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When ESG Signals Fail: The Moderating Role of ESG Controversies in Shaping Firm Value, Returns, and Cost of Capital

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Abstract

This study investigates how disaggregated environmental, social, and governance (ESG) indicators are associated with firm value, stock returns, and the cost of capital, emphasizing the moderating role of ESG controversies. Using panel data of publicly listed firms in the Asia-Pacific region from Refinitiv and applying firm and year fixed effects with forward-looking specifications (t to $t + 3$), the results show that the ESG–performance association is neither uniform across indicators nor stable over time: several environmental indicators lose statistical relevance beyond the short horizon, while selected social and governance indicators remain associated with outcomes only where materiality is high. The central finding is that ESG controversies do not merely add explanatory power but systematically reshape these relationships—attenuating or reversing the association between ESG and firm value or returns, while strengthening the association with the cost of capital. This pattern indicates that ESG is priced by the market only when it is perceived as credible, underscoring reputational risk—rather than ESG performance itself—as the dominant mechanism linking sustainability information to firm outcomes.

Keywords: environmental, social, and governance (ESG); ESG controversies; firm value; stock returns; cost of capital; panel data

1. Introduction

Over the past few decades, environmental, social, and governance (ESG) practices have evolved into one of the primary determinants in the evaluation of corporate performance by investors and stakeholders. The modern finance literature suggests that ESG activities are not merely associated with social responsibility but also carry tangible economic implications for firm value, stock returns, and the cost of capital (Friede et al., 2015). Theoretically, strong ESG practices are viewed as a signal of managerial credibility in handling non-financial risks, thereby reducing both idiosyncratic and systematic risk and enhancing expectations of long-term growth (El Ghoul et al., 2011).

It is important to clarify upfront that “ESG” in this study is proxied by third-party ESG ratings and scores rather than observed directly, and that a growing body of research documents substantial disagreement across rating providers regarding both the level and the components of firm-level ESG performance. This study therefore also draws a clear conceptual distinction, used throughout the paper, between ESG performance (the substantive score reflecting a firm’s sustainability practices) and ESG controversies (a



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separate, reputational signal capturing negative incidents or perceptions), since these two constructs need not move together and their potential inconsistency is itself a central motivation for the moderation analysis that follows. Furthermore, recent bibliometric evidence indicates that, to date, the literature has predominantly framed ESG engagement as a risk-management tool rather than as a strategic driver of long-term value creation, although a smaller stream of research proposes the latter path; this study speaks primarily to the risk-management framing while remaining attentive to the possibility of longer-term value effects (Cippiciani et al., 2025).

However, the relationship between ESG and financial performance is not always consistent. A number of studies indicate that the strength of the ESG–financial performance association largely depends on how the market interprets the credibility of such information. In this context, the ESG Controversies Score becomes a key variable, reflecting the level of controversies or negative issues faced by firms in relation to their ESG practices. This score essentially represents a dimension of negative reputation, such as environmental violations, labor issues, or governance scandals, all of which can undermine investor trust (Servaes & Tamayo, 2013). Consequently, even firms with high ESG scores may experience an erosion of credibility when controversies are present.

From a signaling theory perspective, ESG functions as a quality signal conveyed by firms to the market. However, when ESG controversies arise, this signal may become distorted or even lose its meaning, as investors begin to question the consistency between claims and actual practices. This leads to a phenomenon known as credibility erosion, where ESG information is no longer fully trusted, weakening or even reversing market responses (Fatemi et al., 2018). Within the stakeholder theory framework, controversies also reflect a firm's failure to meet stakeholder expectations, ultimately affecting corporate legitimacy and reputation.

Furthermore, from a risk-based perspective, ESG controversies increase the perceived risk of a firm, whether through a higher likelihood of litigation, regulatory sanctions, or reputational damage. This heightened risk is directly reflected in an increased cost of capital and a decline in market valuation, as investors demand a higher risk premium (Krüger, 2015). In addition, controversies may generate information asymmetry, making it difficult for investors to distinguish between firms that are genuinely committed to ESG and those that engage in symbolic disclosure or ESG washing.

This information asymmetry is closely related to the broader phenomenon of greenwashing, which has become a central concern in the sustainability literature. Market surveillance evidence suggests that outright greenwashing, while a material risk, is not yet pervasive across the sustainable finance market as a whole (International Capital Market Association (ICMA), 2023), whereas other work shows that issuers can practice greenwashing in several distinct forms that investors do not always recognize or price correctly (Yamahaki et al., 2026). These findings motivate the explicit separation of ESG performance from ESG controversies adopted in this study, since controversies can be understood as one observable manifestation of the gap between ESG claims and market perception that greenwashing concerns are ultimately about.

Based on these arguments, this study aims to examine the association between disaggregated ESG indicators—covering environmental, social, and governance dimensions—on corporate financial performance, with ESG Controversies Score explicitly incorporated as a moderating variable. Unlike prior studies that typically rely on aggregated ESG indices, this approach allows for the identification of more specific economic mechanisms associated with each ESG component. Moreover, the study evaluates how the moderating role of controversies varies across different time horizons (t , $t + 1$, $t + 2$, $t + 3$), thereby capturing the dynamics of market responses in both the short and medium term.

This disaggregated approach is motivated not simply by a preference for more granular variables, but by accumulating evidence that aggregate sustainability measures can obscure heterogeneous valuation effects across individual dimensions, such that aggregation itself may bias inferences about the ESG-value relationship (Jitmaneroj, 2024). While this emerging stream of literature has established that heterogeneous sustainability dimensions matter, it has done so largely without an explicit reputational moderator; the present study extends this line of work by showing that disaggregation alone is insufficient—the economic relevance of individual ESG indicators additionally depends on whether the market perceives the firm’s ESG signal as credible, as captured by the ESG Controversies Score.

Accordingly, this study makes two primary contributions. First, it provides empirical evidence on whether ESG genuinely creates economic value or whether its impact depends on market perceptions of credibility. Second, it uncovers how the ESG Controversies Score can strengthen, weaken, or even reverse the relationship between ESG practices and corporate financial performance. The findings are expected to offer important implications for investors, regulators, and corporate managers, emphasizing that the economic value of ESG is determined not only by the level of implementation but also by the consistency and integrity of those practices.

2. Literature Review & Hypothesis

2.1. ESG Performance and Financial Outcomes

The performance of environmental, social, and governance (ESG) has increasingly been regarded as an important determinant in explaining variations in corporate performance, particularly in terms of firm value (Tobin’s Q), stock returns, and cost of capital (WACC). From an environmental perspective, activities related to emissions management, resource efficiency, and waste reduction initiatives theoretically influence firm value through two primary channels: the risk channel and the growth expectations channel. Within the risk-based view, firms with better environmental practices tend to have lower exposure to regulatory risk, litigation risk, and environmental liabilities, thereby reducing both systematic and idiosyncratic risk (Bolton & Kacperczyk, 2021). This reduction in risk is ultimately reflected in higher firm valuation, as investors discount future cash flows at a lower risk rate. However, in certain contexts, indicators such as total emissions may also reflect production scale and economic activity intensity, and thus may be associated with short-term growth expectations. This explains why some environmental indicators may exhibit nonlinear or even ambiguous relationships with Tobin’s Q.

