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Sustainability in M&A: Empirical Findings on the Effect of ESG Scores on M&A Performance

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Abstract

This study investigates the short- and long-term impact of ESG scores on M&A performance across listed companies in the United States and Europe. Utilizing event study methodology and OLS regression analysis with various control variables, the research examines the influence of acquirer ESG, target ESG, and their interaction on cumulative abnormal returns surrounding deal announcements, post-merger return on assets, and bid premiums spanning from 2002 to 2024. It is hypothesized that higher ESG scores of both acquirers and targets, as well as their interaction, positively influence M&A performance and deal valuation. The results show no significant association between ESG and cumulative abnormal returns but reveal that higher ESG scores for both acquirers and targets are positively related to the bid premium, with a significant negative interaction effect. For the return on assets ratio, limited evidence suggests a positive link between the acquirer and target ESG. The findings contribute to a deeper understanding of how ESG characteristics influence M&A outcomes and have implications for corporate strategic decision-making, investor valuation, and academic research on sustainable finance.

Generative AI tool ChatGPT was used to assist in coding, data analysis, and refining the language of this thesis. Section 8.2 of this thesis provides a detailed account of the use of Generative AI tools during the development of this thesis. By submitting this thesis, I declare that I am fully responsible for the accuracy and completeness of its content.

Table of Contents

1	Introduction.....	5
2	Literature review and Hypothesis Development	8
2.1	Conceptual literature	8
2.2	Empirical literature.....	10
2.2.1	ESG and Financial Performance	10
2.2.2	M&A and Financial Performance	11
2.2.3	The Intersection of ESG Performance and M&A Outcomes	12
2.3	Hypotheses.....	13
3	Methodology.....	15
3.1	Data and Sample	15
3.2	Dependent Variables.....	16
3.2.1	CARs.....	16
3.2.2	ROA.....	17
3.2.3	Bid Premium.....	17
3.3	Independent Variable: ESG	18
3.4	Control Variables.....	19
3.5	Preliminary Descriptive Analysis	21
3.5.1	Descriptive Statistics	21
3.5.2	Heteroscedasticity and Multicollinearity	23
3.6	Econometric Specifications for Hypothesis Testing	27
4	Results	30
4.1	Regression Analysis Statistics	30

4.1.1	Hypothesis 1: Acquirer and Target ESG Performance and CARs	30
4.1.2	Hypothesis 2: Acquirer and Target ESG Performance and Changes in ROA	35
4.1.3	Hypothesis 3: Acquirer and Target ESG Performance and the Bid Premium	37
4.1.4	Hypothesis 4: Acquirer ESG and Target ESG Interaction and M&A Outcomes..	39
4.2	Robustness Tests	41
5	Discussion	42
5.1	Interpretation of Results and Comparison with Prior Research	42
5.2	Limitations and Suggestions for Future Research	48
6	Conclusion	50
7	References	51
8	Appendices	55
8.1	Appendix A Additional Analyses and Figures	55
8.2	Appendix B AI Usage Documentation	64

1 Introduction

In recent years, Environmental, Social, and Governance (ESG) considerations have become a more important element in corporate decision-making. The 2015 Paris Agreement played a key role in this transition, establishing global commitments to sustainability and prompting businesses to integrate ESG factors into their strategies. ESG serves as a globally acknowledged framework for assessing corporate responsibility beyond financial performance, influencing investment decisions and regulatory policies worldwide (Guerrero & Viteri, 2024). As institutional investors and stakeholders increasingly prioritize ESG metrics, firms are compelled to align their operations with sustainability principles.

Mergers and Acquisitions (M&A) are among the most significant corporate strategies for growth, market expansion, and competitive advantage. Traditional M&A research has largely focused on financial synergies, operational efficiencies, and strategic fit as primary determinants of deal success (Renneboog & Vansteenkiste, 2019). However, the growing emphasis on sustainable finance and responsible corporate governance, and thus the integration of ESG factors in M&A decision-making, has recently gained attention. A statistical analysis by the Boston Consulting Group (2022) revealed that the number of annual M&A deals increased by 60% between 2011 and 2021, with the steepest growth occurring in the last year, 2021. This raises questions about the impact of ESG considerations on post-deal performance.

As the importance of ESG considerations in corporate decision-making continues to grow, so does the body of research investigating its implications for business strategy. One area of particular interest is the relation between ESG performance and M&A activities, where the role of sustainability in corporate transactions remains a subject of debate. The rising prominence of ESG has introduced new complexities in evaluating deal success. Academicians have increasingly turned their attention to the extent to which ESG scores influence post-merger performance, but findings in this field remain fragmented and, at times, contradictory.

Existing studies provide diverse perspectives on how sustainability measures influence M&A success. Some findings suggest that high corporate social responsibility (CSR) scores contribute positively to merger performance, supporting the notion that firms with strong social practices enjoy better financial and operational integration post-merger (Deng et al., 2013). This perspective aligns with the stakeholder value maximization theory, which argues that socially

responsible firms experience higher merger announcement returns and improved long-term performance (Kaptein, 2025). Similarly, research indicates that acquirers of firms with strong environmental and social risk management practices are rewarded by the stock market, implying that sustainable investments create value for shareholders (Aktas et al., 2010). Moreover, the integration of ESG-conscious firms may enhance the overall sustainability profile of the acquirer, reinforcing the idea that firms learn from their targets and incorporate responsible business practices (Feng, 2021).

However, other studies reveal a more nuanced and sometimes contradictory reality. Some research suggests that the financial performance of firms engaging in ESG-focused M&A activities does not always align with market expectations. For instance, while ESG factors may increase the likelihood of M&A transactions, acquiring firms' financial performance can suffer, particularly in the short term, as integration costs and stakeholder expectations create unforeseen challenges (Feyisetan et al., 2025). Additionally, ESG incidents, particularly those related to environmental and social controversies, can significantly reduce merger success probability and lead to lower premiums, raising concerns about whether ESG-driven deals are inherently beneficial (Cai & Deng, 2025). These inconsistent findings display the complexity of ESG's role in M&A and suggest that its impact might vary depending on several aspects such as firm characteristics, industry contexts, and the specific ESG dimensions being considered. Consequently, the role of ESG considerations in shaping post-merger performance remains an area of ongoing debate, therefore, highlighting the need for further research to establish a clearer understanding of the relationship between ESG scores and M&A outcomes.

Given the existing inconsistencies in prior research, this study aims to provide a clearer understanding of the relationship between ESG scores and M&A outcomes. Specifically, it addresses the following main research question: How do ESG scores influence M&A performance in the U.S. and European markets? These regions are considered frontrunners in both merger and acquisition activity and ESG integration, which enhances the reliability, consistency, and comparability of available data.

Using a comprehensive sample of approximately 2,700 M&A transactions involving acquiring firms with ESG data, and a subset of 150 deals with ESG information available for both acquirer and target, including relevant controls, this study investigates the relationship between ESG performance and M&A outcomes. An event study approach in combination with regression

analysis is employed to capture short-term market reactions, long-term post-deal performance, and deal premium determinants. The empirical results indicate that ESG scores of either the acquirer or the target are not significantly related to cumulative abnormal returns (CARs) around the announcement date. In the longer term, however, acquirer ESG scores show a modest but positive association with post-merger Return on Assets (ROA), whereas target ESG scores display more consistent and statistically significant effects. In terms of valuation, acquirers with higher ESG scores tend to offer higher deal premiums, and targets with strong ESG profiles also appear to attract higher premiums, although the latter effect is less robust. Finally, a slightly negative interaction between acquirer and target ESG scores is observed in relation to the deal premium. Nonetheless, the individual effects of both acquirer and target ESG remain positive and statistically significant.

Understanding the relationship between ESG performance and M&A outcomes has gained increasing relevance in both academic research and corporate practice. As firms face increasing pressure to align financial strategies with sustainability goals, ESG factors are playing an ever more prominent role in investment and acquisition decisions. For investors, this raises the question of whether ESG-aligned firms generate superior returns. For policymakers, it informs the development of disclosure standards and regulatory incentives aimed at promoting sustainable corporate governance.

This study contributes to the existing literature in several keyways. First, it offers robust empirical evidence on the relationship between ESG performance and both short- and long-term M&A outcomes, including deal valuation. Second, it engages with competing theoretical frameworks by demonstrating that the findings align more closely with the stakeholder value maximization perspective than with traditional shareholder primacy. Third, by focusing on two leading capital markets, namely the U.S. and Europe, where ESG integration is comparatively advanced, the study delivers regionally grounded insights with broader relevance for executives, investors, and regulators seeking to balance financial performance with sustainability goals.

2 Literature review and Hypothesis Development

2.1 Conceptual literature

The role of ESG factors in corporate strategy and decision-making is deeply embedded in the ongoing academic debate about the purpose of business and its obligations to various stakeholders. This debate is framed by two foundational theoretical perspectives: Freeman's (1984) Stakeholder Theory and Friedman's (1970) Shareholder Theory. These theories offer distinct viewpoints on corporate responsibility and have implications for how ESG considerations are integrated into business practices such as M&A.

Freeman's Stakeholder Theory challenges the traditional profit-maximization paradigm by arguing that corporations must create value for all stakeholders, not just shareholders (Freeman, 2010). According to this view, a firm's success is contingent upon its ability to balance the interests of diverse groups, including employees, customers, suppliers, communities, and the environment. Freeman emphasizes the ethical responsibility corporations have towards these stakeholders, advocating for long-term sustainability rather than short-term gains. In the M&A context, Stakeholder Theory justifies the integration of ESG factors as a strategic imperative. By conducting thorough ESG due diligence, acquirers can identify potential risks, such as regulatory penalties or reputational damage, and leverage opportunities for synergies through enhanced alignment with key stakeholders. A target firm with strong ESG credentials, for example, is more likely to experience smoother post-merger integration, as employees and communities are more inclined to support organizations that align with their ethical values. Thus, Stakeholder Theory frames ESG not as an additional cost but as a catalyst for resilient value creation, where stakeholder welfare is directly linked to the company's long-term success.

In contrast, Friedman's Shareholder Theory holds that the primary responsibility of a corporation is to maximize profits for its shareholders, provided it operates within the bounds of the law and ethical norms. Friedman famously dismissed ESG initiatives as 'socially responsible distractions', arguing that unless these actions directly contribute to financial returns, they should not be prioritized. Under this theory, managers are agents of the shareholders and are expected to focus on short-term profitability, with little regard for broader societal concerns unless they

directly affect the financial bottom line. In the M&A context, this perspective views ESG-related investments, such as sustainability audits or diversity initiatives, as inefficiencies unless they yield tangible financial benefits, such as energy savings or the attraction of ESG-focused investors. Thus, under Shareholder Theory, M&A deals with poor governance or overall ESG scores might be justified if they offer immediate revenue growth.

However, recent work by Kaptein (2025) provides a nuanced reconciliation of these two seemingly opposing frameworks. Rather than positioning Stakeholder and Shareholder Theories as mutually exclusive, Kaptein proposes that shareholder interests can and should be aligned with stakeholder welfare. A critical aspect of this perspective is Kaptein's challenge to the assumption that shareholders are solely driven by profit maximization. While Friedman acknowledges that shareholders' preferences can vary, Kaptein argues that shareholders have a moral obligation to consider the interests of other stakeholders. This view reframes CSR not as a conflict with the interests of shareholders, but as an extension of them. Shareholders, as the ultimate owners of the corporation, are ethically bound to serve the interests of stakeholders because these interests contribute to the long-term sustainability and success of the business. This approach avoids the dismissal of Shareholder Theory but instead adapts it to incorporate broader societal values, suggesting that a company's duty to stakeholders is not in opposition to, but rather a reflection of, its duty to shareholders.

Kaptein's theoretical integration offers a potential bridge between the two perspectives, fostering dialogue and complementarity. It allows businesses to ethically serve both their shareholders and the wider community, suggesting that pursuing ESG objectives is not merely a moral obligation but a strategy that ultimately benefits shareholders as well.

In summary, the integration of ESG factors into corporate decision-making, particularly in the context of M&A, is framed by competing theoretical perspectives. Stakeholder Theory advocates a holistic approach to corporate responsibility, emphasizing long-term sustainability and alignment with a broad range of stakeholder interests. Shareholder Theory, by contrast, prioritizes profit maximization for shareholders, often sidelining ESG considerations unless they directly enhance financial performance. Kaptein's work offers a reconciliation of these two perspectives by suggesting that shareholder interests can be ethically aligned with stakeholder welfare. Building on this integration, the use of both short-term stock market performance and long-term accounting-based metrics is theoretically justified to assess the financial impact of

ESG in M&A. These measures reflect the dual focus on creating shareholder value and fostering stakeholder alignment, making them appropriate and relevant proxies for evaluating ESG influence on post-merger outcomes.

2.2 Empirical literature

2.2.1 ESG and Financial Performance

A substantial body of empirical research has examined the relationship between ESG performance and corporate financial performance (CFP), with findings generally supporting a positive association. Friede et al. (2015) conducted a meta-analysis aggregating results from over 2,000 empirical studies and found that approximately 90% of the studies reported a non-negative relationship between ESG and CFP, with a clear majority identifying a positive effect. These results, which span different regions, asset classes, and methodological designs, suggest that ESG integration is not only compatible with but can also enhance financial returns. Notably, the positive ESG-CFP relationship appears to be robust across time and especially promising in emerging asset classes such as green real estate and corporate bonds.

More recent evidence by Chen et al. (2023) reinforces these findings using a dataset of over 24,000 observations from 3,332 listed companies across the globe. Their study confirms a statistically significant positive relationship between ESG ratings and corporate financial performance, particularly for large-scale firms and those operating in high-risk environments. The authors attribute this effect to the reputational, operational, and financial advantages that ESG integration can provide, such as increased investor trust, lower financing costs, and enhanced brand value. Importantly, their findings align with stakeholder theory by demonstrating that companies that actively engage in ESG practices tend to outperform peers in both financial and non-financial dimensions.

Together, these studies underscore a growing consensus in the literature: ESG factors are not merely ethical or regulatory considerations but are increasingly seen as strategic drivers of corporate performance. This evidence strengthens the rationale for incorporating ESG metrics into performance evaluation frameworks, including those in the context of mergers and acquisitions.

2.2.2 M&A and Financial Performance

The financial performance of acquiring firms following M&A has been the subject of extensive research, yet findings remain inconclusive for both the short and long term. Many studies focus on short-term market reactions, often using CARs around the announcement date, but even here results vary. Similarly, long-term financial outcomes, whether assessed via stock returns or accounting measures such as ROA, also show mixed evidence (Baker et al., 2011).

In the short term, acquirers tend to generate zero or slightly negative abnormal returns upon deal announcement. However, evidence from non-U.S. contexts suggests that acquirers can sometimes achieve positive abnormal returns, highlighting the potential influence of institutional and market-specific factors.

More troubling for acquiring firms is the body of evidence pointing to long-term underperformance. Numerous studies report significantly negative abnormal stock returns over a one- to three-year period following an acquisition. This persistent pattern challenges the assumption that managers reliably create shareholder value through M&A activity.

In response to these puzzling findings, scholars have increasingly turned to accounting-based indicators such as ROA as alternative measures of post-merger performance. Compared to market-based metrics, these indicators are typically less volatile and may better capture underlying operational changes resulting from the acquisition. However, empirical studies using accounting measures also yield inconsistent results, offering no definitive conclusions about the value implications of M&As.

Recent research has introduced a more nuanced perspective by focusing on M&A capability, the acquiring firm's internal ability to effectively execute and integrate deals, as a key determinant of post-merger success. Vinocur et al. (2022), adopting a strategic management lens, demonstrate that acquirers with strong M&A capabilities, measured via advanced analysis of qualitative firm disclosures, tend to perform better in the long run in terms of ROA and valuation metrics. These findings suggest that successful value creation depends not only on strategic alignment between firms but also on execution quality and integration effectiveness.

In sum, the long-term financial effects of M&As on acquiring firms remain complex and context-dependent. While many acquirers struggle to deliver lasting gains, those with robust internal capabilities and strategic coherence appear more likely to achieve positive outcomes.

2.2.3 The Intersection of ESG Performance and M&A Outcomes

Empirical research exploring the intersection between ESG performance and M&A outcomes reveals a growing interest in how sustainability-related factors influence both the success and strategic direction of acquisitions. Building on the positive relationship between ESG and corporate financial performance, recent studies suggest that ESG characteristics also play a meaningful role in shaping M&A deal outcomes and post-merger performance.

Aktas et al. (2010) provide early evidence that acquirers benefit from targeting firms with strong social and environmental performance, observing positive abnormal stock returns around the announcement of such deals. Deng et al. (2013) extend this view by demonstrating that acquiring firms with high CSR ratings not only achieve higher announcement returns but also show improved long-term stock and operating performance. Moreover, their results indicate that these firms tend to complete deals more quickly and successfully, reinforcing the stakeholder theory perspective that M&As can deliver value beyond shareholder wealth alone.

More recent contributions offer additional insights into the longer-term implications of ESG in M&A settings. Caiazza et al. (2021) find that firms with high ESG scores generally experience improved long-term financial performance following an acquisition. Rahmani et al. (2024) results align with the view that successful integration and stakeholder engagement play a central role in driving long-term value creation post-acquisition.

The relationship between ESG and M&A activity also varies across industries and firm types. Feyisetan et al. (2025) report that firms with higher ESG scores are more likely to engage in M&As, particularly in the financial sector. However, their study also highlights short-term financial drawbacks, namely high ESG ratings are associated with reduced announcement returns for financial firms, though this effect is weaker and statistically insignificant for non-financial firms. In the long run, however, strong ESG performance is linked to better financial outcomes across both sectors, reinforcing the earlier conclusions about ESG's long-term strategic benefits.

Finally, Ma et al. (2023) demonstrate that acquiring firms with robust ESG profiles tend to generate greater post-merger shareholder value, especially in the context of state-owned and non-family enterprises. This supports the broader notion that ESG integration, when aligned with effective M&A execution, can enhance both firm reputation and operational performance over time.

Taken together, these findings underscore the multifaceted role of ESG in M&A activity.

While ESG factors may not always significantly affect short-term market reactions, particularly at the announcement stage, they appear to play an increasingly important role in shaping long-term financial and non-financial outcomes. Therefore, a comprehensive evaluation of post-M&A acquirer performance requires a multidimensional approach that incorporates both market-based and accounting-based performance measures. As acquirers aim to generate lasting value, integrating ESG into M&A strategy and due diligence may serve as a critical driver of post-merger success.

