORES

There are several prominent third party companies offering objective ESG scores. To mention a few, there is Sustainalytics, S&P Global ESG, MSCI Research ESG, JUST Capital and EcoVadis. These all have their own assessment of materiality, and provide different scores when applying their methodology on a company's fundamentals.

To display why results from one ESG scoring party can not be directly compared to another, an introduction to two of the different ESG scoring models is presented. The first is Sustainalytics by Morningstar which is used in the study and thus gets a deeper explanation. The second is S&P global ESG.

Sustainalytics (2024) is an American company that makes a two dimensional assessment of a company's exposure to risk, and then its ability to manage those risks. First, 22 material ESG issues (MEI) by a company's sub-industry are identified. The exposure is measured according to the specific sub-industry characteristic and available data, like information about business model, geographical presence and historical events. These are then adjusted with Beta-indicators, showing deviations from the sub-industry average. Next, the management dimension is assessed in terms of policies, employed systems or responses to controversies. Unmanaged ESG risk is calculated by subtracting the company's managed risk from its total exposure. The unmanaged risks across all MEIs are then aggregated to produce the company's overall ESG risk score. After assessment, companies are placed into five risk categories: negligible, low, medium, high, or severe, based on their overall score.

The thresholds for Sustainalytics "ESG Risk Ratings" are as follows, based on total score:

- Negligible risk: Score between 0 and 9.9.
- Low risk: Score between 10 and 19.9.
- Medium risk: Score between 20 and 29.9.
- High risk: Score between 30 and 39.9.
- Severe risk: Score of 40 and above.

S&P Global ESG is a party based in Sweden, with international ties primarily to the U.S. Their assessment combines company disclosures, media analysis, and quantitative data modeling. Companies are assessed on up to a thousand underlying data points and assigned an overall relative

ESG score ranging from 0 to 100, where higher scores indicate better performance (S&P Global, 2024).

The thresholds for S&P Global ESG total scores are not absolute. The scores are roughly normal distributed and can be indicated as:

- Better than average ESG Performance: Score of 51 and above.
- Average ESG Performance: Score of 50.
- Worse than average ESG Performance: Score of 49 and below.

Importantly, despite not having the same structure or weights for variables, both the developed scoring systems provide a value as final score. This allows for cross-industry comparisons of ESG risks in each model, as a company that has a total score can be compared relative to others that have been assessed the same way. However, the indication of performance is different in scale and reversed, so a good score for one model would be a bad one for the other, proving that no direct comparison can be made between the two separate models final scores, only the relative ones (Sustainalytics, 2024; S&P Global, 2024).