In the context of stock returns, the underlying mechanism tends to be more sensitive to information dynamics and market expectations. Based on signaling theory, the disclosure and implementation of ESG practices can be perceived as signals of managerial quality and long-term orientation (Spence, 1973; Lins et al., 2017). In the short term, the market may respond positively to environmental policy announcements or implementations, as they signal commitment to sustainability and risk management. However, such effects are not always persistent. Over time, investors may revise their expectations if ESG practices are not accompanied by fundamental changes in operational performance or risk profile. As a result, the relationship between ESG indicators and stock returns often exhibits fluctuating patterns across time horizons, reflecting the process of information adjustment and expectation formation.

Meanwhile, in the context of cost of capital, ESG practices operate through mechanisms more directly related to investor and creditor risk perceptions. Firms with stronger ESG performance are generally associated with lower levels of uncertainty, including operational, reputational, and regulatory risks. This leads to a reduction in the required rate of return demanded by investors, thereby lowering the weighted average cost of capital (WACC)

(El Ghouli et al., 2011). From an efficiency perspective, investment in ESG practices can also improve operational efficiency through energy savings, better waste management, and enhanced stakeholder relationships, ultimately strengthening the firm's ability to generate stable cash flows.

However, not all ESG indicators have the same level of materiality in influencing financial outcomes. The materiality literature suggests that only ESG issues directly related to a firm's business model and risk exposure tend to have a significant impact on firm value and cost of capital (Khan et al., 2016). Indicators that are more symbolic in nature, such as formal policies or aggregate scores that do not reflect real operational changes, are often not significantly priced by the market. This is also related to the presence of information asymmetry and greenwashing practices, where investors struggle to distinguish between substantive ESG commitments and symbolic ones.

Furthermore, the relationship between ESG and financial performance cannot be separated from stakeholder theory, which emphasizes that firms capable of effectively managing relationships with various stakeholders will gain long-term competitive advantages (Freeman, 1984; Godfrey et al., 2009). Effective ESG practices can enhance corporate legitimacy, strengthen reputation, and reduce potential conflicts with stakeholders. However, these effects are highly dependent on the perceived credibility of ESG practices. Without sufficient credibility, ESG activities will not translate into tangible economic value.

Thus, conceptually, ESG indicators are expected to have a positive relationship with firm value and stock returns, and a negative relationship with cost of capital. However, the direction and magnitude of these relationships depend heavily on the type of indicator, time horizon, and how the market interprets ESG information in terms of risk, reputation, and growth expectations.

2.2. ESG Controversies Score as a Moderating Mechanism

The ESG Controversies Score represents the negative dimension of ESG practices that is often overlooked in aggregate score-based approaches. Unlike ESG indicators that reflect commitment or performance in sustainability aspects, ESG controversies capture actual events such as violations, scandals, or failures in meeting environmental, social, or governance standards. Therefore, this variable functions not merely as an additional measure, but as a mechanism that fundamentally alters how the market interprets ESG information.

It is worth emphasizing that ESG controversies do not always correspond to a proven wrongdoing or an established scandal; in many cases they instead capture a gap between a firm's ESG claims and how those claims are perceived by external stakeholders and the media. A firm may therefore accumulate a high controversies score purely on the basis of negative perception or contested framing, even absent any confirmed misconduct. This nuance matters conceptually because it means the ESG Controversies Score is best understood as a proxy for a credibility or perception gap between ESG scores and ESG ratings, rather than strictly as a measure of corporate wrongdoing.

Within the signaling theory framework, the effectiveness of ESG as a signal depends heavily on its credibility. ESG controversies directly undermine this credibility by creating inconsistencies between ESG claims and actual corporate practices. When firms face controversies, investors tend to discount ESG information that was previously perceived as positive, due to the increased likelihood that such ESG activities are symbolic or not reflective of fundamental changes (Du et al., 2010). In this sense, ESG controversies act as a credibility filter, where only strong, costly, and difficult-to-imitate ESG signals retain their economic value.

From a reputational perspective, ESG controversies generate reputational damage that directly affects stakeholder perceptions of the firm. The literature shows that reputa-

tional losses resulting from negative events often outweigh the benefits of positive CSR or ESG activities (Minor & Morgan, 2011). This is driven by asymmetry in stakeholder responses, where reputational losses are faster and stronger than gains. In this context, ESG controversies can weaken or even eliminate the economic benefits of ESG practices due to a breakdown of trust between the firm and its stakeholders.

Additionally, within the risk-based view, ESG controversies increase perceived firm risk through multiple channels, including litigation risk, regulatory sanctions, and potential declines in demand due to negative consumer reactions. This increased risk leads investors to adjust the required rate of return, ultimately increasing the cost of capital and reducing firm valuation (Hoepner et al., 2018). In other words, ESG controversies not only diminish ESG benefits but also actively introduce additional risk burdens that affect asset pricing.

Moreover, ESG controversies influence stock return dynamics through market expectation revisions. Empirical evidence shows that markets react significantly to negative ESG-related news, typically generating negative abnormal returns followed by further adjustments in subsequent periods (Capelle-Blancard & Petit, 2019). This indicates that ESG controversies can accelerate market corrections, especially when there is a mismatch between prior expectations and actual outcomes. In this sense, controversies act as amplifiers of negative signals and attenuators of positive signals.

However, the role of ESG controversies is not always unidirectional. In some cases, controversies may increase the value of certain ESG actions, particularly those that are remedial or corrective. When firms face reputational pressure, actions such as emission reductions, improvements in environmental policies, or increased transparency may be perceived as more credible efforts to restore legitimacy compared to normal conditions. This creates the possibility of a reversal effect, where ESG practices that were previously undervalued become more valuable in a post-controversy context. This phenomenon aligns with the view that the economic value of ESG depends not only on its existence but also on context and timing.

From a stakeholder theory perspective, ESG controversies reflect a firm's failure to meet stakeholder expectations. This failure not only affects short-term relationships but may also disrupt long-term legitimacy. In such conditions, investors and other stakeholders become more selective in responding to ESG information, meaning that only material and verifiable practices will be internalized into stock prices and cost of capital.

Taken together, the mechanisms discussed above—credibility erosion under signaling theory, legitimacy loss under stakeholder theory, and risk repricing under the risk-based view—are not competing explanations but operate through a common channel: ESG controversies increase information asymmetry between firms and the market, and it is this asymmetry that simultaneously undermines the credibility of ESG signals (signaling theory), reduces perceived legitimacy (stakeholder theory), and raises the discount rate applied to firm cash flows (risk-based view). The relative strength of each channel is expected to vary systematically across the three ESG pillars. Environmental indicators, which are often output- or activity-based and more easily verified against hard data (e.g., emissions), are expected to be more exposed to the risk-based channel, since controversies here directly signal regulatory and litigation exposure. Social indicators, which are more relational and harder to verify, are expected to operate more strongly through the legitimacy and stakeholder channel. Governance indicators, being closest to internal monitoring and disclosure quality, are expected to interact most directly with the credibility channel, since governance controversies speak directly to the reliability of the firm's own reporting. This differential exposure across pillars provides the conceptual basis for expecting ESG controversies to attenuate, strengthen, or reverse ESG-outcome associations to different degrees depending on which pillar and which financial outcome is examined, consistent

with recent global evidence that the ESG-risk relationship is nonlinear rather than uniform across firms and dimensions (Cippiciani et al., 2026).