2.3 Hypotheses

Building on the conceptual integration of Stakeholder and Shareholder Theory (Kaptein, 2025), as well as the growing empirical consensus that ESG performance enhances corporate financial performance (Chen et al., 2023; Friede et al., 2015), this study proposes that ESG characteristics play a crucial role in shaping the outcomes of mergers and acquisitions. The inclusion of ESG factors in M&A analysis is increasingly seen as both an ethical obligation and a source of competitive advantage. Stakeholder Theory suggests that firms engaging in responsible ESG practices are better positioned to manage risks and build long-term stakeholder trust, while emerging empirical findings point to tangible financial benefits following ESG-integrated deals (Deng et al., 2013; Ma et al., 2023).

The hypotheses below are derived from these theoretical and empirical foundations and are organized around three core areas of post-merger performance: short-term market reaction, long-term performance, and deal valuation.

Research by Aktas et al. (2010) and Deng et al. (2013) shows that acquirers with high ESG or CSR scores achieve superior short-term stock market reactions around deal announcements, likely due to investor expectations of enhanced reputational value, smoother integration, and reduced risk. Stakeholder-aligned acquirers are perceived as more capable of successfully managing complex transactions. Therefore, the first set of hypotheses concerns the relationship between ESG characteristics and the short-term market response to M&A announcements.

H1A: *The CAR of the acquiring firm around the M&A deal announcement is positively related to the acquiring firm's ESG score.*

H1B: *The acquiring firm's CAR around the M&A deal announcement is positively related to the target firm's ESG score.*

While the short-term market reaction is important, sustainable value creation is often reflected in long-term financial outcomes. ESG performance may signal management quality, long-term orientation, and stakeholder alignment, which are key to successful post-merger integration (Chen et al., 2023; Rahmani et al., 2024). Furthermore, Caiazza et al. (2021) found that firms with strong ESG profiles tend to achieve superior post-merger ROA, consistent with the strategic benefits of ESG alignment. Based on this reasoning, the following hypotheses regarding long-term financial performance after M&A are formulated:

H2A: *The change in ROA after the M&A deal is positively related to the acquiring firm's ESG score.*

H2B: *The change in ROA after the M&A deal is positively related to the target firm's ESG score.*

In M&A transactions, bid premiums reflect the acquirer's perceived value of the target. A target with a strong ESG profile may be viewed as more valuable due to reputational benefits, stakeholder goodwill, or lower integration risk. From a stakeholder theory perspective, this implies that acquirers are willing to pay more for firms that bring ESG-related intangible assets. While this might reduce short-term acquirer returns, it can indicate strategic investment in long-term value. The third set of hypotheses therefore addresses how ESG characteristics relate to the valuation of M&A deals, as reflected in the bid premium.

H3A: *The bid premium paid by the acquiring firm is positively related to the acquiring firm's ESG score.*

H3B: *The bid premium paid by the acquiring firm is positively related to the target firm's ESG score.*

Beyond the individual ESG scores of acquiring and target firms, the interaction, the alignment, or the mismatch between their ESG profiles may influence post-merger outcomes. Some studies suggest that acquiring a higher-rated ESG target may allow the acquirer to improve its ESG profile and benefit from reputational or strategic advantages (Deng et al., 2013; Ma et al.,

2023). However, other research highlights the potential for integration challenges when ESG orientations between firms diverge significantly (Rahmani et al., 2024). Given these mixed findings, no specific directional effect is assumed. Instead, It is hypothesized that ESG interaction meaningfully affects CARs, ROA changes, and the bid premium. This is captured through an interaction term between the acquirer and target ESG scores.

H4: *The interaction between the ESG scores of the acquiring and target firms is significantly associated with the acquiring firm's CAR, the change in ROA, and the bid premium paid.*

3 Methodology

3.1 Data and Sample

This study utilizes data from the financial database LSEG and M&A transaction data from Orbis M&A, covering completed acquisition deals regarding listed companies in the United States and Europe from 2002 to 2024. The dataset spans multiple industries, ensuring broad applicability and relevance across sectors.

Overall, the dataset comprised 2,742 deals from the US and 25 European countries, for which ESG scores of acquiring firms were available. After incorporating ESG scores for target firms, the number of usable observations was reduced to about 220. Both datasets are used in this research. One focuses solely on acquirer-level ESG data, while the other combines ESG data from both acquirers and targets.

The analysis investigates the short- and long-term effects of ESG scores on M&A performance. In the short term, CARs surrounding the deal announcement date serve as a measure of market reaction. For the long term, the ROA is used to assess post-merger financial performance. Additionally, the bid premium is examined as a third key outcome, reflecting the acquirer's willingness to pay, potentially influenced by the ESG characteristics of the target. This framework, including multiple dependent variables, allows for a comprehensive evaluation of ESG's influence on deal outcomes across different time horizons.

An analysis of deal frequency over time is shown in Figure 2. The distribution of M&A activity between 2002 and 2024 is highly uneven, with visible peaks and troughs reflecting broader economic dynamics. Deal activity increased notably between 2003 and 2007, reaching an

early high in 2006 and 2007. This was followed by a sharp drop in 2008 and 2009, coinciding with the global financial crisis. From 2010, it shows a pattern of moderate recovery and fluctuations, with a significant resurgence between 2015 and 2019, peaking in 2018 with nearly 180 deals. A temporary dip is visible in 2020, likely due to the COVID-19 pandemic, but activity remained relatively high in 2021. Since 2022, however, deal frequency has declined again, indicating a cooling trend in the later years of the sample. How the current research deals with this distribution will be further explained in section 3.6.

Acquirer sector classification, based on Standard Industrial Classification (SIC) codes from the U.S. Securities and Exchange Commission, reveals that the distribution of M&A deals across different acquiring sectors, based on custom industry categories with SIC ranges (Figure 3). The majority of deals are concentrated in the Manufacturing sector (2000–3999), followed closely by Finance, Insurance, and Real Estate (6000–6799). These two sectors alone account for a substantial portion of total M&A activity. Services (7000–8999) and the combined category of Transportation, Communication, Electric, Gas, and Sanitary Services (4000–4999) also show notable deal volumes, although at a significantly lower level. In contrast, sectors such as Public Administration, Wholesale Trade, and Construction exhibit minimal M&A activity.

Geographically, the dataset is dominated by U.S.-based acquirers, accounting for nearly half of the transactions. The remaining deals are concentrated in European countries, with the United Kingdom and France following the United States in frequency.

Despite limited availability of certain variables, such as target ESG scores, the dataset includes comprehensive coverage of key variables like acquirer ESG scores, CARs, ROA, and bid premiums. Combined with the broad temporal, sectoral, and geographical coverage, the dataset offers a robust and representative foundation for testing how ESG characteristics relate to M&A performance across different contexts.

3.2 Dependent Variables

3.2.1 CARs

To evaluate the impact of a specific event on stock prices, this study employs an event study methodology that focuses on the concept of abnormal returns. Abnormal returns represent the difference between a stock's actual observed return and the return that would be expected in the absence of the event. To estimate the expected return, this study uses the market model, a

commonly applied approach in financial event studies, as outlined by Brown and Warner (1985). The model assumes a linear relationship between the return of a given stock and the return of a market index.

Specifically, for firm i on day t , the abnormal return (AR) is defined as the difference between the actual return and the expected return, calculated as $AR_{i,t} = R_{i,t} - (\alpha_i + \beta_i \cdot R_{m,t})$, where R_t denotes the return on the market index on day t , and α and β are the firm-specific parameters estimated via regression over an estimation window. In this study, the estimation window from day -250 to -30 is chosen to ensure stable parameter estimates by using a sufficiently long pre-event period. Ending the window well before the event introduces a buffer that minimizes the risk of contamination from information leakage or anticipation effects.

To assess the overall effect of the event over multiple trading days, abnormal returns are aggregated across the event window, resulting in the CAR. The CAR captures the total abnormal return attributable to the event over a defined time span. This study evaluates CARs across several event windows, specifically: [-2, +2], [-1, +1], [0, +1], [-5, +5], and [-10, +10], where day 0 represents the day of the announcement. These windows are selected to capture both immediate and short-term market reactions to the event.

3.2.2 ROA

ROA is used in the current study as a key accounting-based measure to assess post-merger firm performance. ROA is widely used in the M&A literature, appearing in nearly half of the core empirical studies reviewed by Thanos and Papadakis (2011), likely due to its relative independence from accounting distortions that can affect alternative ratios such as Return on Equity or Return on Sales. Although there is no consensus on the optimal timeframe for evaluating M&A outcomes using accounting metrics, prior research highlights the trade-off between short- and long-term horizons: longer periods may capture synergy effects but risk contamination by unrelated corporate actions, whereas shorter windows offer cleaner attribution but may miss delayed performance impacts. To address this, the present study examines ROA in both the one- and two-year periods before and after the merger announcement to enable a more comprehensive performance assessment across time.

3.2.3 Bid Premium

The bid premium represents the difference, expressed as a percentage, between the price an acquiring firm is willing to pay for a target company and the market value of that company prior to the announcement of the acquisition. It is often interpreted as a measure of the strategic or operational value that the acquirer attributes to the target beyond its current market valuation (Gigante et al., 2025). Including the bid premium as a dependent variable in this study allows for an examination of the extent to which the ESG performance of the target firm influences the acquirer's willingness to offer additional value. In line with previous findings (Deng et al., 2013; Aktas et al., 2010), a higher ESG score of the target may be perceived as a strategic asset, potentially leading to a higher offer price and, consequently, a higher premium. Similarly, a higher ESG score of the acquirer may also relate to a higher bid premium, as such firms often have more resources to pursue strategic or values-aligned targets.

3.3 Independent Variable: ESG

LSEG captures and calculates approximately 870 ESG-related data points at the company level. From these, a subset of 186 of the most comparable and industry-relevant indicators is selected to power the final ESG assessment (London Stock Exchange Group, 2024). These indicators are grouped into ten categories, which roll up into the three main ESG pillars: environmental, social, and governance. The category weights vary by industry for the environmental and social pillars, while governance weights are fixed across sectors and benchmarked against the country of incorporation. These weighted scores are then normalized to generate a final ESG score.

While ESG scores are known to vary significantly across providers, largely due to differences in measurement and scope, and to a lesser extent, weighting, LSEG stands out as a widely used and market-relevant provider. It offers one of the most comprehensive datasets, using the highest number of underlying indicators among major ESG raters, many of which are unique. Although this contributes to divergence, it also allows for rich coverage of ESG aspects. Furthermore, prior research has shown that Refinitiv's scoring methodology, though proprietary, can be closely approximated with a linear model, suggesting a consistent and interpretable aggregation logic (Guerrero & Viteri, 2024). As such, the use of LSEG scores in this study reflects a meaningful representation of how a major segment of the market evaluates ESG

performance and is suitable for empirical analysis when its methodological characteristics are clearly acknowledged.

3.4 Control Variables

In addition to ESG scores, the central focus of this study, it is essential to include a comprehensive set of control variables to enhance the robustness of the data analysis and mitigate omitted variable bias, a key concern in OLS regression. These variables are broadly categorized into firm-specific financial indicators and deal-related characteristics.

Firm-specific financial variables include ROA for both acquiring and target firms. ROA serves as a proxy for operational efficiency and profitability, which are often used in M&A analysis controls for the underlying financial health of the firms involved, isolating the effects of ESG scores more accurately.

Another key variable is the market-to-book value (MTBV) of both acquirer and target firms. While a high MTBV is sometimes associated with subsequent underperformance, Andriosopoulos et al. (2015) show that acquirers with a high MTBV and substantial domestic institutional ownership tend to exhibit significantly better post-announcement performance. Including MTBV helps control for market valuation differences and investor expectations embedded in firm value.

Leverage (LEV) for both acquiring and target firms is also included, given its relevance in shaping M&A outcomes. Maloney et al. (1993) find that announcement-period returns for acquiring firms tend to be higher when the acquirer has greater leverage, potentially reflecting the market's reaction to financial risk and capital structure.

Furthermore, the logarithm of market capitalization ($\log_marketcap$) is included for both acquirers and targets. Larger firms may possess greater resources and M&A expertise, potentially enhancing deal outcomes independent of deal-specific features. Conversely, smaller targets may be easier to integrate but may offer fewer strategic synergies, while larger targets may be more complex yet yield greater strategic benefits. Moeller et al. (2004) provide evidence that acquiring firm shareholders realize higher announcement returns, by roughly two percentage points, when the acquirer is relatively small. Using the logarithmic form of market capitalization also addresses skewness in the distribution of firm size.

Deal-specific variables, such as method of payment, industry relatedness, deal hostility, cross-border status, and deal value, are also incorporated to account for contextual and transactional heterogeneity. First, year fixed effects are included to control for macroeconomic shocks and event-driven market disruptions, such as the 2008 global financial crisis and the COVID-19 pandemic that happened in 2020.

A continent dummy (1 = Europe; 0 = US) is included to control for jurisdictional differences between European and U.S. acquirers, with the United States serving as the reference category. This dummy captures national and regional variations in legal frameworks, corporate governance standards, and ESG-related policies. For example, the introduction of the European Green Deal in 2019 illustrates the stronger regulatory push toward ESG practices in Europe compared to the U.S., potentially influencing both M&A motivations and outcomes.

The method of payment is controlled for by using a cash payment dummy variable. Chang (1998) finds that stock-financed acquisitions tend to generate higher abnormal returns compared to cash-financed deals. However, over the longer term, cash payments may signal greater financial discipline. This underscores the importance of accounting for payment structure in analyses of M&A performance.

An industry dummy variable is included to account for whether the deal involves firms operating in the same or different industries, based on their SIC codes. If the acquirer and target share an identical SIC code, the deal is classified as horizontal, and the dummy is assigned a value of 1. If the SIC codes differ, the deal is considered vertical, and the dummy takes the value 0. This variable controls for structural differences between horizontal and vertical mergers, which may influence the nature of achievable synergies, the complexity of integration processes, and the anticipated post-merger performance outcomes.

A cross-border dummy is also included, equal to 1 if the transaction occurs between firms in different countries. This controls for the additional complexity, regulatory divergence, and governance challenges typical of cross-border M&A, factors that may particularly relate to the governance dimension of ESG (Xie et al., 2017).

Moreover, a hostility dummy is included to indicate whether the deal was hostile (value = 1). Hostile takeovers may involve higher bid premiums but are also associated with greater post-deal integration challenges and a lower probability of long-term success (Schwert, 2000).

Lastly, the logarithm of deal value (`log_deal_value`) is used to control for the scale and inherent complexity of the transaction. Asquith et al. (1983) highlight that deal size is a significant determinant of value creation and should be appropriately accounted for in performance analyses.

By incorporating these firm-level and deal-level controls, the current research aims to isolate the effect of ESG scores on M&A outcomes more accurately, ensuring the validity of the empirical findings across various financial, structural, and contextual dimensions.

3.5 Preliminary Descriptive Analysis

3.5.1 Descriptive Statistics

Following the general data overview in Section 3.1 Table 1 and Table 2 provide a more detailed descriptive analysis of the dataset. Table 1 reports summary statistics for all continuous dependent, independent, and control variables. To mitigate the influence of extreme values, the dependent variables and financial controls have been winsorized. The mean values for the CAR variables are negative across all event windows, suggesting that M&A announcements in the sample are, on average, met with negative short-term market reactions. Similarly, both Delta ROA1 and Delta ROA2 show negative averages, indicating a decline in post-acquisition operating and financial performance. In contrast, the average bid premium is 23.7%, consistent with typical acquisition premiums found in the literature.

Most key financial variables, such as market capitalization and deal value, exhibit considerable variation, highlighting the diverse scale of transactions in the sample. ESG scores for acquirers show broad variation as well, with means clustered around 45-50 and standard deviations indicating significant dispersion. This heterogeneity suggests the presence of both high- and low-ESG scorers in the acquirer population, which is central to the study's research questions.

Table 2 summarizes the distribution of key binary variables. The majority of deals are domestic (2053 out of 2742), and most are friendly, with only 15 classified as hostile. The industry distribution is reasonably balanced, with 1657 deals marked as within-industry transactions. Cross-border deals represent a meaningful portion of the sample, with 689 observations. European acquirer deals are also well represented, with 1,290 observations,

ensuring geographic diversity.

Together, these descriptive insights underscore both the diversity and structure of the sample, providing a solid foundation for the regression analyses presented in the following sections.

TABLE 1: SUMMARY STATISTICS

Variable Name	<i>Obs</i>	<i>Mean</i>	<i>Median</i>	<i>Max.</i>	<i>Min.</i>	<i>Std. Dev.</i>	<i>Q1</i>	<i>Q3</i>
ROA_acq	2693	5,3	5,0	16,0	-4,0	5,1	1,0	8,0
ROA_tar	974	2,8	3,0	17,0	-22,0	8,7	1,0	8,0
ROA_acq_t_min_2	2646	5,2	4,0	17,0	-5,0	5,5	1,0	9,0
ROA_acq_t_min_1	2742	5,6	5,0	17,0	-3,0	5,3	1,0	9,0
ROA_acq_t_plus_1	2742	4,5	4,0	14,0	-5,0	4,9	1,0	8,0
ROA_acq_t_plus_2	2740	4,2	4,0	14,0	-5,0	4,8	1,0	7,0
DeltaROA1	2742	-1,1	0,0	17,0	-22,0	4,9	-3,0	1,0
DeltaROA2	2644	-1,1	0,0	19,0	-22,0	5,2	-3,0	1,0
AcqESG	2742	47,7	46,0	95,0	4,0	21,1	31,0	64,8
AcqENV	2736	40,6	38,0	99,0	0,0	30,0	16,0	67,0
AcqSOC	2736	49,9	48,0	98,0	1,0	24,3	30,0	69,0
AcqGOV	2736	51,4	52,0	99,0	1,0	22,4	34,0	69,0
AcqESGComb	2742	44,4	43,0	93,0	4,0	18,8	30,0	58,0
TarESG	220	41,9	39,5	93,0	6,0	19,3	26,8	54,3
TarENV	198	36,6	36,0	98,0	0,0	28,9	8,0	64,0
TarSOC	198	46,5	40,5	95,0	6,0	24,8	25,3	70,0
TarGOV	198	41,5	39,0	95,0	3,0	20,4	26,0	56,0
TarESGComb	220	40,2	38,0	93,0	6,0	18,2	25,8	52,0
Bid_premium	1912	23,7	18,0	79,4	-4,0	23,1	5,0	36,0
CAR_2_2	2742	-0,4	0,0	9,0	-10,0	4,6	-3,0	2,0
CAR_1_1	2742	-0,3	0,0	8,0	-9,0	4,1	-2,0	2,0
CAR_0_1	2742	-0,4	0,0	7,0	-9,0	3,8	-2,0	2,0
CAR_5_5	2742	-0,7	0,0	11,0	-13,0	5,9	-4,0	3,0
CAR_10_10	2742	-1,0	-1,0	14,0	-16,0	7,5	-5,8	4,0
log_deal_value	2551	21,2	15,4	36,8	5,9	9,6	13,4	32,9
log_marketcap_acq	2727	16,1	16,0	21,7	9,7	1,6	14,9	17,3
log_marketcap_tar	891	14,1	14,2	18,4	6,8	1,9	12,7	15,5
MTBV_acq	2642	2,6	2,0	8,0	1,0	1,9	1,0	3,0
LEV_acq	2730	1,3	0,7	6,0	0,0	1,5	0,4	1,5
MTBV_tar	2488	2,9	2,0	11,0	0,0	2,8	1,0	4,0
LEV_tar	1004	1,2	0,6	6,4	0,0	1,7	0,1	1,3

Note: Descriptive statistics are reported for all continuous dependent, independent, and control variables. Dummy variables are omitted due to their limited descriptive relevance.