Table 10: Robustness control for FirmValue

	Cumulative Abnormal Returns (CAR)				Standard Deviation (SD)			
Variable	CAR1	CAR3	CAR5	CAR7	SD1	SD3	SD5	SD7
E	-0.0011	-0.0017	-0.0021	-0.0056***	-0.0000	0.0003	0.0010***	0.0010***
	(-1.03)	(-1.10)	(-1.13)	(-2.91)	(-0.14)	(1.54)	(3.32)	(3.04)
	[0.305]	[0.274]	[0.261]	[0.004]	[0.889]	[0.127]	[0.001]	[0.003]
S	0.0005	0.0006	0.0015	0.0025	0.0004**	0.0001	-0.0002	-0.0004
	(0.37)	(0.29)	(0.55)	(0.90)	(2.26)	(0.27)	(-0.60)	(-0.87)
	[0.713]	[0.773]	[0.585]	[0.368]	[0.025]	[0.786]	[0.551]	[0.384]
G	0.0018	0.0044	0.0020	-0.0011	-0.0010***	-0.0001	0.0002	0.0008
	(0.88)	(1.47)	(0.55)	(-0.30)	(-4.47)	(-0.16)	(0.30)	(1.24)
	[0.379]	[0.143]	[0.583]	[0.768]	[0.000]	[0.875]	[0.766]	[0.216]
EVEBITDA	-0.0000	-0.0001*	-0.0001	0.0000	0.0001	0.0000	0.0000	0.0000
	(-1.52)	(-1.94)	(-1.55)	(0.91)	(1.40)	(0.98)	(1.42)	(1.17)
	[0.131]	[0.055]	[0.123]	[0.367]	[0.164]	[0.329]	[0.158]	[0.243]
Private	0.0021	-0.0060	-0.0011	0.0098	-0.0025**	0.0008	0.0020	0.0024
	(0.29)	(-0.56)	(-0.08)	(0.71)	(-2.76)	(0.57)	(0.98)	(1.03)
	[0.773]	[0.576]	[0.936]	[0.482]	[0.007]	[0.568]	[0.328]	[0.305]
ROC	0.0042	0.0803	0.0703	0.1369*	0.0215***	-0.0014	-0.0123	-0.0094
	(0.10)	(1.31)	(0.95)	(1.74)	(3.67)	(-0.15)	(-0.93)	(-0.62)
	[0.921]	[0.191]	[0.345]	[0.084]	[0.000]	[0.882]	[0.353]	[0.534]
CF	-0.0410	-0.0950***	-0.1008***	0.0334	-0.0187***	-0.0071	-0.0190**	-0.0148
	(-1.91)	(-3.03)	(-2.61)	(0.82)	(-4.87)	(-1.13)	(-2.13)	(-1.45)
	[0.058]	[0.003]	[0.010]	[0.415]	[0.000]	[0.262]	[0.035]	[0.150]
Current Ratio	-0.0016	-0.0031	-0.0042	-0.0072	0.0009***	0.0001	0.0001	0.0002
	(-0.56)	(-0.73)	(-0.83)	(-1.33)	(2.67)	(0.20)	(0.07)	(0.17)
	[0.576]	[0.467]	[0.410]	[0.186]	[0.008]	[0.838]	[0.941]	[0.862]
FirmValue	-0.0001 (0.324)	-0.0000 (0.765)	-0.0000 (0.680)	0.0001 (0.268)	0.0000 (0.096)	-0.0000 (0.212)	-0.0000 (0.197)	-0.0000 (0.308)
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