Therefore, ESG Controversies Score is expected to play a significant moderating role in the relationship between ESG indicators and corporate financial performance. Conceptually, controversies may attenuate or even reverse the positive effects of ESG on firm value and stock returns, while strengthening the impact of ESG on increasing the cost of capital. This moderating role reflects that the economic value of ESG is determined not only by ESG performance itself, but also by the reputational and credibility context in which the information is received by the market.

2.3. Hypothesis Development

Based on the conceptual framework developed earlier, the relationship between ESG indicators and corporate financial performance cannot be understood in aggregate form but must be analyzed separately across ESG pillars and types of financial outcomes. This approach allows for a more precise identification of economic mechanisms, particularly in explaining how markets respond to ESG signals in the context of firm value, stock returns, and cost of capital.

In the environmental dimension, indicators such as emissions management, resource efficiency, and waste reduction initiatives are theoretically linked to environmental risk exposure and operational efficiency. In terms of firm value (Tobin's Q), better environmental practices are expected to increase valuation through reduced long-term risk and improved sustainability of cash flows. This is consistent with the view that markets reward firms capable of effectively managing environmental externalities (Clark et al., 2015). In stock returns, environmental practices may generate positive short-term reactions as new information signals improved firm quality, although these effects may be corrected over time. In terms of cost of capital, strong environmental practices are expected to reduce WACC by lowering the risk premium demanded by investors. Thus, the hypotheses for the environmental dimension are:

H1a. *Environmental indicators are positively associated with Tobin's Q.*

H1b. *Environmental indicators are positively associated with Total Return.*

H1c. *Environmental indicators are negatively associated with WACC.*

In the social dimension, indicators such as community engagement, human rights policies, data protection, and workforce composition reflect the quality of a firm's relationship with non-financial stakeholders. Within stakeholder theory, firms that maintain strong stakeholder relationships tend to have higher legitimacy, lower conflict, and better operational stability (Flammer, 2015), which is expected to positively affect firm value. However, for stock returns, the effects of social indicators are often more indirect and depend on market perceptions of their materiality. In terms of cost of capital, strong social practices can reduce reputational and non-financial risks, thereby lowering WACC. Thus, the hypotheses for the social dimension are:

H2a. *Social indicators are positively associated with Tobin's Q.*

H2b. *Social indicators are positively associated with Total Return.*

H2c. *Social indicators are negatively associated with WACC.*

In the governance dimension, indicators such as board size, gender diversity, and shareholder rights reflect the quality of corporate oversight and control mechanisms. Within agency theory, strong governance reduces conflicts of interest between managers and shareholders, improving resource allocation efficiency and decision-making quality (Gompers et al., 2003). This is expected to enhance firm value. Strong governance also increases investor confidence and reduces uncertainty, thereby affecting stock returns and cost of capital. Thus, the hypotheses for the governance dimension are:

H3a. *Governance indicators are positively associated with Tobin's Q.*

H3b. *Governance indicators are positively associated with Total Return.*

H3c. *Governance indicators are negatively associated with WACC.*

Before turning to the moderating hypotheses, it is useful to state explicitly the boundary conditions under which each moderating pattern is expected to dominate. Attenuation is expected when controversies are moderate and the ESG indicator in question is verifiable (e.g., emissions data), such that the market discounts but does not fully disregard the signal. Reversal is expected when controversies directly contradict the specific ESG claim being evaluated—for example, a governance controversy coinciding with a high board diversity score—such that the indicator is reinterpreted as symbolic rather than substantive. Strengthening of a positive association is expected only for indicators that are remedial or corrective in nature (e.g., restoration initiatives, policy tightening), where controversies raise the baseline level of scrutiny against which remedial actions are judged, making genuine corrective effort comparatively more valuable to investors.

However, the relationship between ESG indicators and financial performance is not universal and depends heavily on the firm's reputational and credibility context. In this regard, ESG Controversies Score is expected to play a significant moderating role. When firms face ESG controversies, markets tend to revise their interpretation of ESG signals. Practices previously perceived as positive may lose credibility or even be interpreted as symbolic compliance, weakening their impact on financial performance.

In some cases, ESG controversies may even reverse the direction of the relationship. For example, environmental indicators previously associated with efficiency may be perceived as additional risk sources when firms are involved in environmental controversies. Conversely, remedial ESG actions may become more valuable in post-controversy contexts as credible reputation-repair efforts. This indicates that ESG controversies can function as attenuators, amplifiers, or reversal mechanisms, depending on the indicator type and context (Bénabou & Tirole, 2010; Hong & Kacperczyk, 2009).

Thus, the moderating hypotheses are:

H4a. *ESG Controversies Score moderates the relationship between environmental indicators and Tobin's Q, Total Return, and WACC.*

H4b. *ESG Controversies Score moderates the relationship between social indicators and Tobin's Q, Total Return, and WACC.*

H4c. *ESG Controversies Score moderates the relationship between governance indicators and Tobin's Q, Total Return, and WACC.*

Overall, this hypothesis development underscores that the ESG–financial performance relationship is contextual and inseparable from firm reputation and credibility. Therefore,

the empirical analysis in this study not only examines the direct relationship between ESG indicators and financial outcomes but also evaluates how these relationships change in the presence of ESG controversies.

Because the empirical models in Section 4 are estimated at the level of individual ESG indicators rather than at the aggregate pillar level, each pillar-level hypothesis (H1–H4) is evaluated empirically as being supported when a preponderance of the indicators within that pillar display the hypothesized sign and significance across time horizons, rather than requiring uniform significance across every individual indicator. This indicator-to-pillar mapping is stated explicitly here because the heterogeneity documented within each pillar in Section 5 is itself one of the paper’s substantive findings, not a departure from the hypothesized framework.

3. Data and Variables

3.1. Data Source

This study uses secondary data obtained from the Refinitiv database, which provides comprehensive information on corporate financial performance as well as firm-level ESG indicators. The sample consists of publicly listed companies in the Asia-Pacific region over a multi-year observation period, structured as firm-year panel data. The definitions, types, and measurement scales of all variables used in this study are presented in Table 1.

Table 1. Variable Definitions.

Variable	Type	Definition	Type
Tobin’s Q	Dependent	Firm market valuation relative to total assets	Ratio
Total Return	Dependent	Annual shareholder return including dividends	Ratio
WACC	Dependent	Weighted average cost of capital	Ratio
Environmental Restoration Initiatives	Independent Environment	Corporate initiatives to restore environmental damage	Dummy
Policy Emissions	Independent Environment	Corporate policy on greenhouse gas emissions management	Dummy
Emissions Score	Independent Environment	Firm performance in managing emissions	ESG Score
Estimated CO ₂ Equivalent Emissions	Independent Environment	Total greenhouse gas emissions produced by the firm	Ratio
Resource Use Score	Independent Environment	Efficiency in managing natural resources	ESG Score
Waste Reduction Initiatives	Independent Environment	Corporate initiatives to reduce operational waste	Dummy
Community Score	Independent Social	Firm performance in community engagement and social impact	ESG Score
Human Rights Policy	Independent Social	Corporate policy addressing human rights practices	Dummy
CSR Strategy Score	Independent Social	Firm commitment and strategy toward corporate social responsibility	ESG Score
Data Privacy Policy	Independent Social	Corporate policy for protecting customer and stakeholder data	Dummy

Table 1. Cont.