TABLE 2: BINARY DUMMY VARIABLES DESCRIPTIVES

	<i>0</i>	<i>1</i>
<i>Hostile_dummy</i>	2727	15
<i>industry_dummy</i>	1657	1085
<i>crossborder_dummy</i>	2053	689
<i>Europe_dummy</i>	1452	1290
<i>Cash_dummy</i>	1062	1305

Note: This table presents the number of observations for each category (0 = no, 1 = yes) of the binary dummy variables included in the analysis. A value of 1 indicates that the deal exhibits the characteristic in question. Specifically, a value of 1 refers to a hostile deal for *Hostile_dummy*, a horizontal industry deal for *industry_dummy*, a cross-border deal for *crossborder_dummy*, a European target for *Europe_dummy*, and a cash payment deal for *Cash_dummy*.

3.5.2 Heteroscedasticity and Multicollinearity

To ensure reliable inference, robust standard errors are applied throughout the regression analyses. This decision is made *ex ante*, in anticipation of potential heteroscedasticity in the data, a common concern in empirical M&A research, where firm sizes, deal values, and market conditions often vary substantially across observations. According to Thompson (2010) robust standard errors are frequently used to account for such heterogeneity by employing heteroskedasticity-consistent standard errors. Following this established approach enhances the credibility of statistical conclusions, particularly with regard to hypothesis testing and significance levels, and reduces the risk of under- or overestimating the precision of coefficient estimates.

To explore potential correlations among the variables in the dataset, a pairwise Pearson correlation matrix was constructed (Table 3). Correlation coefficients above 0.70 are generally considered strong and may indicate multicollinearity concerns, therefore these values are highlighted for clarity.

Several notable high correlations were observed. Most prominently, the correlation between deal value (*dea.val*) and the Europe dummy (*Eu.dum.*) is 0.83. This strong associations suggest that larger deals tend to be geographically concentrated. Additionally, the market capitalizations of acquirers and targets (*mc.acq.* & *mc.tar.*) are

highly correlated (0.74), which is logically consistent with the tendency of large firms to acquire similarly sized targets. These strong correlations will be carefully considered in the regression analyses, including the use of VIF tests to address potential multicollinearity (Table 4).

A moderately strong correlation of 0.46 exists between the acquirer and target ESG scores, indicating that firms with higher ESG ratings tend to engage with similarly rated targets. In contrast, the correlations between ESG scores and key dependent variables, such as changes in ROA (D.ROA1, D.ROA2) and bid premium (Bid.pre.), are weak, all falling below 0.10. The only exception is the correlation between AcqESG and the CAR11, which stands at 0.18. Although still weak, this suggests preliminary support for the hypothesized positive relationship outlined in Hypothesis 1.

To improve readability, not all variables are displayed in Table 3. Additional variables, including multiple CAR event windows, ESG subcomponents, and extended ROA timeframes, are included in Table 9 in the appendix. As expected, these variables exhibit logical high correlations among themselves, such as between different CAR windows, ESG subdimensions, and the ROA values over various time periods.

TABLE 3: CORRELATION MATRIX

Variable	ind.dum.	cros.dum.	dea.val.	mc.acq.	mc.tar.	Eu.dum.	ROA.acq.	ROA.tar.	LEV.acq.	LEV.tar.	MTBV.acq.	MTBV.tar.	Bid.pre.	CAR11	D.ROA1	D.ROA2	Cash.dum.	AcqESG	TarESG
ind.dum.	1	-0,03	0,03	-0,17	-0,02	-0,03	-0,04	0,12	0,1	-0,1	-0,11	-0,12	-0,11	-0,04	-0,01	-0,03	-0,02	0	0,03
cros.dum.	-0,03	1	0,33	0,05	-0,02	0,55	0	-0,02	0,12	0,01	-0,05	-0,02	-0,13	0,01	-0,32	-0,25	0,06	0,17	0,12
dea.val.	0,03	0,33	1	0,04	0,06	0,83	-0,13	0,04	0,27	0,02	-0,17	-0,16	-0,32	0	-0,08	-0,09	0,16	0,28	0,42
mc.acq.	-0,17	0,05	0,04	1	0,74	0,05	0,42	0,04	0,1	0,07	0,42	0,26	0,14	0,12	0,08	-0,1	0,21	0,65	0,3
mc.tar.	-0,02	-0,02	0,06	0,74	1	0,04	0,34	0,28	0,07	0,05	0,38	0,32	0,04	0,08	0,02	-0,2	0,1	0,41	0,36
Eu.dum.	-0,03	0,55	0,83	0,05	0,04	1	-0,17	-0,01	0,29	0,09	-0,25	-0,12	-0,35	0,05	-0,11	-0,06	0,13	0,34	0,3
ROA.acq.	-0,04	0	-0,13	0,42	0,34	-0,17	1	0,26	-0,17	-0,08	0,68	0,33	0,28	0,06	-0,21	-0,26	0,04	0,14	0,04
ROA.tar.	0,12	-0,02	0,04	0,04	0,28	-0,01	0,26	1	-0,02	-0,03	0,2	0,26	0,08	0,05	0,02	-0,01	0,02	0,06	0,06
LEV.acq.	0,1	0,12	0,27	0,1	0,07	0,29	-0,17	-0,02	1	0,32	-0,04	0	-0,2	0,11	0,02	0,06	0,22	0,18	-0,02
LEV.tar.	-0,1	0,01	0,02	0,07	0,05	0,09	-0,08	-0,03	0,32	1	-0,05	0,22	-0,08	0	-0,13	-0,08	0,05	0,09	0,09
MTBV.acq.	-0,11	-0,05	-0,17	0,42	0,38	-0,25	0,68	0,2	-0,04	-0,05	1	0,6	0,39	0,16	-0,04	-0,25	-0,04	0,13	0,11
MTBV.tar.	-0,12	-0,02	-0,16	0,26	0,32	-0,12	0,33	0,26	0	0,22	0,6	1	0,17	0,05	-0,03	-0,13	-0,01	0,07	-0,05
Bid.pre.	-0,11	-0,13	-0,32	0,14	0,04	-0,35	0,28	0,08	-0,2	-0,08	0,39	0,17	1	-0,18	0,01	-0,14	0,01	0,06	-0,03
CAR11	-0,04	0,01	0	0,12	0,08	0,05	0,06	0,05	0,11	0	0,16	0,05	-0,18	1	0,08	0,14	0,14	0,18	-0,02
D.ROA1	-0,01	-0,32	-0,08	0,08	0,02	-0,11	-0,21	0,02	0,02	-0,13	-0,04	-0,03	0,01	0,08	1	0,39	0	0,08	0,04
D.ROA2	-0,03	-0,25	-0,09	-0,1	-0,2	-0,06	-0,26	-0,01	0,06	-0,08	-0,25	-0,13	-0,14	0,14	0,39	1	0,06	0,04	-0,04
Cash.dum.	-0,02	0,06	0,16	0,21	0,1	0,13	0,04	0,02	0,22	0,05	-0,04	-0,01	0,01	0,14	0	0,06	1	0,24	0,09
AcqESG	0	0,17	0,28	0,65	0,41	0,34	0,14	0,06	0,18	0,09	0,13	0,07	0,06	0,18	0,08	0,04	0,24	1	0,46
TarESG	0,03	0,12	0,42	0,3	0,36	0,3	0,04	0,06	-0,02	0,09	0,11	-0,05	-0,03	-0,02	0,04	-0,04	0,09	0,46	1

Note: ind.dum. = industry_dummy; cros.dum. = crossborder_dummy; dea.val. = log_deal_value; mc.acq. = log_marketcap_acq; mc.tar. = log_marketcap_tar; Eu.dum. = Europe_dummy; ROA.acq. = ROA_acq; ROA.tar. = ROA_tar; LEV.acq. = LEV_acq; LEV.tar. = LEV_tar_w; MTBV.acq. = MTBV_acq; MTBV.tar. = MTBV_tar; Bid.pre. = Bid_premium; CAR11 = CAR_1_1_w; D.ROA1 = DeltaROA1; D.ROA2 = DeltaROA2; Cash.dum. = Cash_dummy; AcqESG = AcqESG; TarESG = TarESG

TABLE 4: VIF TESTS

Hypotheses	H1A/B				H2A/B				H3A/B						
	H1A	H1B	H1A/B	Corrected	H2A	H2B	H2A/B	adjusted	H3A	H3B	H3A/B	adjusted	H4	H4	H4
AcqESG	1.52		2.74	1.66	1.52		2.74	1.66	1.57		2.65	1.55			
TarESG		1.55	1.98	1.87		1.55	1.98	1.87		1.51	2.01	1.91			
AcqESG_c													1.66	1.66	1.55
TarESG_c													2.30	2.30	2.60
Acq_Tar_interact													1.54	1.54	1.72
Europe_dummy	3.13	4.63	5.75		3.13	4.63	5.75			4.43	5.48				
Hostile_dummy	1.01	1.05	1.08	1.08	1.01	1.05	1.08	1.08	1.01	1.08	1.13	1.12	1.08	1.08	1.12
industry_dummy	1.06	1.04	1.17	1.05	1.06	1.04	1.17	1.05	1.07	1.04	1.17	1.08	1.06	1.06	1.09
crossborder_dummy	1.45	1.53	1.58	1.21	1.45	1.53	1.58	1.21	1.58	1.61	1.64	1.15	1.22	1.22	1.18
Cash_dummy	1.11	1.13	1.25	1.20	1.11	1.13	1.25	1.20	1.12	1.06	1.17	1.15	1.20	1.20	1.15
log_deal_value	2.48	4.19	4.86	1.82	2.48	4.19	4.86	1.82	2.35	3.74	4.24	1.60	1.82	1.82	1.61
log_marketcap_acq	1.71		5.31		1.71		5.31		1.82		4.74				
ROA_acq_w	1.54		2.56	2.43	1.54		2.56	1.75	1.55		2.37	2.26	2.43	2.43	2.26
LEV_acq_w	1.15		1.77	1.75	1.15		1.77	2.95	1.12		1.55	1.54	1.75	1.75	1.54
MTBV_acq_w	1.45		3.16	2.95	1.45		3.16	3.16	1.52		3.46	3.23	2.95	2.95	3.23
log_marketcap_tar		1.60	3.62	1.82		1.60	3.62	1.82		1.42	3.12	1.62	1.82	1.82	1.62
ROA_tar_w		1.35	1.66	1.59		1.35	1.66	1.59		1.15	1.35	1.21	1.68	1.68	1.22
LEV_tar_w		1.10	1.47	1.46		1.10	1.47	1.46		1.11	1.38	1.37	1.46	1.46	1.38
MTBV_tar_w		1.33	2.10	2.05		1.33	2.10	2.05		1.32	2.09	2.04	2.05	2.05	2.04

Note: This table presents the VIF values for the independent and control variables used in the models corresponding to the four main hypotheses. The column labeled adjusted displays the VIF values after addressing multicollinearity, specifically by excluding the variables Europe_dummy and log_marketcap_acq. These variables were removed due to their high correlation in the correlation matrix and elevated VIF scores. VIF values exceeding the conventional threshold of 5 are highlighted in bold.

3.6 Econometric Specifications for Hypothesis Testing

To test each hypothesis transparently and consistently, an estimation is made of a sequence of pooled OLS regressions. This research design is chosen for its straightforward interpretability, its suitability for cross-sectional M&A data, and its ability to isolate the marginal effects of ESG-related variables on deal outcomes when controlling for a consistent set of covariates. While the dependent variable, sample selection, and principal regressor vary according to the hypothesis, the core set of control variables and fixed effects remains constant across all models. Year fixed effects and a Europe dummy are included throughout to capture temporal and regional shocks. Below, it is explained how each hypothesis will be tested, present the corresponding regression equations in display form, and discuss the rationale for choosing acquirer-only, target-only, and combined models.

To examine H1A, which posits that higher acquirer ESG scores are associated with superior short-term market reactions, CARs are employed over multiple event windows, such as [-1, +1], [-2, +2], [-5, +5], [0, +1], and [-10, +10], as the dependent variable. For each event window, the sample is restricted to transactions with valid CAR observations and available acquirer ESG scores. The main regression can be written as follows:

$$CAR_{i, window} = \alpha + \beta_1 AcqESG_i + \sum_j^k \beta_j Control\ Variable\ j + \lambda year + \varepsilon_i$$

Where $CAR_{i, window}$ denotes the CAR for deal i over the specified window,

$AcqESG_i$ is the acquiring firm's ESG score, and $\sum_j^k \beta_j Control\ Variable\ j$ comprises solely the acquirer-specific financial variables, ROA, MTBV, leverage, log market capitalization together with the common deal-level controls payment method dummy, industry relatedness dummy, cross-border dummy, hostility dummy, log deal value. The term $\lambda year$ captures year fixed effects accounting for macroeconomic and temporal shock. A positive and statistically significant β_1 indicates that higher acquirer ESG is linked to less negative or more positive CAR, supporting H1A. Estimating this specification across all chosen CAR windows allows us to assess the robustness of the ESG effect over different short-term horizons.

H1B focuses on the target's ESG score and its association with the acquirer's CAR. In this case, the sample is confined to deals with available target ESG data and valid CAR observations. The following model is estimated:

$$CAR_{i, window} = \alpha + \beta_1 BTarESG_i + \sum_j^k \beta_j \text{Controle Variable } j + \lambda year + \varepsilon_i$$

In this formulation, $TarESG_i$ denotes the ESG score of the target firm. For the controls, besides the deal related variables, the target-specific financial variables, ROA, MTBV, leverage, and log market capitalization will be considered as well. A positive coefficient β_1 provides evidence in favor of H1B. Because this subsample is smaller, confidence intervals are reported, and statistical power is discussed carefully. Furthermore, a combined model that includes both ESG scores is estimated:

$$CAR_{i, window} = \alpha + \beta_1 AcqESG_i + \beta_2 TarESG_i + \sum_j^k \beta_j \text{Controle Variable } j + \lambda + \varepsilon_i$$

This combined specification enables the analysis of whether the effect of acquirer ESG persists after controlling for target ESG, and vice versa. As in previous models, financial control variables for both the acquirer and target are included. To mitigate issues of multicollinearity, variables identified as problematic in earlier diagnostics, *Europe_dummy* and *log_marketcap_acq*, have been excluded based on their high correlation in Table 3 and VIF values exceeding the critical threshold of 5 in Table 4. By estimating the acquirer-only, target-only, and combined ESG models, the analysis captures the distinct and joint influence of ESG characteristics on short-term market reactions.

For H2A, which focuses on long-term performance, the dependent variable ΔROA_i is defined for each deal i as the average ROA in the two-year period following the M&A deal relative to the deal date, minus the average ROA in the two-year period preceding the M&A. The regression is then:

$$\Delta ROA_i = \alpha + \beta_1 AcqESG_i + \sum_j^k \beta_j \text{Controle Variable } j + \lambda year + \varepsilon_i$$

where the sample includes only deals with complete pre- and post-merger ROA data for the acquirer. A positive β_1 is interpreted as evidence that higher acquirer ESG predicts better or less negative changes in operating and long-term financial efficiency, supporting H2A. In parallel, H2B addresses the target's ESG:

$$\Delta ROA_i = \alpha + \beta_1 BTarESG_i + \sum_j^k \beta_j \text{Controle Variable } j + \lambda year + \varepsilon_i$$

with the sample restricted to observations having both target ESG and full ROA histories. The following combined model is also estimated:

$$\Delta ROA_i = \alpha + \beta_1 AcqESG_i + \beta_2 TarESG_i + \sum_j^k \beta_j \text{Controle Variable } j + \lambda year + \varepsilon_i$$

to determine the relative influence of each ESG score on long-term performance. To detect potential multicollinearity, VIFs and a correlation table will be used again. As the current model does not differ much from the model used for H1, multicollinearity is handled the same way, eliminating *Europe_dummy* and *log_marketcap_acq*.

To test H3A, the relationship between the acquiring firm's ESG score and the bid premium is examined. In the initial model, only the acquirer's ESG score is included:

$$Premium_i = \alpha + \beta_1 AcqESG_i + \sum_j^k \beta_j \text{Controle Variable } j + \lambda year + \varepsilon_i$$

using all deals with available acquirer ESG and premium data. Controls mirror those in previous regressions. A positive β_1 supports H3A, suggesting that higher-ESG acquirers pay higher premiums. For H3B, a model restricted to deals with observed target ESG, and premium is used, estimating

$$Premium_i = \alpha + \beta_1 BTarESG_i + \sum_j^k \beta_j \text{Controle Variable } j + \lambda year + \varepsilon_i$$

Lastly, The Acquirer ESG score is added again to estimate the combined model:

$$Premium_i = \alpha + \beta_1 AcqESG_i + \beta_2 TarESG_i + \sum_j^k \beta_j \text{Controle Variable } j + \lambda year + \varepsilon_i$$

Finally, for H4 it is assessed how interaction between acquirer and target ESG relates to each dependent variable, CAR, ΔROA , and bid premium. The sample comprises deals with both ESG scores available. One approach is to include their interaction, after centering each ESG variable:

$$Y_i = \alpha + \beta_1 AcqESG_i + \beta_2 TarESG_i + \beta_3 (AcqESG_i \times TarESG_i) + \sum_j^k \beta_j \text{Controle Variable } j + \lambda year + \varepsilon_i,$$

where Y_i denotes the chosen dependent variable in separate estimations. A significant β_3 indicates that combined ESG profiles exert an additional effect.