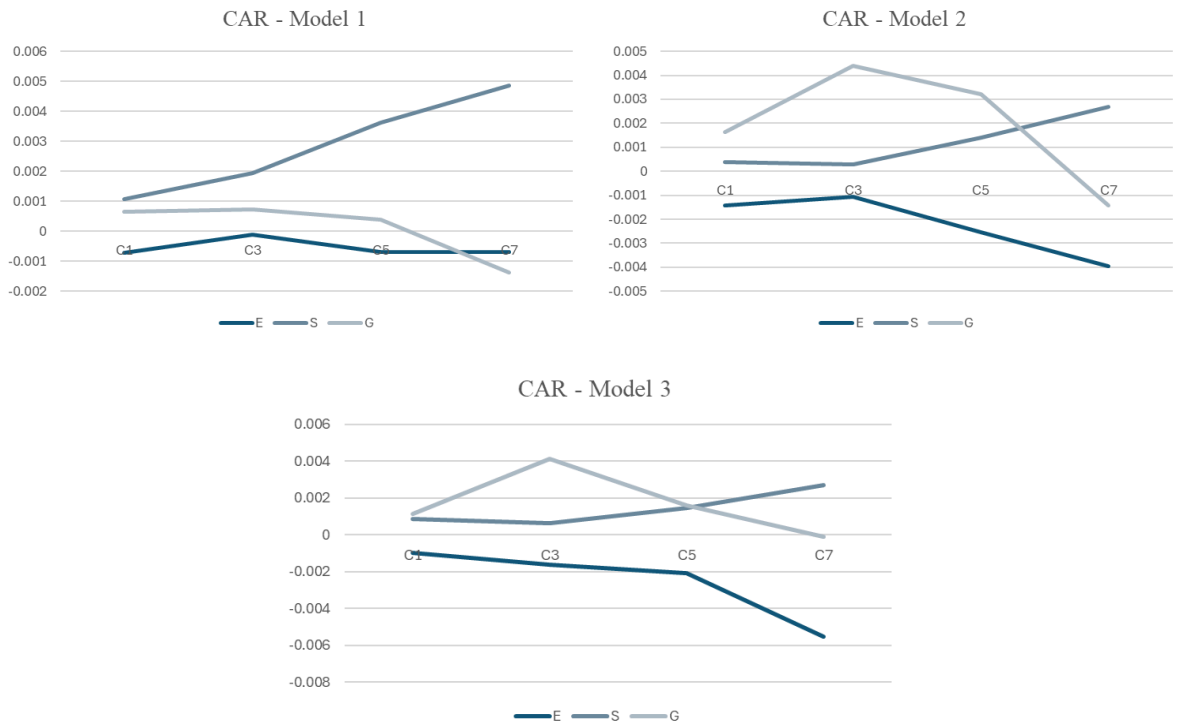

Figure 4: Illustration of ESG's coefficients on cumulative abnormal return

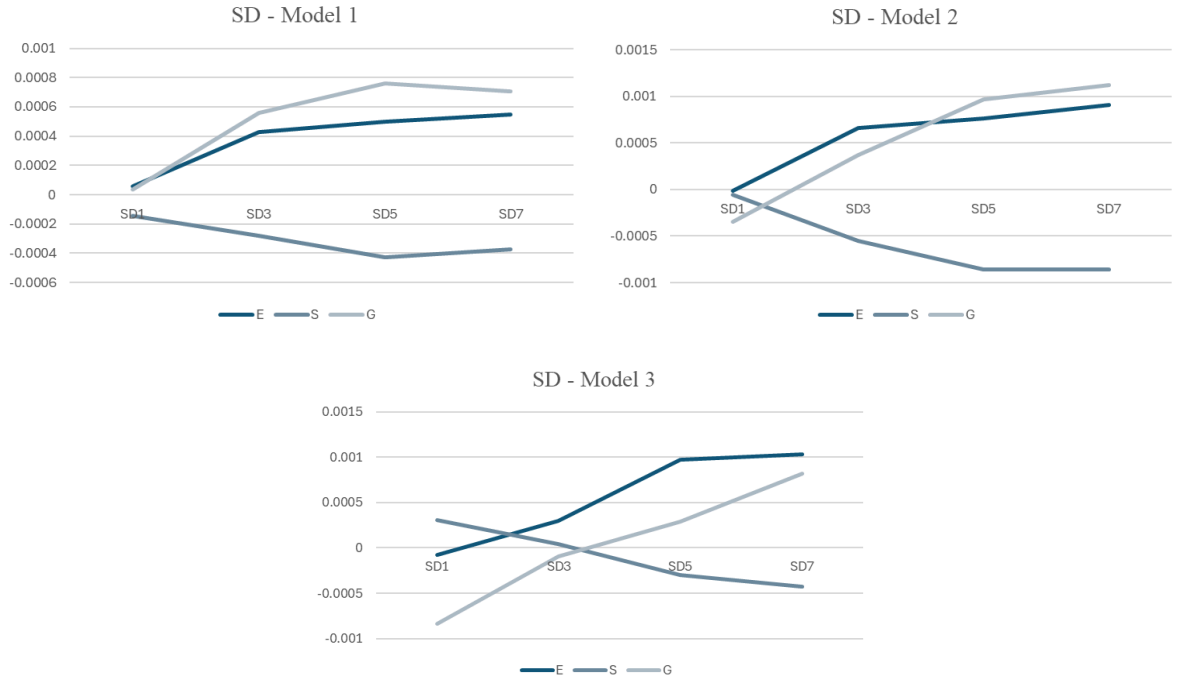

Figure 5: Illustration of ESG's coefficients on normalized standard deviation