Variable	Type	Definition	Type
Women Employment Score	Independent Social	Firm performance in promoting female workforce participation	ESG Score
Board Size	Independent Governance	Total number of directors on the board	Count
Board Gender Diversity (%)	Independent Governance	Proportion of female directors on the board	Ratio
Shareholder Rights	Independent Governance	Strength of policies protecting shareholder rights	ESG Score
Shareholder Vote Score	Independent Governance	Shareholder voting rights and governance practices	ESG Score
ESG Controversies Score	Moderator	Severity of environmental, social, and governance controversies that capture reputational risk, trust erosion, and negative stakeholder responses	Dummy
Working Capital/Total Assets	Controls	Net working capital relative to total assets	Ratio
Asset Turnover	Controls	Revenue generated per unit of total assets	Ratio
Developed Country	Controls	Indicator for firms located in developed economies	Dummy
GDP (log)	Controls	Country-level economic size	Log
Revenue (log)	Controls	Firm size measured by total revenue	Log

The final estimation sample covers 23 economies in the Asia-Pacific region, comprising 1858 unique publicly listed firms observed over the 2017–2023 period, yielding the firm-year panel described below.

Refinitiv is selected because it provides disaggregated ESG indicators at a granular level, enabling more detailed analysis compared to the use of aggregated ESG scores. In addition, the database also provides ESG Controversies Score, which captures negative events or incidents related to corporate ESG practices.

Corporate financial data, including Tobin's Q, total return, and weighted average cost of capital (WACC), are also obtained from the same source to ensure measurement consistency and minimize potential measurement error arising from differences in data sources.

3.2. ESG Indicators

This study adopts a disaggregated ESG indicator approach, where each indicator within the environmental, social, and governance pillars is included separately in the estimation model. In the environmental dimension, the indicators include environmental restoration initiatives, policy emissions, emissions score, estimated CO₂ equivalent emissions, resource use score, and waste reduction initiatives. These indicators reflect a combination of policies, performance, and the intensity of corporate environmental activities. Economically, output-based indicators such as total emissions primarily capture risk exposure and activity scale, while policy- and initiative-based indicators reflect corporate commitment to environmental management.

These environmental indicators were selected to jointly capture policy commitment (environmental restoration initiatives, policy emissions, waste reduction initiatives), disclosed performance (emissions score, resource use score), and physical activity (estimated

CO₂ equivalent emissions), so that the empirical analysis can distinguish symbolic commitment from verifiable outcomes rather than treating environmental performance as a single construct.

In the social dimension, the indicators include community score, human rights policy, CSR strategy score, data privacy policy, and women employment score. These indicators represent the quality of the firm's relationship with non-financial stakeholders, including communities, employees, and consumers. In this context, social indicators are expected to operate through mechanisms of reputation, legitimacy, and stakeholder relationship stability.

These social indicators were chosen to represent the firm's principal non-financial stakeholder relationships—community (community score), employees (women employment score), customers and data subjects (data privacy policy), and human rights exposure (human rights policy, CSR strategy score)—reflecting the stakeholder groups most commonly identified in the materiality literature as relevant to firm value and reputational risk in this sector and region.

In the governance dimension, the indicators include board size, board gender diversity, shareholder rights policy score, and shareholder vote score. These indicators reflect corporate governance structures and internal monitoring mechanisms, which are directly related to decision-making efficiency and the protection of shareholder interests.

These governance indicators were selected because board size, board gender diversity, shareholder rights policy score, and shareholder vote score are the governance dimensions most consistently linked in prior literature to monitoring quality and shareholder protection, and because they are available on a comparably disaggregated basis in the Refinitiv database across the full sample period.

3.3. Dependent Variables

This study uses three dependent variables to represent three distinct dimensions of firm performance: firm value, stock market performance, and cost of capital. The use of these three proxies is important because the relationship between ESG and firm performance does not necessarily appear in only one dimension; instead, it may operate through valuation channels, market reaction channels, or financing risk channels.

The first dependent variable is Tobin's Q, which is used as a proxy for firm value. Tobin's Q reflects the ratio between a firm's market value and the book value of its assets, thereby capturing how the market assesses the firm's growth prospects and its ability to create future value. In general, Tobin's Q is calculated as:

$$\text{Tobin's Q} = (\text{Market Capitalization} + \text{Total Debt}) / \text{Total Assets}$$

A higher Tobin's Q indicates that the market values the firm more highly relative to the book value of its assets, which suggests stronger growth expectations or lower perceived risk.

The second dependent variable is total return, which represents the annual return to shareholders. This variable captures the actual return received by investors from both stock price changes and dividends over the observation period. Total return is calculated as:

$$\text{Total Return} = [(P_n - P_{n-1}) + D] / P_{n-1} \times 100\%$$

where P_n is the stock price in year n , P_{n-1} is the stock price in the previous year, and D is the dividend per share received during that period. This variable is used to capture short- to medium-term market responses to information reflected in the firm's ESG practices.

The third dependent variable is weighted average cost of capital (WACC), which represents the average cost of financing from a combination of equity and debt. WACC indicates the minimum return a firm must generate to meet the expectations of investors and creditors. In general, WACC is calculated as:

$$\text{WACC} = (E/V) \times R_e + (D/V) \times R_d \times (1 - T)$$

where E is the market value of equity, D is the market value of debt, V = E + D is total financing, R_e is the cost of equity, R_d is the cost of debt, and T is the corporate tax rate. A lower WACC indicates that the firm obtains financing at a more efficient cost, whereas a higher WACC reflects greater perceived risk in the capital market.

These three dependent variables are used simultaneously to capture whether ESG indicators are associated with firm outcomes through higher market valuation, stock return movements, or lower financing costs. Accordingly, this study does not merely assess whether ESG has a general impact, but also explains the specific economic channels through which that impact occurs.

3.4. Moderator Variable

The moderating variable in this study is ESG Controversies Score, which represents the level of controversies or negative incidents related to corporate ESG practices. Unlike ESG indicators that capture positive efforts or performance, ESG controversies reflect the downside risk dimension of ESG activities, including environmental violations, social issues, and governance failures. This variable captures reputational risk, erosion of trust, and potential negative reactions from stakeholders.

The ESG Controversies Score, like the underlying ESG indicators, is sourced from Refinitiv, which compiles it from publicly available news, NGO reports, and litigation records rather than from company self-disclosure. Because this score and the firm's ESG performance score are compiled through different processes, they need not move together; a firm can hold a high ESG performance score while also accumulating a high controversies score, and it is precisely this potential inconsistency between the two that the moderation analysis is designed to exploit.

In the empirical model, ESG Controversies Score is incorporated through interaction terms with each ESG indicator. This approach aims to test whether the relationship between ESG practices and firm performance is conditional on the level of controversies faced by the firm. Conceptually, this variable functions as a mechanism that can strengthen, weaken, or even reverse the effect of ESG on firm performance, depending on how the market evaluates the credibility and risk associated with ESG practices.

3.5. Control Variables

To isolate the effect of ESG indicators on firm performance, this study includes several control variables representing firm characteristics and macroeconomic conditions. Working capital to total assets is used to measure firm liquidity, which may affect the firm's ability to operate and meet short-term obligations. Asset turnover is used as an indicator of operational efficiency, reflecting the firm's ability to generate revenue from its asset base.

Additionally, a developed country dummy variable is included to control for institutional differences between developed and developing countries, which may influence both ESG practices and market responses to ESG. GDP is used as a proxy for macroeconomic conditions, while revenue is used as a proxy for firm size. The inclusion of these control variables ensures that the estimated relationship between ESG indicators and firm performance is not biased by other factors that systematically influence corporate financial outcomes.