Some overarching considerations apply to all the models discussed above. In terms of control variables, in addition to deal-specific characteristics, acquirer and target financials are included where appropriate, depending on statistical power considerations and to mitigate the risk

of omitted variable bias. As outlined in Section 3.5, all regressions include the computation of VIFs and are supported by a comprehensive correlation table covering all relevant variables. To address potential heteroscedasticity, robust standard errors are consistently applied, and extreme values are managed through winsorization at the 5% level. This structured empirical framework is designed to generate meaningful insights into the role of ESG in M&A performance.

4 Results

Using event study and Pooled Multivariate OLS regression analysis with year fixed effects and robust standard errors, this study investigates the impact of ESG scores on M&A performance.

4.1 Regression Analysis Statistics

4.1.1 Hypothesis 1: Acquirer and Target ESG Performance and CARs

Table 5 presents the regression results for the relationship between ESG performance of both acquirers and targets and CARs. Model 1 tests Hypothesis 1A, focusing on Acquirer ESG scores. The coefficient on AcqESG is negative and statistically insignificant across all event windows. Therefore, Hypothesis 1A is rejected. Model 2 examines Hypothesis 1B using Target ESG scores. The coefficient on TarESG is positive but also statistically insignificant in all specifications, leading to a rejection of Hypothesis 1B. In Model 3, both AcqESG and TarESG are included jointly. Neither variable is statistically significant, which reinforces the rejection of both hypotheses.

Regarding control variables, only few show statistically significant associations with CARs. The Cash Dummy is significant and positive in Model 1, indicating that cash-financed deals are associated with higher announcement returns. A coefficient of 0.827, which is the case for the -2, +2 CAR window, implies that, all else equal, cash deals lead to a 0.827 higher CAR. Cross-border deals are also positively and significantly associated with CARs in Model 1 with a coefficient of 0.711 ($p < 0.01$), meaning that international acquisitions are met with more favorable market responses. Other control variables, such as ROA, Leverage, MTBV, Hostility, and Size, do not reach structural and notable statistical significance.

The explanatory power of the models remains modest. Model 1 shows R^2 values between

0.024 and 0.053, while Model 2 ranges from 0.111 to 0.170, although its adjusted R^2 is negative across all windows. Model 3, despite including more explanatory variables, exhibits adjusted R^2 values between negative 0.121 and negative 0.007, with the highest unadjusted R^2 of 0.232 in the (0, +1) window.

To verify the robustness of the baseline findings and further investigate the negative adjusted R^2 values in certain models, we compare alternative model specifications shown in Table 10 in the appendix. While models with more control variables show higher R^2 values, adjusted R^2 remains low or negative, particularly in models with limited observations. To further enhance the analysis, a fixed effects regression was conducted as a robustness check, controlling for unobserved heterogeneity at the acquirer country, target country, and year level (Table 11 in the appendix). Results confirm the absence of statistically significant relationships between ESG variables and CARs across all event windows. However, compared to earlier specifications, the adjusted R^2 values have increased to approximately 0.2, whereas they were previously negative.

TABLE 5: OLS REGRESSION RESULTS FOR HYPOTHESIS 1 - ESG AND CARs

	CAR (-2,+2)	CAR (-1,+1)	CAR (0,+1)	CAR (-5,+5)	CAR (-10,+10)	CAR (-2,+2)	CAR (-1,+1)	CAR (0,+1)	CAR (-5,+5)	CAR (-10,+10)	CAR (-2,+2)	CAR (-1,+1)	CAR (0,+1)	CAR (-5,+5)	CAR (-10,+10)
	(1)					(2)					(3)				
AcqESG	-0.005	-0.006	-0.002	-0.003	-0.001						0.015	0.028	0.029	0.014	0.015
	(0.007)	(0.006)	(0.005)	(0.008)	(0.011)						(0.029)	(0.026)	(0.022)	(0.036)	(0.045)
TarESG						0.009	0.016	0.015	0.037	0.034	0.008	0.003	0.005	0.051	0.041
						(0.040)	(0.035)	(0.032)	(0.042)	(0.053)	(0.046)	(0.041)	(0.037)	(0.048)	(0.059)
Hostile_dummy	-0.009	-0.214	-0.309	-0.586	-2.497	-1.170	-1.481	-0.526	-4.800	-4.560	-0.226	-0.141	0.682	-4.134	-4.187
	(1.010)	(0.834)	(0.933)	(1.632)	(2.055)	(1.682)	(1.339)	(1.209)	(4.178)	(5.329)	(1.818)	(1.341)	(1.204)	(4.531)	(5.729)
industry_dummy	-0.138	-0.236	0.400**	-0.317	-0.445	-0.224	-0.260	-0.416	-1.091	-1.159	-0.253	-0.340	-0.480	-1.339	-1.360
	(0.218)	(0.194)	(0.183)	(0.278)	(0.347)	(1.107)	(0.997)	(0.891)	(1.259)	(1.533)	(1.146)	(1.012)	(0.909)	(1.292)	(1.597)
crossborder_dummy	0.711**	0.511**	0.429**	1.099**	0.998**	-0.188	-0.488	-0.512	-0.179	-0.760	0.274	-0.121	-0.262	0.196	-0.248
	(0.243)	(0.214)	(0.201)	(0.316)	(0.402)	(1.627)	(1.373)	(1.244)	(1.989)	(2.356)	(1.416)	(1.172)	(1.064)	(1.651)	(2.013)
Cash_dummy	0.827**	0.908**	0.966**	1.015**	0.569	0.732	0.601	0.749	1.365	1.050	0.558	0.465	0.568	1.024	0.882
	(0.219)	(0.195)	(0.183)	(0.279)	(0.351)	(1.127)	(1.008)	(0.903)	(1.210)	(1.461)	(1.190)	(1.051)	(0.939)	(1.322)	(1.525)
Europe_dummy	0.247	0.570*	0.474	0.229	1.628**	2.394	2.019	1.677	2.176	1.732					
	(0.352)	(0.316)	(0.299)	(0.435)	(0.582)	(2.261)	(2.066)	(1.903)	(2.531)	(3.124)					
log_deal_value	-0.002	-0.008	-0.014	-0.019	-0.016	-0.089	-0.069	-0.062	-0.146	-0.064	-0.001	0.011	-0.001	-0.099	0.002
	(0.012)	(0.010)	(0.009)	(0.015)	(0.019)	(0.120)	(0.101)	(0.091)	(0.135)	(0.162)	(0.087)	(0.081)	(0.069)	(0.098)	(0.121)
log_marketcap_tar						0.129	0.072	0.131	-0.020	-0.578	0.065	-0.016	0.007	-0.209	-0.881

		(0.510)	(0.453)	(0.406)	(0.543)	(0.739)	(0.601)	(0.550)	(0.473)	(0.672)	(0.825)				
ROA_tar_w		-0.069	-0.089	-0.097	-0.090	-0.079	-0.067	-0.060	-0.073	-0.088	-0.087				
		(0.079)	(0.067)	(0.060)	(0.096)	(0.119)	(0.082)	(0.071)	(0.064)	(0.100)	(0.125)				
LEV_tar_w		-0.083	-0.111	-0.081	-0.203	-0.350	-0.041	0.015	0.002	-0.385	-0.306				
		(0.340)	(0.324)	(0.297)	(0.379)	(0.477)	(0.408)	(0.379)	(0.356)	(0.476)	(0.609)				
MTBV_tar_w		0.047	0.078	0.070	0.039	0.091	-0.205	-0.218	-0.198	-0.129	-0.028				
		(0.248)	(0.220)	(0.211)	(0.250)	(0.406)	(0.297)	(0.274)	(0.261)	(0.302)	(0.472)				
log_marketcap_acq	0.019	-0.035	-0.057	-0.038	0.022										
	(0.089)	(0.079)	(0.074)	(0.113)	(0.145)										
ROA_acq_w	0.044	0.033	0.022	0.043	0.078*		-0.162	-0.257*	-0.224*	-0.091	0.036				
	(0.027)	(0.024)	(0.023)	(0.034)	(0.044)		(0.177)	(0.143)	(0.135)	(0.190)	(0.219)				
LEV_acq_w	0.097	0.076	0.024	0.078	0.090		0.220	-0.022	0.071	0.728	0.043				
	(0.073)	(0.063)	(0.060)	(0.097)	(0.130)		(0.548)	(0.465)	(0.408)	(0.689)	(0.702)				
MTBV_acq_w	-0.037	-0.0002	0.032	-0.024	-0.079		0.689	0.881**	0.800**	0.461	0.253				
	(0.065)	(0.058)	(0.054)	(0.080)	(0.107)		(0.478)	(0.405)	(0.371)	(0.480)	(0.599)				
Constant	-1.114	-0.215	0.047	-0.862	-1.507	0.836	0.854	-1.206	1.303	4.474	0.836	0.854	-1.206	1.303	4.474
	(1.400)	(1.226)	(1.145)	(1.821)	(2.352)	(4.163)	(3.520)	(4.361)	(6.222)	(5.985)	(6.163)	(5.530)	(5.161)	(7.822)	(8.685)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,219	2,219	2,219	2,219	2,219	140	140	140	140	140	136	136	136	136	136
R ²	0.039	0.046	0.053	0.032	0.024	0.111	0.151	0.170	0.165	0.144	0.148	0.205	0.232	0.194	0.145
Adjusted R ²	0.025	0.032	0.039	0.018	0.010	-0.123	-0.073	-0.049	-0.055	-0.082	-0.117	-0.041	-0.007	-0.057	-0.121
Residual Std. Error	4.707	4.182	3.917	5.998	7.612	5.816	5.164	4.668	6.600	8.002	5.825	5.148	4.618	6.678	8.248
F Statistic	2.784***	3.317***	3.831***	2.274***	1.675**	0.475	0.675	0.774	0.750	0.637	0.558	0.832	0.972	0.773	0.546

Note: This table reports the results of an OLS regression analysis for Hypothesis 1, examining the relationship between acquirer and target ESG performance and CARs around M&A deals. Model 1 includes only acquirer ESG scores, Model 2 includes only target ESG scores, and Model 3 includes both. The dependent variable is the CAR over different event windows. Robust standard errors are reported in parentheses. Control variables include

firm-level financial indicators and deal characteristics, with fixed effects included. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels.

4.1.2 Hypothesis 2: Acquirer and Target ESG Performance and Changes in ROA

Table 6 presents the regression results for the relationship between the ESG performance of both acquirers and targets and changes in ROA. Model 1 tests Hypothesis 2A, focusing on Acquirer ESG scores. Model 2 tests Hypothesis 2B, examining the effect of Target ESG scores. Model 3 includes both AcqESG and TarESG simultaneously to assess their joint impact on post-acquisition operating performance, measured by Δ ROA one and two years around the transaction.

Across specifications, the results provide limited support for Hypothesis 2a, which predicted a positive association between acquirer ESG performance and post-deal ROA changes. In Model 1, the coefficient for AcqESG is positive but statistically insignificant for Δ ROA $t+1$ (0.013), and only marginally significant for Δ ROA $t+2$ (0.024, $p < 0.1$). When both ESG variables are included in Model 3, the coefficient for AcqESG becomes insignificant in both periods, suggesting that its explanatory power is changed by including target ESG performance.

By contrast, the findings consistently support Hypothesis 2b, which posits a positive association between target ESG performance and changes in ROA post-acquisition. In Model 2, TarESG is significantly and positively associated with both Δ ROA $t+1$ (0.025, $p < 0.1$) and Δ ROA $t+2$ (0.037, $p < 0.05$). These results remain robust in Model 3, where TarESG retains statistical significance even after controlling for acquirer ESG performance.

Control variables reveal several meaningful relationships. The Cross-border dummy is consistently negative and statistically significant across all models in both years, indicating that cross-border deals tend to be associated with poorer post-deal ROA outcomes.

Firm-level financial characteristics are also relevant, the leverage ratio of the acquirer (LEV_acq_w) exhibits a positive and significant coefficient for Δ ROA $t+2$ in Model 3 (1.196, $p < 0.05$), implying that higher leverage at the acquirer level is associated with improved post-deal ROA. Specifically, a one-unit increase in leverage corresponds with a 1.196-point increase in Δ ROA $t+2$.

Although the R^2 and adjusted R^2 values across all models remain modest, they offer insight into the explanatory power of the specifications. Models 1 and 2, which include only AcqESG or TarESG, respectively, produce adjusted R^2 values between 0.043 and 0.080, indicating limited standalone explanatory value. However, the inclusion of both ESG variables

and a broader set of controls in Model 3 results in an improvement, with adjusted R² increasing to 0.101 for $\Delta\text{ROA } t+1$ and 0.180 for $\Delta\text{ROA } t+2$. This suggests that a more comprehensive model, provides a better fit for explaining post-deal ROA.

TABLE 6: OLS REGRESSION RESULTS FOR HYPOTHESIS 2 - ESG AND ROA

	$\Delta\text{ROA } t+1$	$\Delta\text{ROA } t+2$	$\Delta\text{ROA } t+1$	$\Delta\text{ROA } t+2$	$\Delta\text{ROA } t+1$	$\Delta\text{ROA } t+2$
		-1		-2		-3
AcqESG	0.013 (0.007)	0.024* (0.007)			0.021 (0.025)	0.037 (0.025)
TarESG			0.025* (0.034)	0.037** (0.034)	0.020* (0.037)	0.061* (0.034)
Hostile_dummy	-0.529 (1.841)	0.261 (1.543)	-2.628 (5.244)	0.695 (1.746)	-1.652 (5.615)	0.445 (1.816)
industry_dummy	0.063 (0.216)	0.120 (0.232)	0.018 (0.956)	-0.792 (0.910)	-0.700 (0.947)	-1.252 (0.814)
crossborder_dummy	-0.271 (0.301)	-0.302 (0.324)	-3.394** (1.432)	-3.284** (1.471)	-3.216*** (1.189)	-3.150*** (1.123)
Cash_dummy	0.020 (0.223)	0.497** (0.243)	-0.003 (1.040)	0.851 (0.884)	-0.018 (1.082)	-0.071 (0.932)
Europe_dummy	0.040 (0.392)	-0.109 (0.419)	2.486 (1.782)	1.143 (2.154)		
log_deal_value	0.002 (0.018)	-0.023 (0.019)	-0.080 (0.094)	-0.053 (0.118)	-0.023 (0.077)	-0.106 (0.074)
log_marketcap_tar			0.045 (0.413)	-0.763* (0.423)	0.001 (0.496)	-0.917** (0.453)
ROA_tar_w			0.023 (0.064)	0.029 (0.051)	0.100 (0.066)	0.054 (0.053)
LEV_tar_w			-0.525 (0.391)	-0.135 (0.377)	-0.751 (0.537)	-0.811* (0.462)
MTBV_tar_w			-0.138 (0.252)	-0.237 (0.218)	-0.215 (0.276)	0.044 (0.215)
log_marketcap_acq	0.204** (0.089)	0.086 (0.097)				
ROA_acq_w	-0.083*** (0.032)	-0.106*** (0.034)			-0.324** (0.152)	-0.112 (0.149)
LEV_acq_w	0.214*** (0.070)	0.189** (0.074)			0.562* (0.596)	1.196** (0.504)

MTBV_acq_w	-0.055 (0.072)	-0.102 (0.078)			0.442 (0.370)	-0.480 (0.346)
Constant	2.004 (1.001)	2.867 (1.002)	1.541 (0.955)	1.779 (1.004)	-0.619 (1.877)	2.376 (1.687)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,219	2,144	140	140	136	136
R2	0.092	0.093	0.204	0.207	0.360	0.418
Adjusted R2	0.079	0.080	0.043	0.075	0.101	0.180
Residual Std. Error	4.775	5.081	5.080	4.761	4.926	4.449
F Statistic	6.736***	6.986***	0.975*	0.987*	1.253**	1.573**

Note: This table reports the results of an OLS regression analysis for Hypothesis 2, examining the relationship between acquirer and target ESG performance and changes in ROA one and two years around M&A deals. Model 1 includes only acquirer ESG scores, Model 2 includes only target ESG scores, and Model 3 includes both. Robust standard errors are reported in parentheses. Control variables include firm-level financial indicators and deal characteristics, with fixed effects included. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels.

4.1.3 Hypothesis 3: Acquirer and Target ESG Performance and the Bid Premium

Table 7 presents the regression results for the relationship between ESG performance and bid premiums offered in M&A transactions. Model 1 tests Hypothesis 3A, examining the association between acquirer ESG performance and the bid premium. Model 2 focuses on Hypothesis 3B, evaluating the effect of target ESG performance. Model 3 includes both AcqESG and TarESG to enrich the analyses for both H3A and H3B.

In support of Hypothesis 3A, AcqESG is positively and significantly associated with bid premiums in Model 1 (coefficient = 0.067, $p < 0.05$). When both ESG variables are included in Model 3, the coefficient for AcqESG remains positive (0.059) but loses statistical significance. Hypothesis 3B is not supported, as TarESG remains statistically insignificant in both Model 2 (0.041) and Model 3 (-0.002).

Among the control variables, several show noteworthy effects. The cash payment dummy is significantly positive in Model 1 (coefficient = 3.351, $p < 0.01$). The acquirer's leverage ratio (LEV_acq_w) is significantly negative in both Model 1 (-1.218, $p < 0.01$) and Model 3 (-2.431, $p < 0.10$). Conversely, the acquirer's market-to-book ratio (MTBV_acq_w) is strongly positive in both models as well (1.331 and 3.516, both $p < 0.01$).

Lastly, the models show moderate explanatory power. Model 1 achieves an R^2 of 0.144

and an adjusted R^2 of 0.128. While Models 2 and 3 demonstrate higher R^2 values (0.356 and 0.404), their adjusted R^2 figures are relatively lower (0.146 and 0.169).

TABLE 7: OLS REGRESSION RESULTS FOR HYPOTHESIS 3 - ESG AND THE BID PREMIUM

	Bid Premium (%)		
	-1	-2	-3
AcqESG	0.067** (0.034)		0.059 (0.075)
TarESG		0.041 (0.108)	-0.002 (0.125)
Hostile_dummy	-6.547 (3.441)	-19.534 (6.729)	-13.831 (5.803)
industry_dummy	-1.357 (1.083)	-6.758* (3.480)	-3.894 (2.932)
crossborder_dummy	2.253 (1.734)	1.786 (4.796)	-0.687 (3.880)
Cash_dummy	3.351*** (1.082)	4.871 (3.427)	4.476 (3.346)
Europe_dummy	-0.022 (2.336)	-10.243 (6.668)	
log_deal_value	-0.724*** (0.106)	-0.025 (0.340)	-0.337 (0.206)
log_marketcap_tar		-0.773 (1.820)	-1.466 (1.979)
ROA_tar_w		0.219 (0.285)	0.151 (0.232)
LEV_tar_w		-1.680 (1.053)	-0.090 (1.213)
MTBV_tar_w		0.532 (0.823)	-0.929 (0.908)
log_marketcap_acq	-0.113 (0.452)		
ROA_acq_w	-0.150 (0.130)		-0.183 (0.475)
LEV_acq_w	-1.218*** (0.419)		-2.431* (1.400)
MTBV_acq_w	1.331*** (0.344)		3.516*** (1.336)

Constant	0.106 (0.333)	0.050 (0.133)	0.061 (0.201)
Year FE	Yes	Yes	Yes
Observations	1,808	111	107
R ²	0.144	0.356	0.404
Adjusted R ²	0.128	0.146	0.169
Residual Std. Error	21.669	15.206	14.061
F Statistic	9.027***	1.699**	1.721**

Note: This table reports the results of an OLS regression analysis for Hypothesis 3, examining the relationship between acquirer and target ESG performance and bid premiums in M&A transactions. Model 1 includes only acquirer ESG scores, Model 2 includes only target ESG scores, and Model 3 includes both. The dependent variable is the bid premium offered in the deal. Robust standard errors are reported in parentheses. Control variables include firm-level financial indicators and deal characteristics, with year fixed effects included. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels.

4.1.4 Hypothesis 4: Acquirer ESG and Target ESG Interaction and M&A Outcomes

Table 8 reports the regression results for Hypothesis 4, which examines whether the interaction between the ESG scores of the acquiring and target firms is associated with M&A outcomes. The models include all three dependent variables: CARs, Δ ROA, and bid premiums. Due to the inclusion of an interaction term, the ESG variables are mean-centered to reduce multicollinearity and improve interpretation.

The interaction term does not appear to be significantly associated with CARs across any event windows. These findings are broadly consistent with those reported in Hypothesis 1, where limited significant relationships were found between ESG scores and CARs. Additionally, similar to earlier models, the CAR regressions again display negative adjusted R² values, showing that the explanatory power of the model is weak for short-term market returns.

Similarly, the interaction does not show statistical significance for changes in ROA one- and two-years post-deal. However, a statistically significant negative coefficient is observed for the bid premium ($\beta = -0.006$, $p < 0.05$).

For the controls, several patterns remain consistent with earlier findings. In the bid premium model, acquirer leverage and market-to-book ratio continue to be statistically significant, with negative and positive signs, respectively. For the CAR regressions, control variables show limited significance, which aligns with the earlier CAR models under Hypothesis 1, where few controls were consistently influential. In the Δ ROA model, the negative effect of

cross-border deals and the positive effect of acquirer leverage are again observed, reflecting similar patterns as in the earlier results for Hypothesis 2.

Overall, the results provide partial support for Hypothesis 4. While ESG interaction does not appear to affect immediate market returns or post-acquisition financial performance, it does exhibit a significant relationship with deal valuation, specifically the bid premium paid.

TABLE 8: OLS REGRESSION RESULTS FOR HYPOTHESIS 4 – ESG INTERACTION EFFECTS ON M&A OUTCOMES

	CAR (- 2,+2)	CAR (- 1,+1)	CAR (0,+1)	CAR (- 5,+5)	CAR (- 10,+10)	Δ ROA t+1	Δ ROA t+2	Bid Premium (%)
			-1			-2		-3
AcqESG_c	0.013 (0.030)	0.027 (0.027)	0.029 (0.023)	0.013 (0.037)	0.015 (0.046)	0.024 (0.025)	0.069 (0.025)	0.091** (0.074)
TarESG_c	-0.005 (0.052)	0.001 (0.045)	0.006 (0.040)	0.045 (0.062)	0.039 (0.077)	0.046* (0.040)	0.078** (0.038)	0.063* (0.133)
Acq_Tar_interact	0.001 (0.001)	0.0001 (0.001)	-0.004 (0.001)	0.0004 (0.002)	0.0001 (0.002)	-0.001 (0.001)	-0.005 (0.001)	-0.006** (0.003)
Hostile_dummy	-0.235 (1.825)	-0.142 (1.352)	0.683 (1.210)	-4.138 (4.519)	-4.188 (5.748)	-1.635 (5.788)	0.450 (1.857)	-14.302 (5.572)
industry_dummy	-0.300 (1.142)	-0.348 (1.015)	-0.477 (0.912)	-1.361 (1.298)	-1.366 (1.598)	-0.608 (0.958)	-1.221 (0.816)	-3.721 (2.966)
crossborder_dummy	0.448 (1.457)	-0.090 (1.208)	-0.271 (1.108)	0.278 (1.649)	-0.225 (2.029)	-3.557** (1.179)	-3.266** (1.162)	-1.880 (3.900)
Cash_dummy	0.554 (1.197)	0.465 (1.056)	0.568 (0.943)	1.021 (1.327)	0.881 (1.532)	-0.009 (1.079)	-0.068 (0.930)	4.493 (3.281)
log_deal_value	0.003 (0.089)	0.012 (0.082)	-0.001 (0.069)	-0.098 (0.101)	0.002 (0.124)	-0.026 (0.079)	-0.107 (0.074)	-0.346* (0.197)
log_marketcap_tar	0.081 (0.609)	-0.013 (0.558)	0.006 (0.479)	-0.201 (0.687)	-0.879 (0.841)	-0.031 (0.496)	-0.928* (0.459)	-1.486 (2.000)
ROA_tar_w	-0.060 (0.084)	-0.059 (0.072)	-0.073 (0.067)	-0.085 (0.100)	-0.086 (0.122)	0.085 (0.064)	0.049 (0.053)	0.120 (0.238)
LEV_tar_w	-0.047 (0.412)	0.014 (0.382)	0.002 (0.356)	-0.387 (0.474)	-0.306 (0.610)	-0.739 (0.530)	-0.807* (0.462)	0.066 (1.217)
MTBV_tar_w	-0.215 (0.298)	-0.219 (0.277)	-0.197 (0.267)	-0.133 (0.305)	-0.029 (0.479)	-0.196 (0.278)	0.050 (0.220)	-0.923 (0.898)

ROA_acq_w	-0.169 (0.179)	-0.258* (0.144)	-0.223 (0.136)	-0.094 (0.194)	0.035 (0.223)	-0.312* (0.152)	-0.108 (0.150)	-0.161 (0.465)
LEV_acq_w	0.191 (0.562)	-0.027 (0.474)	0.072 (0.419)	0.714 (0.707)	0.039 (0.721)	0.618* (0.595)	1.216** (0.509)	-2.185* (1.451)
MTBV_acq_w	0.705 (0.480)	0.883** (0.407)	0.799** (0.374)	0.468 (0.486)	0.254 (0.607)	0.412 (0.363)	-0.490 (0.347)	3.405** (1.339)
Constant	1.638 (6.485)	0.880 (5.886)	-1.209 (5.457)	2.111 (7.926)	5.706 (9.056)	0.501 (0.029)	0.714 (0.023)	0.103 (0.939)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	136	136	136	136	136	136	136	107
R ²	0.150	0.206	0.232	0.194	0.145	0.290	0.329	0.419
Adjusted R ²	-0.125	-0.052	-0.016	-0.067	-0.132	0.060	0.113	0.179
Residual Std. Error	5.847	5.173	4.640	6.709	8.288	4.917	4.466	13.975
F Statistic	0.545	0.800	0.934	0.744	0.524	1.260	1.519*	1.748**

Notes: This table reports the results of an OLS regression analysis for Hypothesis 4, examining the relationship between ESG acquirer and target interaction and M&A outcomes. The key independent variable is the interaction term between the centered ESG scores of the acquiring and target firms. The dependent variables include CARs over various event windows, Δ ROA one and two years before and after the acquisition, and the bid premium. Robust standard errors are reported in parentheses. Control variables include firm-level financial indicators and deal characteristics, with year fixed effects included. The symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels.

4.2 Robustness Tests

To assess the stability of the main results and address sample- or specification-driven concerns, three additional robustness tests were conducted focusing on the CAR (-1, +1) window, Δ ROA (t+1, t+2), and bid premium outcomes.

First, separate regressions were conducted for the EU and US subsamples, as presented in Table 12 in the Appendix, to account for potentially divergent ESG dynamics across regions. In the EU sample, AcqESG emerges as a significant predictor of CAR (-1, +1) ($\beta = 0.079$, $p < 0.10$), accompanied by a slightly positive adjusted R². Regarding Δ ROA t+2, both the acquirer's and the target's ESG scores show significant positive coefficients. Furthermore, a marginally significant negative interaction effect for bid premium ($\beta = -0.011$, $p < 0.10$) is observed, with both main effects also significant at the 10% level, broadly consistent with the main findings for H4. In contrast, no significant effects were identified within the US sample.

Second, the ESG score was disaggregated into its three pillars to explore potential nuanced effects, as shown in Table 13 in the Appendix. Only the acquirer's environmental score

shows a significant positive effect on the bid premium ($\beta = 0.051, p < 0.10$). All other pillar coefficients are statistically insignificant, and neither the CAR nor ROA models display notable results. Interestingly, the adjusted R^2 for the CAR model is no longer negative, suggesting a modest improvement in model fit, though this does not alter the central conclusions.

Third, a categorical ESG-pairing approach was applied by splitting both acquirer and target ESG scores at the median, forming four dummy variables to represent deal types. The combinations Low–High, High–Low, and High–High are reported in Table 14 in the appendix. While both CAR and bid premium remain statistically insignificant, and CAR’s adjusted R^2 turns negative again, Δ ROA exhibits significantly positive coefficients for both High–High ($\beta = 3.804, p < 0.05$) and High–Low ($\beta = 1.524, p < 0.10$) deal types. This suggests that acquirers with high ESG profiles tend to generate stronger post-acquisition operating performance, regardless of the target’s ESG standing.

Finally, none of the control variables exhibited noteworthy changes in effects across the three robustness tests, further reinforcing the robustness of the ESG-related findings.

5 Discussion

This study examined the influence of corporate ESG performance on M&A outcomes in the United States and Europe between 2002 and 2024. Using LSEG ESG scores and a comprehensive transaction dataset, the study analyzed short-term market reactions, post-merger long-term financial performance, and acquisition premiums. This discussion section contextualizes the results within existing literature, considers their theoretical and practical implications, and reflects on the study’s limitations.

5.1 Interpretation of Results and Comparison with Prior Research

Contrary to the expectations outlined in the hypotheses, the empirical analysis across five event windows consistently revealed no statistically significant association between ESG performance and short-term market reactions, as measured by CARs. This pattern holds across acquirer-only, target-only, and combined acquirer–target models. In particular, models incorporating target firm ESG data displayed negligible explanatory power, with adjusted R^2 values below zero. Acquirer-only models yielded slightly higher explanatory power, yet the ESG

coefficients remained small, with relatively large standard errors. A series of robustness checks, including disaggregation of ESG into environmental, social, and governance pillars, alternative model specifications with different fixed effects and control variables, fixed-effects panel regressions, regional subsamples (Europe versus the United States), and a categorical ESG pairing approach, also failed to produce statistically significant results. Together, these findings suggest that ESG performance does not systematically influence immediate investor reactions around M&A announcements.

One possible explanation lies in the theoretical assumptions underlying the CAR-related hypotheses, particularly Freeman's (1984) stakeholder theory. While this framework suggests that strong ESG performance should signal long-term value creation, its relevance to short-term investor reactions may be limited. As noted by Cao et al. (2022) and Edmans (2022), ESG-related benefits often unfold over longer time horizons, rather than being immediately reflected in stock prices around deal announcements. Furthermore, Teti and Spiga (2022) argue that ESG integration, especially in larger transactions, can introduce operational complexity, strategic uncertainty, and resource intensiveness, all of which may temper investor confidence in the short run. This perspective is partially supported in the CAR regressions, where the coefficients for log deal value were consistently negative but statistically insignificant. Although this direction aligns with theoretical expectations, the lack of significance suggests that the data, in practical terms, do not strongly support this relationship.

Beyond these theoretical considerations, issues related to information timing and asymmetry may further help explain the observed absence of CAR effects. Dierkens (1991) emphasizes how information asymmetry can distort investor responses to corporate events, and Cohen et al. (2011) document the fragmented and inconsistent nature of ESG information used by market participants. ESG disclosures are not always timely or standardized, and relevant information may not be readily available to investors at the moment of the M&A announcement. This information lag can dampen or delay market responses to ESG-related signals.

A possible way to address this in future research would be to include a proxy for recent ESG developments, for example, a binary variable indicating whether a firm's ESG score improved during the year leading up to the deal. Alternative specifications could include earlier changes in ESG scores or lagged ESG values to capture ESG momentum effects. These approaches might offer insight into whether investors respond more strongly to recent changes

than to static ESG levels. Unfortunately, due to data limitations, such variables could not be constructed or included in the present study.

To further explore the time horizon over which ESG performance may influence M&A outcomes, the earlier observations by Cao et al. (2022) and Edmans (2022), that ESG effects tend to manifest gradually and are less likely to be captured by short-term market reactions, offer valuable theoretical support for the findings of this study. While no significant relationship was found between ESG scores and short-term CARs, the analysis of post-merger operating performance revealed several positive and statistically significant associations with ESG variables. The most compelling evidence emerged from Table 6 and Table 8, particularly concerning Hypothesis 2B, where the target firm's ESG score consistently showed significant main effects, both in models with and without interaction terms. Although the acquirer's ESG score was less consistently significant in the main models, additional robustness tests (Table 14) indicated that transactions involving high-ESG acquirers, either in combination with high-ESG targets or as standalone high performers, were associated with improved operating performance in the post-merger period.

These findings suggest that ESG considerations may lack immediate visibility or salience for investors at the time of the deal announcement but may become increasingly consequential during the post-merger integration phase. This aligns with the view that ESG integration creates value through mechanisms such as strategic alignment, efficiency improvements, and enhanced stakeholder trust, factors that unfold over time rather than being instantly priced in by the market.

The pattern observed in the robustness analyses, in which high-ESG acquirers consistently yielded significantly positive ROA coefficients, also aligns with the findings of Zumente and Bistрова (2021), who demonstrate that strong ESG performance enhances long-term value creation, both theoretically and empirically.

Interestingly, the main regression models (Table 6) showed that the ESG score of the target firm exhibited a stronger association with Δ ROA than that of the acquirer. A plausible explanation is that acquiring a high-ESG target introduces new capabilities, reputational capital, or stakeholder relationships that can enhance the combined firm's operational performance.

At the same time, the robustness results indicating significant positive effects for high-ESG acquirers, particularly in high-high ESG combinations, may point to the amplifying role of ESG alignment between deal partners. Acquirers with established ESG structures, processes, and

cultures may be better equipped to preserve and scale the ESG strengths of their targets, transforming ESG alignment into tangible post-merger gains.

Furthermore, the positive effects found in high–low ESG combinations could be indicative of an ESG diffusion effect, whereby ESG-leading acquirers help elevate the ESG standards of their less mature targets. However, for such a mechanism to materialize, the acquirer must possess not only the capacity but also the willingness to actively transfer ESG principles, a process similar to knowledge transfer in post-merger integration (Gonzalez et al., 1998).

Although low–high ESG transactions may seem strategically promising, such as acquiring ESG capabilities, market access, or reputational benefits, the empirical results do not support a significant post-merger performance effect. This may be due to ESG misalignment or limited absorptive capacity on the acquirer’s side. In contrast, high–low deals suggest that ESG-leading acquirers are better positioned to integrate and upgrade lower-ESG targets, leveraging their existing structures to realize post-deal gains

Finally, the relatively weak or non-significant effects of acquirer ESG in the main models, compared to their emergence in the robustness checks, may reflect differences in model specification or may suggest that ESG-related synergies become more visible under certain ESG-matching conditions rather than in isolation.

Regarding the control variables in the ROA regressions, leverage and cash payments stand out due to their associations with post-merger profitability. Acquirer leverage shows a robust and statistically significant positive relationship with post-deal ROA. In contrast, target leverage generally displays negative, but less consistent and statistically weaker, effects. A similar pattern emerges with the method of payment, the inclusion of a cash dummy reveals modestly positive and occasionally significant coefficients. This suggests that cash-financed deals may be associated with greater deal certainty and fewer post-merger frictions, aligning with the view put forward by Chang (1998), who argues that while stock payments can generate higher short-term returns, cash deals often reflect stronger long-term financial commitment. These findings indicate that financial structure variables such as leverage and payment method are more informative for predicting long-term operational performance than short-term investor responses. This contrasts with the conclusions of Maloney et al. (1993), who found leverage to play a more prominent role around the announcement period, a relationship that is not supported in the present analysis.

Taken together, the results provide cautious yet credible evidence for a positive role of ESG in driving long-term post-merger performance. Although ESG effects are not consistently robust across all models, the recurring significance of target ESG and the positive outcomes in deals involving high-ESG acquirers suggest that ESG considerations can contribute to value creation, though in ways that depend on deal structure, firm-specific characteristics, and potentially the alignment between these factors. At the same time, the findings underscore that ESG is not the sole determinant of post-merger success; financial structure variables such as leverage and payment method, alongside broader strategic alignment, also play substantial roles in shaping long-term outcomes.