4. Methodology

$$Y_{i,t+h} = \beta_0 + \beta_1 Z_{k,i,t} + \beta_2 Z_{k,i,t} \times M_{i,t} + \gamma' \text{Controls}_{i,t} + \alpha_i + \delta_t + \varepsilon_{i,t}$$

The empirical specification in this study adopts a panel data notation following a firm–year observation structure. In this framework, the index i represents firms, while the index t denotes the observation year. The study also employs a forward-looking time horizon, denoted by h , where $h = 0, 1, 2, 3$. Accordingly, the dependent variable can be measured contemporaneously as well as across several future periods after the ESG variables are observed.

The dependent variable in the model is denoted as $Y_{i,t+h}$, which represents firm outcomes for firm i at period $t + h$. In this study, these outcomes include measures of firm performance such as Tobin's Q, stock returns, and the weighted average cost of capital (WACC). By incorporating forward-looking horizons, the model allows for the identification of ESG–performance associations in both the short and medium term.

The main explanatory variables in this study are ESG indicators, denoted as $Z_{k,i,t}$. The index k refers to the k -th ESG indicator within each ESG pillar—environmental, social, and governance. Each ESG indicator is measured at time t and included separately in the estimation model. This approach is intended to avoid aggregation bias commonly associated with the use of aggregate ESG scores, thereby enabling a more precise identification of which ESG practices are linked to firm outcomes.

In addition to the main ESG indicators, the model includes a moderating variable, ESG Controversies Score, denoted as $M_{i,t}$. This variable captures the level of controversies or negative incidents related to ESG practices faced by the firm in a given year. Including this variable allows the analysis to test whether ESG controversies influence the relationship between ESG practices and firm performance.

The empirical model also incorporates a set of control variables, denoted as $\text{Controls}_{i,t}$. These controls include firm characteristics and macroeconomic factors that may affect firm performance, such as working capital to total assets, asset turnover, GDP, revenue, and a developed-country indicator. The purpose of including these control variables is to isolate the effect of ESG indicators on firm outcomes from other factors that may systematically influence corporate performance.

Within the panel model, i also captures firm-specific effects, representing unobserved firm characteristics that are constant over time. These fixed effects are used to control for unobservable heterogeneity across firms. Meanwhile, t represents time effects or year fixed effects, capturing macroeconomic shocks or market-wide changes that affect all firms in a given year.

Finally, $\varepsilon_{i,t}$ denotes the error term in the model, representing the stochastic component that cannot be explained by the variables included in the estimation.

5. Empirical Results

5.1. Descriptive Statistics

Table 2 shows that the research sample consists of 13,937 firm-year observations in the contemporaneous horizon, with the number of observations declining in the $t + 1$, $t + 2$, and $t + 3$ horizons due to the availability of forward-looking data. The average value of Tobin's Q is 1.65, indicating that, on average, firms in the sample have a market valuation slightly higher than their asset value, reflecting the presence of market growth expectations.

Meanwhile, the average WACC of 0.07 suggests that firms' cost of financing is around 7 percent, representing the minimum required rate of return demanded by investors and creditors. For total return, the average value of 0.12 indicates that, on average, firms

generate positive annual returns, although the relatively large standard deviation suggests considerable volatility in returns across firms and periods.

Table 2. Descriptive Statistics of Environmental Indicators and Financial Variables.

Variable	Count	Mean	Std	Min	Max
Tobins Q (USD)	13,937	1.65	1.67	0.05	8.86
Tobins Q (USD) $t + 1$	11,965	1.65	1.69	0.05	8.82
Tobins Q (USD) $t + 2$	9974	1.64	1.70	0.07	8.79
Tobins Q (USD) $t + 3$	8002	1.57	1.58	0.11	8.09
Weighted Average Cost of Capital	13,937	0.07	0.03	0.01	0.16
Weighted Average Cost of Capital $t + 1$	11,965	0.07	0.03	0.01	0.15
Weighted Average Cost of Capital $t + 2$	9974	0.06	0.03	0.01	0.15
Weighted Average Cost of Capital $t + 3$	8002	0.07	0.03	0.02	0.16
Total Return	13,937	0.12	0.40	−0.76	2.24
Total Return $t + 1$	11,965	0.12	0.40	−0.76	2.20
Total Return $t + 2$	9974	0.17	0.41	−0.68	2.15
Total Return $t + 3$	8002	0.15	0.40	−0.75	2.13
Environmental Restoration Initiatives	13,937	0.31	0.46	0.00	1.00
Policy Emissions	13,937	0.68	0.46	0.00	1.00
Emissions Score Grade	13,937	6.18	3.92	1.00	12.00
Estimated CO ₂ Equivalent Emission Total	13,937	10.90	2.60	5.14	15.53
Resource Use Score Grade	13,937	6.03	3.86	1.00	12.00
Waste Reduction Initiatives	13,937	0.74	0.44	0.00	1.00
ESG Controversies Score	13,937	0.87	0.34	0.00	1.00
Working Capital on Total Assets	13,937	−0.01	0.04	−0.18	0.15
Asset Turnover	13,937	0.57	0.47	0.01	2.01
Developed Country	13,937	0.85	0.36	0.00	1.00
GDP	13,937	29.53	1.55	26.49	30.94
Price to Book Value per Share	13,937	2.85	2.67	0.25	12.15
Revenue	13,937	20.93	1.48	13.02	22.23

In the environmental variables, there is substantial variation across both dummy-based indicators and score-based measures, indicating heterogeneity in ESG practices across firms. For example, environmental restoration initiatives have a mean of 0.31, policy emissions 0.68, and waste reduction initiatives 0.74, while the ESG Controversies Score of 0.87 indicates that most firms in the sample face relatively low levels of controversies.

It should be noted that estimated CO₂ equivalent emissions are reported here as a mean level in absolute terms for descriptive purposes only; because absolute emissions scale mechanically with firm size, the empirical literature typically prefers an emissions-intensity measure (e.g., emissions scaled by revenue or assets) for meaningful cross-firm comparison, and this distinction should be borne in mind when interpreting the descriptive statistics above.

On the other hand, the average value of estimated CO₂ equivalent emissions at 10.90 and the resource use score at 6.03 indicate that environmental characteristics among firms in the sample also vary substantially. Overall, these descriptive statistics suggest that the

sample exhibits sufficient variation to enable empirical testing of the relationship between environmental indicators and corporate financial performance.

Table 3 presents descriptive statistics for social variables and financial variables in the research sample. Overall, the average value of Tobin's Q ranges from 1.57 to 1.65 across different time horizons, indicating that firms in the sample maintain relatively stable market valuations that are slightly above their book values. Meanwhile, the average WACC remains consistently around 0.07 across all horizons, suggesting that firms' cost of financing is relatively stable over the observation period. For total return, the mean ranges from 0.12 to 0.16, although the relatively high standard deviation (around 0.37) reflects significant volatility in returns across firms.

Table 3. Descriptive Statistics of Social Indicators and Financial Variables.

Variable	Count	Mean	Std	Min	Max
Tobins Q (USD)	4361	1.64	1.74	0.07	8.86
Tobins Q (USD) $t + 1$	3742	1.65	1.76	0.07	8.82
Tobins Q (USD) $t + 2$	3119	1.64	1.77	0.07	8.79
Tobins Q (USD) $t + 3$	2500	1.57	1.63	0.11	8.09
Weighted Average Cost of Capital	4361	0.07	0.03	0.01	0.16
Weighted Average Cost of Capital $t + 1$	3742	0.07	0.03	0.01	0.15
Weighted Average Cost of Capital $t + 2$	3119	0.07	0.03	0.01	0.15
Weighted Average Cost of Capital $t + 3$	2500	0.07	0.03	0.02	0.15
Total Return	4361	0.13	0.37	−0.76	2.24
Total Return $t + 1$	3742	0.12	0.37	−0.76	2.20
Total Return $t + 2$	3119	0.16	0.37	−0.68	2.15
Total Return $t + 3$	2500	0.15	0.37	−0.68	2.13
Community Score Grade	4361	8.81	3.11	1.00	12.00
Policy Human Rights	4361	0.77	0.42	0.00	1.00
CSR Strategy Score Grade	4361	8.25	3.26	1.00	12.00
Policy Data Privacy Score	4361	4.05	0.06	3.94	4.22
Women Employees	4361	3.48	0.57	1.54	4.23
ESG Controversies Score	4361	0.80	0.40	0.00	1.00
Working Capital on Total Assets	4361	−0.01	0.04	−0.18	0.15
Asset Turnover	4361	0.57	0.46	0.01	2.01
Developed Country	4361	0.82	0.39	0.00	1.00
GDP	4361	28.77	1.60	26.49	30.94
Price to Book Value per Share	4361	2.82	2.76	0.25	12.15
Revenue	4361	21.42	1.20	13.02	22.23

For social indicators, the community score grade has an average of 8.81, while the CSR strategy score grade averages 8.25, indicating that firms in the sample generally exhibit relatively high levels of social engagement and CSR strategy. The policy on human rights has a mean value of 0.77, suggesting that most firms have adopted human rights-related policies. On the other hand, the data privacy policy score has an average of 4.05 with relatively low variation, indicating homogeneity in data protection practices across firms. The women employees variable has an average of 3.48, reflecting variation in female workforce participation.

In addition, the ESG controversies score has an average of 0.80, indicating that most firms face relatively low levels of controversies, although there remains sufficient variation for it to be analyzed as a moderating variable. Overall, the distribution of minimum and maximum values across social variables indicates heterogeneity in social practices among firms, providing an important basis for testing how social indicators affect firm performance across different time horizons.

Table 4 shows that the research sample consists of 13,006 observations in the contemporaneous horizon, with the number of observations declining in the $t + 1$, $t + 2$, and $t + 3$ horizons due to limitations in forward-looking data availability. The average Tobin's Q ranges from 1.57 to 1.65, indicating that, on average, firms in the sample have market valuations slightly higher than their asset values. The average WACC is around 0.07 across all horizons, suggesting that firms' cost of capital is relatively stable. Meanwhile, the average total return ranges from 0.12 to 0.17, although the relatively large standard deviation indicates substantial variation in stock returns across firms.

Table 4. Descriptive Statistics of Governance Indicators and Financial Variables.

Variable	Count	Mean	Std	Min	Max
Tobins Q (USD)	13,006	1.65	1.68	0.05	8.86
Tobins Q (USD) $t + 1$	11,167	1.65	1.70	0.05	8.82
Tobins Q (USD) $t + 2$	9309	1.65	1.71	0.07	8.79
Tobins Q (USD) $t + 3$	7470	1.58	1.59	0.11	8.09
Weighted Average Cost of Capital	13,006	0.07	0.03	0.01	0.16
Weighted Average Cost of Capital $t + 1$	11,167	0.07	0.03	0.01	0.15
Weighted Average Cost of Capital $t + 2$	9309	0.07	0.03	0.01	0.15
Weighted Average Cost of Capital $t + 3$	7470	0.07	0.03	0.02	0.16
Total Return	13,006	0.12	0.40	−0.76	2.24
Total Return $t + 1$	11,167	0.12	0.41	−0.76	2.20
Total Return $t + 2$	9309	0.17	0.41	−0.68	2.15
Total Return $t + 3$	7470	0.16	0.41	−0.75	2.13
Board Size	13,006	2.21	0.26	1.61	2.64
Board Gender Diversity, Percent	13,006	20.61	12.44	0.00	45.45
Shareholder Rights Policy Score	13,006	3.94	0.06	3.91	4.31
Shareholders Score Grade	13,006	6.88	3.31	1.00	12.00
ESG Controversies Score	13,006	0.87	0.34	0.00	1.00
Working Capital on Total Assets	13,006	−0.01	0.04	−0.18	0.15
Asset Turnover	13,006	0.56	0.47	0.01	2.01
Developed Country	13,006	0.84	0.36	0.00	1.00
GDP	13,006	29.58	1.60	26.49	30.94
Price to Book Value per Share	13,006	2.90	2.70	0.25	12.15
Revenue	13,006	20.88	1.50	13.02	22.23

In the governance variables, board size has an average of 2.21, indicating a relatively moderate board size within the sample. Board gender diversity percent has an average of 20.61 percent, with considerable variation, suggesting that the proportion of female directors differs across firms. Shareholder rights policy score and shareholders score grade also exhibit variation, but relatively narrower compared to other indicators, indicating that

most firms have somewhat similar levels of shareholder protection. The ESG controversies score has an average of 0.87, suggesting that the majority of firms face relatively low levels of controversies, although sufficient heterogeneity remains for empirical analysis.

Overall, these descriptive statistics indicate adequate variation in both governance indicators and financial variables, supporting the empirical examination of the relationship between corporate governance and financial performance across different time horizons.

5.2. Correlation Matrix

We conduct pairwise correlation to check whether our variables in the model exhibit a multicollinearity issue. We check whether our independent variables' coefficient correlation in the models is more (or less) than 0.7 (or -0.7) or not (Viverita et al., 2024). Furthermore, we construct each of our regression models based on the test to avoid multicollinearity bias. The results also indicate that the relationship between ESG indicators and financial outcomes is neither uniform nor consistently aligned across pillars. Specifically, firm value tends to respond more to firm-level growth and efficiency characteristics than to ESG performance directly, returns exhibit a more dynamic pattern that diverges from valuation effects, and governance indicators show the most internally consistent associations among the three pillars. Moreover, the ESG Controversies Score consistently behaves as a negative reputational signal across all three dimensions.

5.3. Results by ESG Pillar

As shown in Table 5, For Tobin's Q, the model without interaction shows that total CO₂ is significant at horizon t , while waste reduction is significant at horizons t and $t + 2$. The variables env_restoration, policy_emissions, emissions_score, and resource_use_score do not exhibit significance for Tobin's Q. After incorporating ESG controversies as an interaction variable, CO₂ total $\times$ ESG controversies becomes significant at horizon t , and waste reduction $\times$ ESG controversies becomes significant at horizons t and $t + 2$. The interaction terms for env_restoration, policy_emissions, emissions_score, and resource_use_score remain insignificant across all Tobin's Q horizons.

For total return, the baseline model indicates that env_restoration is significant at horizons $t + 1$ and $t + 2$, policy_emissions is significant at $t + 1$, CO₂ total is significant at $t + 2$, resource_use_score is significant at t , and waste reduction is significant at t , $t + 1$, and $t + 2$. With the inclusion of ESG controversies interactions, CO₂ total $\times$ ESG controversies becomes significant at horizon $t + 2$, while waste reduction $\times$ ESG controversies is significant at t , $t + 1$, and $t + 2$. Other interaction terms in the return models do not show significance. Emissions_score remains insignificant across all return specifications.