The analysis of bid premiums reveals a quite strong and consistent role for ESG in line with earlier literature and hypotheses of the current study (Feng, 2021). A particularly intriguing finding emerges from the analysis of the bid premium, where both Acquirer ESG and Target ESG exhibit significant positive coefficients. At the same time, their interaction term shows a significant negative coefficient. This pattern suggests a nuanced relationship between the ESG profiles of the acquiring and target firms and the premium an acquirer is willing to pay (Figure 1). The positive main effects indicate that, in isolation or at average levels of the other firm's ESG, a stronger ESG performance by either the acquirer or the target is associated with a higher deal premium. This aligns with prior literature suggesting that strong ESG credentials signal reduced risk, enhanced reputation, better access to capital, and potential future value creation, all of which could justify a higher willingness to pay (Gigante et al., 2025)

However, the significant negative interaction term indicates that the positive impact of one firm's ESG performance on the bid premium diminishes as the ESG performance of the other firm increases. This implies a 'diminishing returns' or even a 'ceiling effect' for combined ESG excellence (Seifert et al., 2024). While a high ESG score in either the acquirer or target contributes positively to the premium, combining two firms that both possess exceptionally high ESG scores does not lead to a proportionally compounded increase in the premium. Instead, the marginal benefit of additional ESG strength from one party decreases when the other party is already strong in ESG. A potential explanation for this is that the market's perceived 'ESG premium' might cap at a certain combined level, beyond which additional ESG investments or capabilities do not generate sufficient incremental value to warrant a higher bid. Alternatively, it could signal that acquirers are willing to pay a premium for ESG improvement potential, for

example, a strong ESG acquirer lifting a weaker ESG target, rather than simply for the absolute highest combined ESG status, as the latter might offer fewer opportunities for synergy capture or cost reduction in ESG-related areas. This nuanced result suggests that the market values ESG, but perhaps within a strategic context where the greatest premiums are paid for deals that offer clear pathways for ESG-driven value enhancement, rather than merely for the aggregation of already outstanding ESG profiles.

Building on the previously discussed interaction effect, the analysis further explored ESG alignment between acquirer and target firms by categorizing deals into four ESG combination groups based on above- or below-median scores. This approach aimed to assess whether alignment in ESG performance influences M&A outcomes. However, this categorical breakdown did not yield any notable findings regarding short-term market reactions or deal premiums, suggesting that simple ESG matching does not significantly impact these outcomes.

Nonetheless, there is some evidence indicating that when both the acquirer and the target exhibit high ESG scores, post-merger operational performance, as measured by ROA, may improve modestly over time. This finding may reflect smoother post-deal integration due to shared corporate values, stakeholder orientations, or governance practices. Alternatively, it could be that high-ESG firms are inherently better managed and more efficient, thus already equipped with capabilities that enhance post-merger performance.

Besides the robustness check for non-linearity using categorical median splits, the other robustness checks offer further insight into the conditional nature of the ESG–M&A relationship. The regional split reveals notable divergence between the EU and US samples, with ESG effects predominantly concentrated in the European subsample. This may be attributed to the fact that ESG integration is more advanced and institutionalized in Europe, supported by stronger regulatory frameworks, mandatory disclosure standards, and more active stakeholder engagement around sustainability. In contrast, the lack of significant ESG effects in the US may reflect a still-developing ESG landscape, where sustainability concerns are more heterogeneous across firms, industries, and political agendas, and are less consistently incorporated into investor expectations or managerial decision-making.

The decomposition of ESG into its environmental, social, and governance pillars yields limited explanatory power, with only the acquirer's environmental score showing a weakly significant association with the bid premium. The overall lack of significance across the

disaggregated dimensions suggests that the aggregate ESG score may more effectively capture a firm's sustainability profile in the M&A context. One possible explanation is that the composite ESG score reflects broader organizational quality and risk management capabilities that are not easily isolated in the individual pillars.

Distinguishing between these competing explanations remains a challenge and highlights the need for further research into the mechanisms through which ESG alignment may generate synergy effects in M&A contexts.

5.2 Limitations and Suggestions for Future Research

While this study offers a comprehensive empirical exploration of ESG in the M&A context, several limitations should be acknowledged. Most notably, the analysis is constrained by the limited availability of target ESG data, which reduced sample sizes for models incorporating both acquirer and target ESG scores. This restricts statistical power and may introduce selection bias, as firms with publicly disclosed ESG data tend to be larger and more transparent, potentially limiting generalizability.

Moreover, the industry distribution in the sample is skewed toward manufacturing and financial services, which may not fully reflect the ESG–M&A dynamics present in other sectors such as IT, healthcare, or energy as sustainability priorities and stakeholder expectations vary across industries, future research could benefit from more balanced sectoral coverage to capture these heterogeneities.

Although the use of winsorization helped mitigate the influence of outliers, it may have also suppressed meaningful variation at the extremes. Robustness checks, such as quantile regression or bootstrap methods, could help assess whether the findings hold across the full distribution of ESG and financial variables.

A further limitation concerns the exclusive use of ESG ratings from LSEG as input data. While ESG scores are increasingly used in both academic research and investment practice, recent evidence highlights substantial divergence between rating providers. Berg et al. (2022) document that correlations between ratings from major agencies, such as Refinitiv, MSCI, and Sustainalytics, range from as low as 0.38 to 0.71, with measurement differences accounting for the majority of this variation. These discrepancies arise not only from differences in scope and weighting but especially from how similar indicators are quantified and interpreted. Refinitiv, for

instance, uses the broadest indicator set among the reviewed providers, which may lead to materially different assessments compared to others. This rating divergence introduces uncertainty about what ESG scores truly capture and limits the comparability and generalizability of ESG-based findings. To enhance robustness, future research could integrate multiple ESG datasets or construct harmonized composite indicators that account for provider-specific variation.

The temporal coverage of the sample, spanning from 2002 to 2024, also introduces potential challenges. This period saw major shifts in both ESG awareness and M&A practices. Although year fixed effects account for general temporal variation, specific events, such as the 2008 global financial crisis, the introduction of the European Green Deal, EU's Corporate Sustainability Reporting Directive, may have induced nonlinear structural breaks. Similarly, political developments such as the Trump administration's deregulatory agenda may have influenced acquirer behavior, particularly in U.S.-based deals. Sub-period or event-based analyses could help disentangle such contextual effects.

An underexplored and potentially interesting dimension for future research is investor heterogeneity. The market's reaction to ESG signals in M&A may vary depending on whether the dominant investors are institutional or retail. While institutional investors may reward sustainability alignment and long-term value creation, retail investors might respond more to short-term deal fundamentals or media narratives. Future research could examine these differential responses, for example, through investor ownership structures or trading behavior around announcement dates.

A limitation in the analysis of the CARs is the static nature of the ESG variables used. While ESG scores offer a useful snapshot of a firm's sustainability profile, they may fail to capture recent developments or momentum that are more salient to investors at the time of deal announcements. As noted earlier, the null findings for ESG effects on CARs could partly reflect this temporal disconnect. Future research could address this by incorporating a proxy for recent ESG change. Like a binary indicator denoting whether a firm's ESG score improved in the year preceding the acquisition, or lagged ESG values, or measures of ESG score acceleration to better reflect investor perception of ESG trajectories.

Taken together, the points discussed above reflect both practical constraints and conceptual opportunities. Some suggestions arise from limitations, such as data availability or

rating divergence, while others offer natural extensions, like exploring ESG momentum, investor heterogeneity, or sector-specific dynamics. These directions not only respond to current constraints but also offer meaningful avenues to deepen our understanding of how ESG considerations influence M&A valuation, integration, and long-term performance.

6 Conclusion

This study contributes to the ongoing discourse on the financial implications of ESG performance, focusing on its role in mergers and acquisitions. Using a comprehensive empirical framework and an extensive dataset of U.S. and European M&A deals from 2002 to 2024, this study examined the role of ESG scores in explaining short-term market reactions, long-term post-merger performance, and acquirers' willingness to pay a premium. The findings indicate that ESG scores, whether from acquirers, targets, or their interaction, have no consistent or significant effect on short-term financial performance, as measured by CARs. For long-term outcomes, there is some tentative evidence that target ESG quality may support operational improvements post-merger, though results remain inconclusive, and model fit is limited. More robust findings emerged in the analysis of bid premiums, where ESG scores, particularly those of the acquirer, were positively associated with the willingness to pay.

These findings provide practical implications for investors, managers, and policymakers seeking to navigate the intersection of sustainability and corporate finance and offer theoretical contributions to the broader field of sustainable finance by highlighting the contingent nature of ESG's impact.

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8 Appendices

8.1 Appendix A | Additional Analyses and Figures

TABLE 9: CORRELATION MATRIX FOR ADDITIONAL VARIABLES

Variable	ROA.acq-2	ROA.acq.-1	ROA.acq+2	ROA.acq.+1	CAR22	CAR01	CAR55	CAR1010	AcqENV	AcqSOC	AcqGOV	AcqESGC.	TarENV	TarSOC	TarGOV	TarESGC.
ROA.acq-2	1	0,69	0,59	0,53	-0,09	-0,1	-0,01	-0,01	0,14	0,02	0,06	0,06	0,12	-0,04	0,14	0,03
ROA.acq.-1	0,69	1	0,57	0,49	-0,07	-0,11	0	0,03	0,09	-0,01	0,09	0,08	0,05	-0,01	0,23	0,03
ROA.acq+2	0,59	0,57	1	0,72	-0,03	0	0,02	0	0,17	0,08	0,2	0,12	0,16	-0,04	0,29	0,11
ROA.acq.+1	0,53	0,49	0,72	1	-0,02	0	0	-0,06	0,12	0	0,16	0,04	0,1	-0,06	0,12	-0,01
CAR22	-0,09	-0,07	-0,03	-0,02	1	0,86	0,81	0,65	-0,07	-0,02	-0,02	-0,01	-0,03	-0,02	-0,06	-0,03
CAR01	-0,1	-0,11	0	0	0,86	1	0,7	0,58	0	0,05	0,03	0,04	0	0,01	-0,07	-0,02
CAR55	-0,01	0	0,02	0	0,81	0,7	1	0,78	-0,05	-0,03	-0,05	-0,01	0,01	-0,03	-0,01	0
CAR1010	-0,01	0,03	0	-0,06	0,65	0,58	0,78	1	-0,02	-0,04	-0,06	-0,02	-0,02	-0,08	-0,02	-0,04
AcqENV	0,14	0,09	0,17	0,12	-0,07	0	-0,05	-0,02	1	0,81	0,41	0,78	0,57	0,46	0,12	0,52
AcqSOC	0,02	-0,01	0,08	0	-0,02	0,05	-0,03	-0,04	0,81	1	0,46	0,82	0,46	0,58	0,1	0,54
AcqGOV	0,06	0,09	0,2	0,16	-0,02	0,03	-0,05	-0,06	0,41	0,46	1	0,61	0,12	0,11	0,21	0,2
AcqESGC.	0,06	0,08	0,12	0,04	-0,01	0,04	-0,01	-0,02	0,78	0,82	0,61	1	0,43	0,43	0,18	0,53
TarENV	0,12	0,05	0,16	0,1	-0,03	0	0,01	-0,02	0,57	0,46	0,12	0,43	1	0,73	0,21	0,8
TarSOC	-0,04	-0,01	-0,04	-0,06	-0,02	0,01	-0,03	-0,08	0,46	0,58	0,11	0,43	0,73	1	0,17	0,84
TarGOV	0,14	0,23	0,29	0,12	-0,06	-0,07	-0,01	-0,02	0,12	0,1	0,21	0,18	0,21	0,17	1	0,47
TarESGC.	0,03	0,03	0,11	-0,01	-0,03	-0,02	0	-0,04	0,52	0,54	0,2	0,53	0,8	0,84	0,47	1

Note: ROA.acq-2 = ROA_acq_t_min_2; ROA.acq.-1 = ROA_acq_t_min_1; ROA.acq+2 = ROA_acq_t_plus_2; ROA.acq.+1 = ROA_acq_t_plus_1; CAR22 = CAR_2_2_w; CAR01 = CAR_0_1; CAR55 = CAR_5_5; CAR1010 = CAR_10_10; AcqENV = AcqENV; AcqSOC = AcqSOC; AcqGOV = AcqGOV; AcqESGC. = AcqESGComb; TarENV = TarENV; TarSOC = TarSOC; TarGOV = TarGOV; TarESGC. = TarESGComb

TABLE 10: ROBUSTNESS TEST OLS REGRESSION FOR HYPOTHESIS 1 - ESG AND CARS

	CAR (-1,+1)	CAR (-1,+1)	CAR (-1,+1)	CAR (-1,+1)	CAR (-1,+1)	CAR (-1,+1)
	-1	-2	-3	-4	-5	-6
AcqESG	0.001	0.009	0.012	0.034	0.054	
	(0.004)	(0.016)	(0.017)	(0.025)	(0.042)	
TarESG		-0.010		-0.004	-0.002	

	(0.018)		(0.024)	(0.042)		
LEV_acq_w		-0.056			0.066	
		(0.173)			(0.064)	
MTBV_acq_w		0.120			0.010	
		(0.169)			(0.059)	
industry_dummy			-0.564	-0.690	-0.210	
			(0.807)	(1.287)	(0.194)	
crossborder_dummy			-0.633	-1.846	0.312	
			(1.023)	(2.221)	(0.230)	
log_deal_value			-0.055	0.030	-0.010	
			(0.082)	(0.281)	(0.014)	
Cash_dummy			1.307	1.078	0.885***	
			(0.828)	(1.250)	(0.195)	
log_marketcap_acq			-0.576*	-0.755	-0.075	
			(0.306)	(0.506)	(0.062)	
Europe_dummy			0.931	-0.567	0.484	
			(1.650)	(7.451)	(0.308)	
Hostile_dummy					-0.207	
					(0.826)	
ROA_acq_w					0.033	
					(0.024)	
Constant	-0.385*	-0.805	-1.302	7.347	8.880	1.456
	(0.199)	(0.938)	(1.104)	(4.804)	(7.406)	(1.001)
Year FE	No	No	No	No	Yes	Yes
Country FE	No	No	No	No	Yes	No
Observations	2,742	220	2,219	159	159	2,219
R ²	0.00003	0.002	0.006	0.038	0.240	0.047
Adjusted R ²	-0.0003	-0.007	0.001	-0.013	-0.167	0.033
	4.080	4.570	4.558	5.060	5.430	
Residual Std. Error	(df =	(df =	(df =	(df =	(df =	4.180
	2740)	217)	204)	150)	103)	
F Statistic	0.072	0.214	0.284	0.748	0.590	3.359***

Note: This table compares six OLS regression models to assess the robustness of results and investigate the negative adjusted R² values. Model 1 includes only Acquirer ESG (adj. R² = -0.0003), while Model 2 adds Target ESG (adj. R² = -0.007). Model 3 introduces two financial controls and leaves Target ESG out, yielding a marginally positive adjusted R² (0.001). Model 4 adds deal-level controls, but adjusted R² turns negative again (-0.013) due to the small sample (n = 159). Model 5 incorporates year and country fixed effects, increasing R² to 0.240 but sharply lowering adjusted R² (-0.167). Model 6 excludes ESG variables but includes all controls with year fixed effects, resulting in the highest adjusted R² (0.033). The ESG coefficients remain non-significant across all models.

TABLE 11: ROBUSTNESS TEST FIXED EFFECTS FOR HYPOTHESIS 1 - ESG AND CARs

	CAR (- 2,+2)	CAR(- 1,+1)	CAR (0,+1)	CAR (- 5,+5)	CAR (10,+10)
AcqESG	0.0084 (0.1067)	0.0586 (0.1060)	0.0691 (0.1011)	0.0095 (0.1240)	-0.0057 (0.1630)
TarESG	-0.0643 (0.1480)	-0.0024 (0.1393)	0.0246 (0.1362)	-0.0851 (0.1679)	-0.1897 (0.2043)
Hostile Deal	-2.286 (4.889)	0.3328 (2.400)	0.5614 (2.404)	-6.396 (9.422)	-5.638 (12.20)
Industry dummy	0.7856 (1.835)	2.476 (1.173)	2.222 (1.188)	-0.6982 (1.928)	-0.2927 (2.141)
Cross-border dummy	-2.237 (2.799)	-2.991 (2.831)	-2.881 (2.594)	-3.182 (3.366)	-5.018 (3.856)
LogDeal Value	0.2411 (0.3001)	0.1116 (0.3144)	0.0912 (0.2747)	0.1631 (0.3402)	0.3772 (0.4294)
log_mc_acq	-1.115 (0.9390)	-0.9195 (0.6932)	-0.5993 (0.8133)	-1.941 (1.168)	-1.967 (1.519)
log_mc_tar	1.192 (0.9772)	1.203 (0.9061)	0.7891 (0.8075)	0.9470 (1.117)	1.018 (1.415)
ROA Acq.	-0.3207 (0.2454)	-0.3770 (0.2069)	-0.3575 (0.1883)	-0.1728 (0.2766)	-0.0532 (0.3113)
ROA Tar.	-0.0687 (0.0923)	-0.0794 (0.0821)	-0.0640 (0.0783)	-0.1604 (0.1111)	-0.1576 (0.1406)
MTBV Tar.	-0.4048 (0.4027)	-0.3315 (0.3741)	-0.2886 (0.3788)	-0.4448 (0.4380)	-0.5444 (0.5759)
Leverage Acq.	0.1529 (0.9741)	-0.2706 (0.8711)	-0.1773 (0.8022)	1.063 (1.009)	0.0512 (1.255)
Leverage Tar.	-0.2045 (0.6228)	-0.1210 (0.5389)	-0.1085 (0.5634)	-0.4988 (0.6843)	-0.6400 (0.8847)
MTBV Acq.	1.622** (0.6086)	1.574** (0.5194)	1.379** (0.5067)	1.181 (0.6768)	1.061 (0.7876)
ESG Interaction	0.0007 (0.0020)	-0.0005 (0.0019)	-0.0007 (0.0019)	0.0021 (0.0022)	0.0026 (0.0030)
Observations	136	136	136	136	136
R2	0.4356	0.4607	0.4499	0.4211	0.3998
Within R2	0.1834	0.2082	0.1992	0.1897	0.1362
Fixed Effects					
Acquirercountrycode	Yes	Yes	Yes	Yes	Yes
Targetcountrycod	Yes	Yes	Yes	Yes	Yes
year	Yes	Yes	Yes	Yes	Yes
SE-type	Heterosked.	Heterosked.	Heterosked.	Heterosked.	Heterosked.