For WACC, the baseline model shows that env_restoration is significant at horizons $t + 1$ and $t + 3$, CO₂ total is significant at $t + 1$ and $t + 2$, resource_use_score is significant at t and $t + 2$, and waste reduction is significant at t . The variables policy_emissions and emissions_score are not significant across all WACC horizons. After including ESG controversies, the interaction env_restoration $\times$ ESG controversies becomes significant at $t + 3$, and waste reduction $\times$ ESG controversies is significant at $t + 2$. Other interaction terms for WACC remain insignificant.

Overall, the results in this table indicate that the associations between environmental indicators and the three outcomes are not uniform and are highly dependent on the type of indicator, time horizon, and the presence of ESG controversies interactions. The variables most frequently found to be significant are CO₂ total and waste reduction, while policy_emissions and emissions_score show little to no significance across all models. From the interaction perspective, ESG controversies exhibit selective moderation, as only certain variable–horizon combinations are significant rather than consistently across all indicators.

Table 5. Environmental Indicators and Financial Outcomes: Fixed Effects Regression Results with ESG Controversies Interaction (t to $t + 3$ Horizons).

Variables ↓/ Models →	Tobin's Q (t)	Tobin's Q ($t + 1$)	Tobin's Q ($t + 2$)	Tobin's Q ($t + 3$)	Return (t)	Return ($t + 1$)	Return ($t + 2$)	Return ($t + 3$)	WACC (t)	WACC ($t + 1$)	WACC ($t + 2$)	WACC ($t + 3$)
env_restoration	−0.0130 (0.0378)	0.0075 (0.0560)	0.0114 (0.0635)	0.0338 (0.0658)	0.0097 (0.0236)	0.0773 ** (0.0311)	−0.0553 * (0.0327)	0.0716 (0.0465)	−0.0005 (0.0013)	0.0042 ** (0.0017)	0.0020 (0.0020)	0.0052 ** (0.0024)
policy_emissions	−0.0144 (0.0901)	−0.0325 (0.1163)	0.0658 (0.0959)	0.0642 (0.0980)	−0.0108 (0.0477)	0.0943 * (0.0518)	−0.0700 (0.0528)	0.0183 (0.0781)	−0.0022 (0.0025)	0.0033 (0.0028)	0.0037 (0.0031)	0.0053 (0.0033)
emissions_score	−0.0012 (0.0080)	−0.0175 (0.0141)	−0.0099 (0.0152)	0.0020 (0.0132)	0.0075 (0.0055)	0.0057 (0.0073)	−0.0127 (0.0083)	0.0039 (0.0102)	−0.0004 (0.0003)	0.0002 (0.0004)	0.0002 (0.0005)	−0.0006 (0.0005)
co2_total	0.0352 *** (0.0133)	−0.0079 (0.0220)	−0.0312 (0.0279)	−0.0313 (0.0241)	−0.0124 (0.0089)	0.0084 (0.0114)	0.0560 *** (0.0114)	−0.0144 (0.0147)	0.0002 (0.0005)	−0.0024 *** (0.0005)	−0.0036 *** (0.0006)	−0.0011 (0.0007)
resource_use_score	−0.0006 (0.0087)	−0.0114 (0.0137)	−0.0196 (0.0122)	0.0049 (0.0128)	0.0005 (0.0050)	0.0061 (0.0060)	0.0012 (0.0076)	0.0031 (0.0091)	−0.0006 ** (0.0003)	0.0005 (0.0004)	0.0009 ** (0.0004)	0.0001 (0.0005)
waste_reduction	−0.2427 *** (0.0927)	−0.0766 (0.1140)	−0.1886 * (0.1143)	−0.1204 (0.1155)	0.0807 * (0.0445)	−0.1075 * (0.0627)	0.1161 * (0.0649)	0.1085 (0.0807)	−0.0052 * (0.0029)	0.0013 (0.0032)	−0.0015 (0.0029)	−0.0006 (0.0038)
env_restoration × esg_controversies	−0.0050 (0.0352)	0.0037 (0.0550)	0.0362 (0.0606)	0.0009 (0.0573)	−0.0091 (0.0242)	−0.0442 (0.0321)	0.0492 (0.0327)	−0.0243 (0.0458)	0.0010 (0.0013)	−0.0020 (0.0017)	0.0003 (0.0021)	−0.0042 * (0.0023)
policy_emissions × esg_controversies	−0.0025 (0.0876)	0.0551 (0.1103)	0.0168 (0.0874)	−0.0401 (0.0963)	0.0230 (0.0495)	−0.0865 (0.0530)	0.0627 (0.0534)	−0.0436 (0.0790)	0.0004 (0.0026)	−0.0020 (0.0028)	−0.0005 (0.0032)	−0.0010 (0.0034)
emissions_score × esg_controversies	−0.0042 (0.0078)	−0.0049 (0.0133)	−0.0116 (0.0128)	−0.0183 (0.0117)	−0.0016 (0.0055)	0.0016 (0.0072)	0.0073 (0.0078)	0.0071 (0.0101)	0.0002 (0.0003)	0.0003 (0.0004)	−0.0004 (0.0004)	0.0001 (0.0005)
co2_total × esg_controversies	−0.0345 *** (0.0097)	−0.0096 (0.0140)	0.0019 (0.0176)	0.0082 (0.0167)	0.0090 (0.0062)	−0.0021 (0.0084)	−0.0145 * (0.0081)	0.0171 (0.0113)	−0.0002 (0.0003)	0.0001 (0.0004)	0.0002 (0.0004)	0.0001 (0.0005)
resource_use_score × esg_controversies	0.0007 (0.0079)	−0.0185 (0.0125)	−0.0136 (0.0105)	−0.0091 (0.0116)	0.0090 * (0.0050)	0.0039 (0.0061)	−0.0037 (0.0069)	0.0067 (0.0087)	−0.0003 (0.0003)	−0.0001 (0.0004)	0.0002 (0.0004)	−0.0004 (0.0005)

Table 5. Cont.