Note: This table presents a fixed effects regression model used as a robustness check for the CAR analyses under Hypothesis 1. The dependent variables are CARs over five event windows surrounding the M&A

announcement. Each model includes the ESG scores of the acquiring and target firms, their interaction term, and a set of deal- and firm-level control variables. Fixed effects for acquirer country, target country, and year are included to account for unobserved heterogeneity across time and geography. Standard errors are heteroskedasticity-robust. The ESG interaction term and both ESG main effects remain statistically insignificant across all event windows, in line with the baseline results. Compared to earlier model specifications, the adjusted R^2 values have increased to approximately 0.2, whereas they were previously negative in the CAR models, indicating a modest improvement in explanatory power.

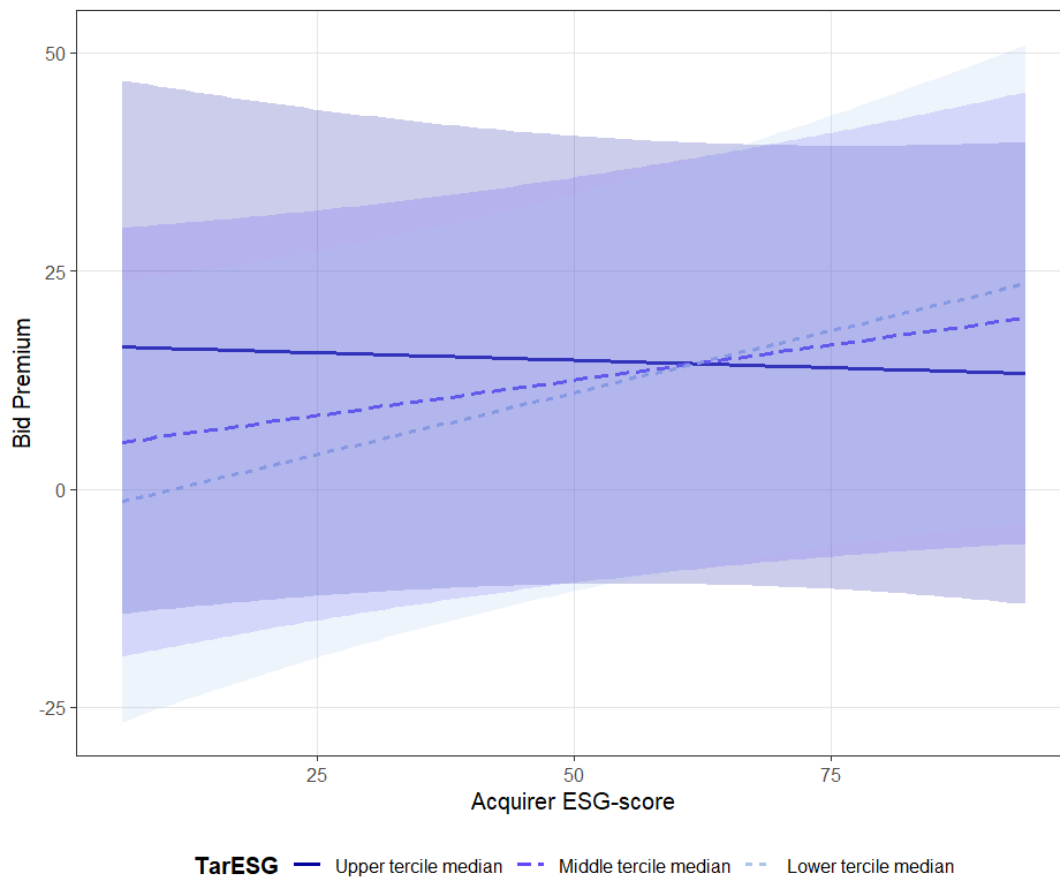


FIGURE 1: THE ESG INTERACTION EFFECT ON THE BID PREMIUM

Note: This graph depicts how the effect of an acquirer's ESG score on the bid premium depends on the target's ESG performance, with higher acquirer ESG leading to a significantly increased bid premium for targets with lower ESG scores. While acknowledging the potential for positive main effects of ESG on M&A performance, this illustration specifically uncovers a negative interaction, indicating a reduced, or even inverse, impact of acquirer ESG on the bid premium when the target company already exhibits strong ESG characteristics.

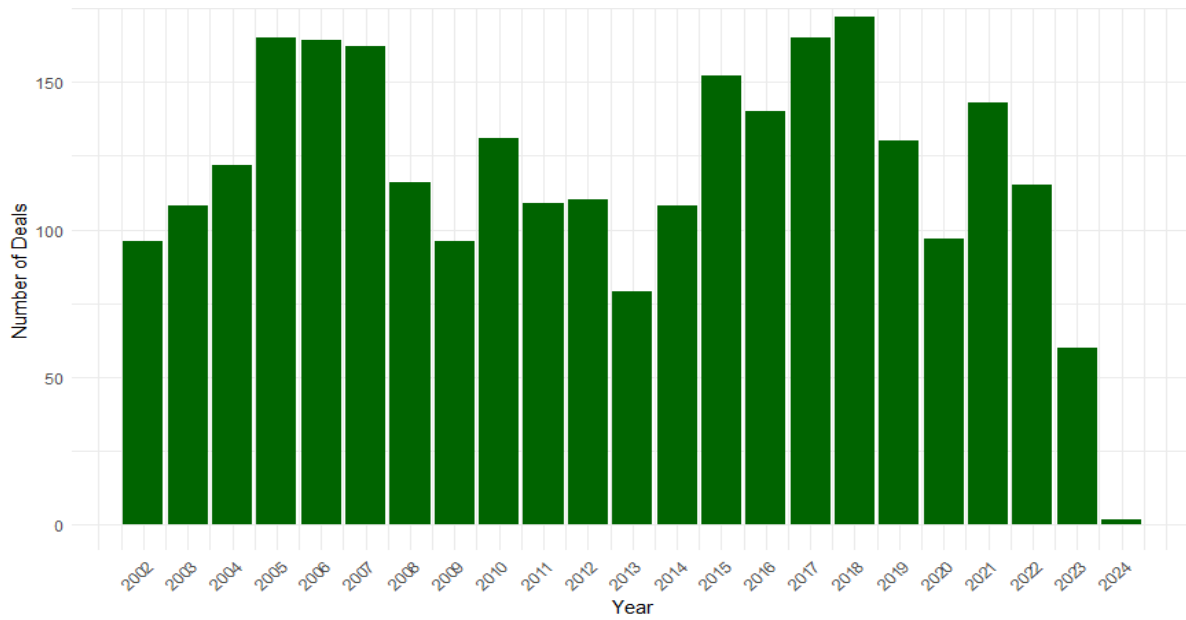


FIGURE 2: DISTRIBUTION OF M&A DEALS OVER TIME

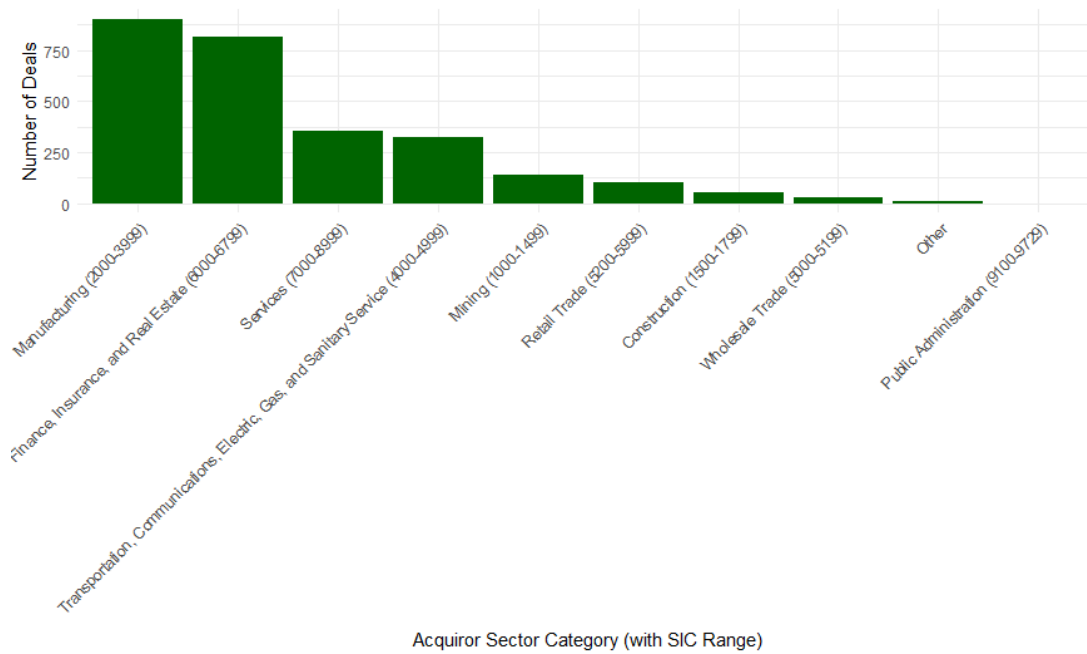


FIGURE 3: DISTRIBUTION OF DEALS BY ACQUIRER SECTOR

TABLE 12: ROBUSTNESS BY REGION (EU vs. US)

	CAR (- 1,+1) EU	Δ ROA t+1 EU	Δ ROA t+2 EU	Bid Premium EU	CAR (- 1,+1) US	Δ ROA t+1 US	Δ ROA t+2 US	Bid Premium US
AcqESG_c	0.079* (0.043)	0.029 (0.065)	0.081* (0.048)	0.258* (0.220)	-0.034 (0.054)	0.051 (0.039)	0.049 (0.033)	0.059 (0.142)
TarESG_c	0.047 (0.050)	0.069* (0.045)	0.117** (0.053)	0.180* (0.270)	-0.042 (0.087)	0.012 (0.062)	0.034 (0.053)	0.259 (0.179)
Acq_Tar_interact	-0.001 (0.002)	-0.002 (0.003)	-0.002 (0.002)	-0.011* (0.008)	0.001 (0.003)	-0.005 (0.002)	-0.0005 (0.002)	0.004 (0.008)
Hostile_dummy	-0.034 (2.946)	-1.152 (4.421)	1.500 (3.408)	-11.009 (7.674)	-0.034 (2.443)	-1.012 (3.411)	1.101 (4.322)	-9.008 (6.658)
industry_dummy	-3.026** (1.389)	-1.443 (2.589)	-4.111** (1.939)	-6.314 (9.057)	0.102 (2.433)	-0.938 (1.473)	0.952 (1.726)	1.981 (6.686)
crossborder_dummy	2.785* (1.458)	-4.291** (1.825)	-5.000*** (1.877)	-4.964 (9.503)	- 15.610*** (4.329)	- 10.404*** (2.970)	2.312 (4.260)	39.643*** (13.773)
Cash_dummy	-1.080 (1.339)	-2.463 (1.729)	0.267 (1.555)	-0.441 (8.513)	0.840** (2.240)	-0.619 (1.388)	0.407 (1.430)	3.307 (5.560)
log_deal_value	0.157 (0.146)	-0.086 (0.202)	-0.257 (0.210)	-0.127 (0.810)	0.201 (0.404)	0.154 (0.338)	-0.313 (0.279)	-1.375 (1.057)
log_marketcap_tar	0.058 (0.935)	0.186 (1.200)	-1.256 (0.803)	5.447 (4.740)	-0.270*** (1.087)	0.011 (0.701)	-0.627 (0.781)	-3.384 (2.850)
ROA_tar_w	0.090 (0.122)	0.010 (0.140)	-0.022 (0.124)	-1.037 (0.995)	-0.029 (0.096)	0.131 (0.092)	0.098 (0.066)	-0.134 (0.351)
LEV_tar_w	0.069 (0.430)	-1.228 (0.851)	-1.697*** (0.642)	-1.289 (2.169)	-0.373 (1.160)	0.393 (0.525)	0.287 (0.916)	-0.954 (2.698)
MTBV_tar_w	-0.223 (0.313)	-0.909 (0.613)	-0.186 (0.310)	0.141 (1.348)	-0.753*** (0.478)	0.137 (0.294)	-0.137 (0.392)	0.463 (1.919)
ROA_acq_w	-0.240 (0.193)	-0.370 (0.280)	-0.101 (0.216)	0.912 (1.116)	-0.178 (0.276)	-0.400** (0.191)	-0.176 (0.176)	-0.347 (0.884)
LEV_acq_w	0.178 (0.426)	0.803 (0.804)	2.075*** (0.780)	-1.445 (1.856)	0.944 (1.625)	-0.681 (0.937)	0.739 (1.036)	0.996 (4.377)
MTBV_acq_w	0.436 (0.480)	1.035* (0.616)	-0.485 (0.515)	3.591 (3.104)	1.747 (0.690)	0.360 (0.463)	-0.234 (0.625)	3.770 (2.551)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	67	67	67	47	69	69	69	60

R ²	0.497	0.543	0.629	0.627	0.502	0.589	0.404	0.504
Adjusted R ²	0.024	0.113	0.281	0.009	0.109	0.264	0.066	0.024
Residual Std. Error	3.923	5.195	4.455	14.561	5.594	3.978	4.358	14.403
F Statistic	1.050	1.263	1.805**	0.986	1.276)	1.812**	0.859	1.050

Note: This table reports the results of OLS regressions with robust standard errors, examining the impact of ESG performance (Acquirer ESG, Target ESG, and their interaction) on CAR [-1,+1], Δ ROA t+1, Δ ROA t+2, and Bid Premium. The analysis is conducted for two separate subsamples based on the deal's region: European (EU) deals and United States (US) deals, as indicated by the column headers. All models include Year Fixed Effects to control for unobserved time-specific factors. The values in parentheses represent robust standard errors. Statistical significance is indicated by asterisks: *p<0.10, **p<0.05, ***p<0.01.

TABLE 13: ROBUSTNESS CHECK USING ESG PILLAR-LEVEL SCORES

	CAR [-1,+1]	Δ ROA t+1	Δ ROA t+2	Bid Premium
	-1	-2		-3
AcqENV	-0.007 (0.008)	0.002 (0.006)	0.008 (0.007)	0.051* (0.030)
AcqSOC	-0.006 (0.010)	-0.007 (0.007)	0.003 (0.008)	-0.003 (0.036)
AcqGOV	-0.002 (0.006)	0.003 (0.005)	-0.005 (0.006)	0.015 (0.026)
Hostile_dummy	-0.378 (0.867)	-0.524 (1.842)	0.233 (1.537)	-6.726* (3.484)
industry_dummy	-0.174 (0.311)	0.055 (0.216)	0.135 (0.234)	-1.385 (1.087)
crossborder_dummy	0.417 (0.310)	-0.237 (0.301)	-0.292 (0.323)	2.334 (1.728)
Cash_dummy	1.007*** (0.267)	0.015 (0.219)	0.488** (0.243)	3.432*** (1.082)
Europe_dummy	0.810* (0.428)	0.113 (0.392)	-0.185 (0.418)	-0.325 (2.333)
log_deal_value	-0.026 (0.020)	-0.001 (0.018)	-0.027 (0.020)	-0.729*** (0.106)
log_marketcap_acq	-0.084 (0.148)	0.227** (0.090)	0.038 (0.101)	-0.211 (0.461)
ROA_acq_w	-0.003 (0.048)	-0.082** (0.032)	-0.104*** (0.034)	-0.156 (0.130)
LEV_acq_w	0.064	0.214***	0.175**	-1.292***

	(0.131)	(0.072)	(0.075)	(0.425)
MTBV_acq_w	0.050	-0.051	-0.099	1.390***
	(0.097)	(0.073)	(0.079)	(0.348)
Year FE	Yes	Yes	Yes	Yes
Observations	2,215	2,215	2,214	1,805
R ²	0.030	0.094	0.094	0.145
Adjusted R ²	0.015	0.079	0.080	0.128
Residual Std. Error	6.502	4.743	5.081	21.664
F Statistic	1.931***	6.451***	6.638***	8.555***

Note: This table reports the results of OLS regressions with robust standard errors, examining the impact of acquirer's ESG pillar-level scores (Environmental, Social, and Governance) on CAR [-1,+1], Δ ROA t+1, Δ ROA t+2, and Bid Premium. The models include Acquirer Environmental (AcqENV), Social (AcqSOC), and Governance (AcqGOV) scores as independent variables. All models include Year Fixed Effects to control for unobserved time-specific factors. The values in parentheses represent robust standard errors. Statistical significance is indicated by asterisks: *p<0.10, **p<0.05, ***p<0.01.

TABLE 14: ROBUSTNESS ANALYSIS WITH CATEGORICAL ESG SCORE PAIRINGS

	CAR [-1,+1]	Δ ROA t+1	Δ ROA t+2	Bid Premium
	-1	-2		-3
ESG_comboLow-High	-1.260	1.298	0.418	3.960
	-2.033	-2.098	-1.760	-5.396
ESG_comboHigh-Low	0.967	2.467**	1.524*	4.670
	-1.661	-1.166	-1.180	-4.679
ESG_comboHigh-High	2.251	3.581**	3.804**	0.063
	-1.835	-1.742	-1.626	-5.386
Hostile_dummy	-0.401	-1.810	0.488	-14.840**
	-1.291	-5.437	-1.833	-6.092
industry_dummy	-0.169	-0.482	-0.850	-3.779
	(0.991)	(0.898)	(0.824)	-3.013
crossborder_dummy	-0.265	-3.674***	-3.315***	-0.765
	-1.162	-1.191	-1.190	-3.904
log_deal_value	-0.016	-0.053	-0.106	-0.282
	(0.076)	(0.078)	(0.071)	(0.210)
log_marketcap_tar	-0.131	-0.167	-0.730*	-0.688
	(0.461)	(0.473)	(0.393)	-1.725
ROA_acq_w	-0.284**	-0.349**	-0.166	-0.183

	(0.134)	(0.156)	(0.143)	(0.426)
ROA_tar_w	-0.039	0.107	0.064	0.132
	(0.070)	(0.068)	(0.051)	(0.245)
MTBV_tar_w	-0.204	-0.213	-0.004	-1.061
	(0.265)	(0.278)	(0.204)	(0.889)
MTBV_acq_w	0.923**	0.484	-0.354	3.361**
	(0.384)	(0.358)	(0.335)	-1.306
LEV_acq_w	-0.050	0.512	1.017**	-2.512*
	(0.439)	(0.549)	(0.475)	-1.397
LEV_tar_w	-0.057	-0.796	-0.803*	0.252
	(0.366)	(0.533)	(0.445)	-1.278
Year FE	Yes	Yes	Yes	Yes
Observations	136	136	136	107
R ²	0.222	0.305	0.326	0.414
Adjusted R ²	-0.029	0.080	0.108	0.172
Residual Std. Error	5.118	4.863	4.478	14.040
F Statistic	0.884	1.358	1.496*	1.710**

Note: This table presents the results of OLS regressions with robust standard errors, examining the impact of ESG score pairings on CAR [-1,+1], Δ ROA t+1, Δ ROA t+2, and Bid Premium. The ESG_combo variables categorize deals based on the acquirer's and target's ESG scores: Low-High for acquirers with low ESG acquiring targets with high ESG, High-Low for acquirers with high ESG acquiring targets with low ESG, and High-High for both acquirers and targets having high ESG scores. The omitted reference category is Low-Low. All models include Year Fixed Effects to control for unobserved time-specific factors. The values in parentheses represent robust standard errors. Statistical significance is indicated by asterisks: *p<0.10, **p<0.05, ***p<0.01

8.2 Appendix B | AI Usage Documentation

1. Statement of Purpose

This appendix provides a detailed overview of the use of Generative AI tools during the writing of this thesis. These tools were used to support coding, data analysis, and the refinement of language, ensuring clarity, precision, and efficiency in the presentation of findings. All outputs generated were critically evaluated and, where necessary, modified by myself to align with the objectives of this research.

2. Tools Used

ChatGPT (GPT-4 / GPT-3.5) (OpenAI, 2025)

3. Scope of Use

3.1. Coding and Data Analysis

- o Tool: ChatGPT, RStudio, Excel
- o Purpose: Assistance in writing and fixing errors in the R code for data cleaning, OLS regression analysis, and data/results visualization/plotting. The initial data cleaning process was performed in Excel, where ChatGPT provided practical suggestions to improve efficiency.
- o My Role: The AI suggestions were reviewed, adjusted, and integrated with the original code to ensure correctness.
- o My reflection: AI helped me improve my coding in RStudio. Later, I successfully applied the same method independently.
- o Sections 3, 4, and 8.

3.2. Writing and Grammar Refinement

- o Tool: ChatGPT
 - o Purpose: Improved clarity and fluency in writing. Suggestions were provided to restructure sentences, improve structure, or simply give an overview with synonyms.
 - o My Role: All suggestions generated by ChatGPT were carefully evaluated and modified as needed before being included. No content was used without revision.
 - o My reflection: AI helped me to better structure my text, to be more fluent in writing, while not
-

changing the meaning of the content. Additionally, ChatGPT enhanced my vocabulary by offering synonyms and alternative phrasing.

o Used throughout the writing of the whole thesis.

3.3. Data visualization

o Tool: ChatGPT and R

o Purpose: Assisted in generating R code to initial data visualizations based on the provided dataset and visualization types (interaction plot, histograms). ChatGPT was used to refine and create code snippets for creating professional charts. R was used to execute the visualizations and customize features like titles, axis labels, colors, and legends.

o My Role: AI-generated code snippets were used as a starting point and critically reviewed to ensure accuracy, or were used as a small addition to the original code. Final visualizations and R codes were customized and edited to align with the research objectives and thesis formatting guidelines.

o My reflection: AI saved on my search time to find the right code snippets online, leaving more room for adjusting and experimenting with the code to find the right way of visualization, and adding details.

o Section 8.

4. Overview of AI Interaction

- Assistance with data cleaning in Excel

• Prompt input:

Ik heb de functie X.zoeken nodig in Excel, de gegevens die je moet invullen staan aangegeven als 'X.ZOEKEN(zoekwaarde; zoekbereik; [resultaatbereik]; [als_niet_gevonden]; [overeenkomende_methode]; [zoekmethode]) ' Kun je me dit uitleggen

• Output:

Zeker! De functie X.ZOEKEN (in het Engels: XLOOKUP) is een krachtige vervanger van oudere

zoekfuncties zoals VERT.ZOEKEN en INDEX + VERGELIJKEN. Hij is veel flexibeler, makkelijker te lezen, en veiliger (bijvoorbeeld bij het invoegen van kolommen).

Hieronder leg ik stap voor stap uit hoe je X.ZOEKEN gebruikt:

Syntaxis van X.ZOEKEN

X.ZOEKEN(zoekwaarde; zoekbereik; resultaatbereik; [als_niet_gevonden];
[overeenkomende_methode]; [zoekmethode])

Uitleg per argument:

1. zoekwaarde

- De waarde die je wilt opzoeken (bijv. een naam of ID).
- Bijvoorbeeld: "Klant123" of celverwijzing A2.

2. zoekbereik

- Het bereik waarin Excel moet zoeken naar de zoekwaarde.
- Bijvoorbeeld: A2:A100 (de kolom met klant-ID's).

3. resultaatbereik

- Het bereik waarin de overeenkomstige waarde staat die je terug wilt krijgen.
- Bijvoorbeeld: B2:B100 (de kolom met klantnamen bij de ID's).

4. [als_niet_gevonden] (optioneel)

- Wat Excel moet tonen als er geen match wordt gevonden.
- Bijvoorbeeld: "Niet gevonden".

5. [overeenkomende_methode] (optioneel)

- Hoe moet gezocht worden:
 - 0 = exacte overeenkomst (standaard)
 - -1 = exacte of volgende kleinere

- 1 = exacte of volgende grotere
- 2 = jokertekens toegestaan (zoals * en ?)

6. [zoekmethode] (optioneel)

- Richting van het zoeken:
 - 1 = van boven naar beneden (standaard)
 - -1 = van beneden naar boven
 - 2 = binair zoeken oplopend gesorteerd
 - -2 = binair zoeken aflopend gesorteerd

Laat me weten als je een concreet voorbeeld hebt of een datastructuur — dan maak ik een specifieke formule voor jouw situatie.

• How the output was used:

The output served as a helpful reminder of how the function worked, enabling me to apply it correctly in my data cleaning process.

- Coding Assistance in RStudio

• Prompt input:

Ik heb een regressie analyse uitgevoerd met meerdere dependent en independent variabele via Rstudio. De regressietabel is gemaakt met Stargazer. Ik wil deze tabel nu exporteren naar Word of Excel. Wat is de juiste code voor beide opties. Bovendien wil ik nog een VIF test toevoegen aan de analyse en deze mee exporteren. Wat is het script hiervoor.

• Output:

Prima vraag! Ik help je met een compleet script voor:

1. Exporteren van een regressietabel (via stargazer) naar Word en Excel
2. Toevoegen van een VIF-analyse (multicollineariteitstest)
3. Optioneel: Exporteren van de VIF-resultaten ook naar Word of Excel

```
r
KopiërenBewerken
install.packages("stargazer")
install.packages("officer")      # Voor Word
install.packages("flextable")   # Voor Word output
install.packages("writexl")     # Voor Excel
install.packages("car")         # Voor VIF
```

```
r
KopiërenBewerken
library(stargazer)
library(car)
library(writexl)
library(officer)
library(flextable)
```

```
# Voorbeelddata
data(mtcars)
```

```
# Regressie
modell1 <- lm(mpg ~ wt + hp + qsec, data = mtcars)
modell2 <- lm(mpg ~ wt + hp, data = mtcars)
```

```
# VIF berekenen (voor modell1)
vif_values <- vif(modell1)
```

Let op: stargazer maakt HTML/LaTeX-uitvoer. Voor Word kun je dit via clipboard plakken óf je gebruikt een workaround.

```
r
KopiërenBewerken
stargazer(modell1, modell2, type = "html", out = "regressie_tabel.html")
# Open de HTML in browser, selecteer en plak in Word
r
KopiërenBewerken
# Maak flextable van regressie-output (andere benadering, maar goed werkend)
reg_summary <- summary(modell1)
reg_df <- as.data.frame(coef(reg_summary))

ft <- flextable::qflextable(reg_df)

doc <- read_docx() %>%
  body_add_par("Regressietabel", style = "heading 1") %>%
  body_add_flextable(ft) %>%
  body_add_par("", style = "Normal")

# VIF toevoegen
vif_df <- data.frame(Variable = names(vif_values), VIF =
as.numeric(vif_values))
vif_ft <- flextable::qflextable(vif_df)

doc <- doc %>%
  body_add_par("VIF-analyse", style = "heading 1") %>%
```

```
body_add_flextable(vif_ft)

# Opslaan
print(doc, target = "Regressie_VIF.docx")
r
KopiërenBewerken
# Combineer coef en VIF
regression_results <- as.data.frame(coef(summary(modell)))
vif_df <- data.frame(Variable = names(vif_values), VIF =
as.numeric(vif_values))

# Meerdere tabbladen exporteren naar Excel
write_xlsx(
  list(
    Regressie = regression_results,
    VIF = vif_df
  ),
  path = "Regressie_VIF.xlsx"
)
```

Laat me weten of je met meerdere modellen werkt of een andere formattering wilt (bijvoorbeeld sterretjes voor significantie in Word of kleurcodering in Excel), dan pas ik het aan.

- How the output was used:

The resulting output formed the basis for further development of the regression and VIF tables.

- Coding Assistance in RStudio

- Prompt input:

Ik heb ongeveer 15 variabelen die ik wil verwerken in een correlatiematrix. Kun je hier een concept Rscript voor schrijven. Indien nodig wil ik de variabelen namen op de x-as verticaal formuleren

- Output:

Zeker! Hieronder vind je een volledig R-script om een correlatiematrix te maken voor ongeveer 15 variabelen, inclusief:

Automatische berekening van de correlatiematrix

Visualisatie via `ggplot2` of `corrplot`

- Optioneel: variabelenamen verticaal op de x-as voor leesbaarheid

```

r
KopiërenBewerken
# Installeer indien nodig
install.packages("ggplot2")
install.packages("reshape2")
install.packages("corrplot")
r
KopiërenBewerken
# Laad de packages
library(ggplot2)
library(reshape2)
library(corrplot)
r
KopiërenBewerken
# Simuleer een dataset met 15 variabelen en 100 observaties
set.seed(123)
data <- as.data.frame(matrix(rnorm(100 * 15), ncol = 15))
colnames(data) <- paste0("Var", 1:15) # Hernoem kolommen naar Var1 t/m
Var15

# Of gebruik je eigen data:
# data <- jouw_dataframe[, c("var1", "var2", ..., "var15")]
r
KopiërenBewerken
# Bereken correlaties
cor_matrix <- cor(data, use = "complete.obs", method = "pearson")
r
KopiërenBewerken
corrplot(cor_matrix, method = "color", type = "upper",
          tl.col = "black", tl.srt = 90) # tl.srt = 90 zet namen verticaal
r
KopiërenBewerken
# Matrix omvormen naar lange vorm
cor_melt <- melt(cor_matrix)

# Plot
ggplot(cor_melt, aes(Var2, Var1, fill = value)) +
  geom_tile(color = "white") +
  scale_fill_gradient2(low = "blue", high = "red", mid = "white",
                       midpoint = 0, limit = c(-1,1), space = "Lab",
                       name="Pearson\nCorrelation") +
  theme_minimal() +
  theme(axis.text.x = element_text(angle = 90, vjust = 0.5, hjust = 1)) + #
Verticaal
  coord_fixed()

```

Laat me weten als je echte variabelen hebt (namen of dataframe), dan pas ik het script direct aan voor jouw dataset.

- How the output was used:

The resulting output formed the basis for further development regarding the two correlation matrices.

- Coding Assistance in RStudio

- Prompt input:

Ik krijg de volgende error in R, wat betekent deze error:

```
Error in if (nchar(text.matrix[r, c]) > max.length[real.c]) { : missing value where TRUE/FALSE needed
```

- Output:

De foutmelding:

```
pgsql  
KopiërenBewerken  
Error in if (nchar(text.matrix[r, c]) > max.length[real.c]) :  
  missing value where TRUE/FALSE needed
```

komt meestal voor in `stargazer()` als er NA-waarden in de regressiecoëfficiënten zitten én je gebruikt `covariate.labels` die niet precies aansluiten bij wat er uit de modellen komt.

1. `covariate.labels` bevat labels voor variabelen die niet in alle modellen zitten
2. Je neemt een categorische tijdsvariabele op in het regressiemodel als controle, maar je geeft deze niet weer in de outputtabel. Hierdoor probeert het rapportagepakket alle categorieën van deze variabele als aparte rijen te tonen, wat de tabel onoverzichtelijk maakt. Om dit te voorkomen, moet je expliciet aangeven dat deze categorieën niet meegenomen moeten worden in de weergave.

- How the output was used:

The output was used to learn from coding mistakes, causing an error.

- Writing Assistance

- Prompt input:

Geef me synoniemen voor signaal/verbindingswoorden zoals *however* en *in addition*

- Output:

Natuurlijk! Hier is een overzicht van veelgebruikte signaal- of verbindingswoorden in het Engels, met synoniemen per categorie zoals "however" en "in addition".

Origineel Synoniemen / Alternatieven
However Nevertheless, Nonetheless, But, Yet, Still, That said, Even so, On the other hand,
In contrast, Conversely

Voorbeeld:

The results were promising. However, more research is needed.
→ The results were promising. Nevertheless, more research is needed.

Origineel Synoniemen / Alternatieven
In addition Moreover, Furthermore, Also, As well, What's more, Additionally, Besides that,
On top of that

Voorbeeld:

The treatment reduced pain. In addition, it improved mobility.
→ The treatment reduced pain. Moreover, it improved mobility.

Oorzaak/gevolg:

Therefore, Thus, As a result, Consequently, Hence, For that reason

Voorbeelden geven:

For example, For instance, Such as, Namely, To illustrate

Samenvatting/conclusie:

In conclusion, To sum up, All in all, Ultimately, In summary

Wil je dat ik een lijst maak die specifiek past bij een presentatie of informeel taalgebruik? Dan pas ik het aan!

• How the output was used:

This overview was consistently used throughout the thesis to enhance my writing and avoid repetitive word choice.

- **Writing Assistance**

• Prompt input:

Herschrijf de volgende zin wat vloeiender:

‘It is hypothesized that higher ESG scores are associated with superior short-term post-M&A performance, as measured by CARs and higher ESG scores are expected to positively influence long-term post-M&A performance.’

• Output:

Hier is een herschreven versie:

Origineel:

It is hypothesized that higher ESG scores are associated with superior short-term post-M&A performance as measured by CARs and higher ESG scores are expected to positively influence long-term post-M&A performance.

Herschreven:

The hypothesis states that higher ESG scores correlate with better short-term post-M&A performance, indicated by CARs, and are anticipated to have a positive effect on long-term post-M&A outcomes.

Wil je dat ik het iets formeler of juist eenvoudiger maak?

• How the output was used:

The output was only used as a reminder for correct comma use. Furthermore, it did not improve the sentence the way I wanted.

- Data visualization, histogram of data distribution

• Prompt input:

Ik heb data van de jaren 2002 tot en met 2024, ieder jaar zijn er een bepaalde hoeveelheid deals. Kun je een Rscript schrijven voor het opstellen van een histogram om deze data weer te geven in R. Maak de bars groen.

• Output:

Zeker! Hier is een concept R-script om een histogram te maken van het aantal deals per jaar, met jouw data van 2002 tot en met 2024.

Ik ga ervan uit dat je dataset een kolom bevat met de jaartallen van de deals, bijvoorbeeld `deal_year`.

```
r
KopiërenBewerken
# Voorbeelddata aanmaken (als je eigen data al in een dataframe zit, sla
deze stap over)
set.seed(123)
n_deals <- 500
```

```
data <- data.frame(
  deal_year = sample(2002:2024, n_deals, replace = TRUE)
)

# Laad ggplot2 (indien nog niet geïnstalleerd)
install.packages("ggplot2")
library(ggplot2)

# Histogram maken met groene bars
ggplot(data, aes(x = factor(deal_year))) +
  geom_bar(fill = "forestgreen") + # groene kleur voor de bars
  labs(title = "Aantal deals per jaar",
        x = "Jaar",
        y = "Aantal deals") +
  theme_minimal() +
  theme(axis.text.x = element_text(angle = 45, hjust = 1))
```

`factor(deal_year)`: zorgt dat de jaartallen als discrete categorieën worden behandeld (en niet als continue variabele).

`geom_bar()`: telt automatisch het aantal observaties per categorie.

`theme(axis.text.x = element_text(angle = 45, hjust = 1))`: draait de x-as labels schuin zodat ze beter leesbaar zijn.

- How the output was used:

The output was used as a conceptual R script to create the figures regarding the dataset distribution.

- Data visualization, interaction plot

- Prompt input:

Write me a conceptual R script for an interaction plot with two variables using GGplot

- Output:

Sure! Here's a conceptual R script to create an interaction plot between two variables using `ggplot2`. I'll show you how to visualize the interaction between a continuous predictor and a categorical moderator, which is a common scenario.

```
r
KopiërenBewerken
# Load necessary package
install.packages("ggplot2") # run once if not installed
library(ggplot2)
```

```
# Example data: simulate continuous predictor (x), categorical moderator
(group), and outcome (y)
set.seed(42)
data <- data.frame(
  x = rep(seq(1, 10, length.out = 100), 2),
  group = rep(c("A", "B"), each = 100)
)
# Simulate y with interaction effect
data$y <- 5 + 2 * data$x + ifelse(data$group == "B", 3 * data$x, 0) +
rnorm(200, 0, 2)

# Basic interaction plot
ggplot(data, aes(x = x, y = y, color = group)) +
  geom_point(alpha = 0.5) + # scatter points
  geom_smooth(method = "lm", se = FALSE) + # regression lines per group
  labs(title = "Interaction Plot",
        x = "Predictor X",
        y = "Outcome Y",
        color = "Group") +
  theme_minimal()
```

x: continuous predictor

group: categorical moderator (factor with levels "A" and "B")

y: dependent variable simulated to depend on both x and its interaction with group

geom_point(): plots raw data points

geom_smooth(method = "lm"): plots regression lines for each group, showing different slopes if interaction is present

- How the output was used:

The output was used as a conceptual R script for creating the interaction plot between the ESG variables.