Variables ↓/ Models →	Tobin's Q (<i>t</i>)	Tobin's Q (<i>t</i> + 1)	Tobin's Q (<i>t</i> + 2)	Tobin's Q (<i>t</i> + 3)	Return (<i>t</i>)	Return (<i>t</i> + 1)	Return (<i>t</i> + 2)	Return (<i>t</i> + 3)	WACC (<i>t</i>)	WACC (<i>t</i> + 1)	WACC (<i>t</i> + 2)	WACC (<i>t</i> + 3)
waste_reduction × esg_controversies	0.2328 *** (0.0883)	0.0614 (0.1099)	0.1871 * (0.1128)	0.1302 (0.1139)	−0.0933 ** (0.0459)	0.1466 ** (0.0647)	−0.1450 ** (0.0649)	−0.1123 (0.0826)	0.0012 (0.0029)	0.0011 (0.0032)	0.0062 ** (0.0031)	0.0030 (0.0039)
Working Capital/Total Assets	−0.1425 (0.1377)	0.2716 (0.1991)	0.1448 (0.2183)	0.3262 (0.2177)	−0.0478 (0.1132)	0.1631 (0.1246)	0.3070** (0.1371)	−0.1636 (0.1614)	−0.0065 (0.0062)	−0.0522 *** (0.0068)	0.0094 (0.0064)	0.0073 (0.0073)
Asset Turnover	0.3012 *** (0.0664)	0.5849 *** (0.0973)	1.1553 *** (0.1236)	0.4783 *** (0.0927)	−0.0728 * (0.0403)	−0.4211 *** (0.0508)	0.0554 (0.0504)	0.1028 * (0.0599)	0.0270 *** (0.0024)	0.0172 *** (0.0023)	−0.0070 *** (0.0022)	−0.0190 *** (0.0031)
GDP	−0.0712 (0.0589)	0.1023 (0.0919)	−0.9364 *** (0.1617)	−1.2274 *** (0.2277)	0.0355 (0.0332)	0.0010 (0.0435)	0.6170 *** (0.0785)	−0.6204 *** (0.1350)	0.0389 *** (0.0021)	−0.0011 (0.0023)	0.0310 *** (0.0036)	0.2302 *** (0.0097)
Price to Book	0.4701 *** (0.0141)	0.1743 *** (0.0105)	−0.0860 *** (0.0110)	−0.1151 *** (0.0127)	−0.0091 * (0.0049)	0.0455 *** (0.0052)	−0.0468 *** (0.0064)	−0.0631 *** (0.0061)	−0.0019 *** (0.0002)	−0.0019*** (0.0003)	0.0013 *** (0.0002)	0.0001 (0.0003)
Revenue (total USD)	−0.0814 ** (0.0319)	−0.4075 *** (0.0594)	−0.6226 *** (0.0804)	−0.2625 *** (0.0562)	0.0768 *** (0.0237)	0.0997 *** (0.0275)	−0.1354 *** (0.0272)	0.0201 (0.0342)	−0.0063 *** (0.0014)	0.0039*** (0.0014)	0.0033 ** (0.0013)	0.0068 *** (0.0016)
Constant	3.7216 ** (1.7986)	6.5869 ** (2.5724)	42.3870 *** (4.7476)	43.5759 *** (6.8070)	−2.3998 ** (0.9417)	−2.0191 (1.2624)	−15.6530 *** (2.1988)	18.1550 *** (3.9357)	−0.9493 *** (0.0582)	0.0304 (0.0665)	−0.8834 *** (0.1042)	−6.8381 *** (0.2840)
Observations	13,937	11,946	9955	7964	13,937	11,946	9955	7964	13,937	11,946	9955	7964
Number of firms (groups)	1991	1991	1991	1991	1991	1991	1991	1991	1991	1991	1991	1991
Rho	0.74	0.79	0.93	0.96	0.20	0.32	0.86	0.88	0.91	0.56	0.87	1.00
R ² (within)	0.63	0.14	0.14	0.10	0.01	0.04	0.04	0.04	0.06	0.05	0.07	0.25

Notes: Robust standard errors are reported in parentheses. Bold values indicate statistically significant coefficients. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The downward arrow (↓) indicates variables listed by row, while the rightward arrow (→) indicates models listed by column.

The results in Table 6 indicate that social indicators do not exhibit a uniform pattern of significance across outcomes, and the inclusion of interactions with the ESG Controversies Score meaningfully alters some of the results. For Tobin's Q, the model without interaction shows significance only for *community_score* at horizons $t + 1$ and $t + 2$, while other social variables—*policy_human_rights*, *csr_strategy_score*, *policy_data_privacy*, and *women_employees*—are not significant across all horizons. After incorporating ESG controversies interactions, the Tobin's Q pattern remains limited: the interaction *women_employees* $\times$ ESG controversies becomes significant at t , while other social interaction terms remain insignificant. Thus, for firm value, the most prominent social indicator is *community_score* in the baseline model, while ESG controversies moderation appears only marginally through *women_employees* at the initial horizon.

For Total Return, the baseline model shows that *policy_human_rights* is positively significant at $t + 1$ and $t + 2$, *csr_strategy_score* is negatively significant at $t + 2$, and *policy_data_privacy* is significant across all horizons with a strong pattern of significance. *Community_score* and *women_employees* are not significant across all return horizons. When ESG controversies interactions are included, *policy_human_rights* $\times$ ESG controversies becomes negatively significant at $t + 2$, *csr_strategy_score* $\times$ ESG controversies becomes positively significant at $t + 1$, *policy_data_privacy* $\times$ ESG controversies becomes negatively significant at $t + 1$ and $t + 2$, while *women_employees* $\times$ ESG controversies becomes negatively significant at $t + 2$. The interaction *community_score* $\times$ ESG controversies remains insignificant across all horizons. Therefore, in stock returns, ESG controversies primarily influence market interpretation of *policy_human_rights*, *csr_strategy_score*, *policy_data_privacy*, and *women_employees*, whereas *community_score* does not show meaningful changes.

For WACC, the baseline model shows that *community_score* is negatively significant at $t + 3$, *policy_human_rights* is negatively significant at t but becomes positively significant at $t + 2$ and $t + 3$, *csr_strategy_score* is positively significant at $t + 1$, *policy_data_privacy* is significant across all horizons with varying signs, and *women_employees* is negatively significant at $t + 1$. After including ESG controversies, *community_score* $\times$ ESG controversies becomes negatively significant at $t + 3$, *policy_data_privacy* $\times$ ESG controversies becomes positively significant at $t + 1$, $t + 2$, and $t + 3$, and *women_employees* $\times$ ESG controversies becomes positively significant at $t + 1$. Meanwhile, the interactions *policy_human_rights* $\times$ ESG controversies and *csr_strategy_score* $\times$ ESG controversies remain insignificant across all WACC horizons. This indicates that for cost of capital, ESG controversies moderation is most evident in *policy_data_privacy*, followed by *community_score* and *women_employees*.

Overall, the results in this table show that *policy_data_privacy* is the most consistently significant social indicator across outcomes, particularly for Total Return and WACC, in both baseline and interaction models. *Policy_human_rights* is also relatively prominent, although its significance is more limited and mainly appears in return and WACC. *Community_score* is only significant in certain cases for Tobin's Q and WACC, while *csr_strategy_score* and *women_employees* exhibit more sporadic significance, highly dependent on time horizon and the presence of ESG controversies. Thus, the associations for social indicators in this table are selective, contextual, and strongly influenced by interactions with the ESG Controversies Score.

Table 7 presents the fixed effects regression results for governance indicators on three dimensions of firm performance—Tobin's Q, Total Return, and WACC—both in their direct form and through interaction with the ESG Controversies Score. Overall, the results indicate that the significance of governance indicators is uneven across variables and time horizons.

Table 6. Social Indicators and Financial Outcomes: Fixed Effects Regression Results with ESG Controversies Interaction (t to $t + 3$ Horizons).

Variables ↓/ Models →	Tobin's Q (t)	Tobin's Q ($t + 1$)	Tobin's Q ($t + 2$)	Tobin's Q ($t + 3$)	Return (t)	Return ($t + 1$)	Return ($t + 2$)	Return ($t + 3$)	WACC (t)	WACC ($t + 1$)	WACC ($t + 2$)	WACC ($t + 3$)
community_score	−0.0008 (0.0096)	− 0.0400 ** (0.0162)	− 0.0538 *** (0.0205)	−0.0350 (0.0219)	0.0066 (0.0067)	0.0068 (0.0091)	−0.0066 (0.0098)	−0.0150 (0.0120)	−0.0003 (0.0004)	−0.0001 (0.0004)	0.0002 (0.0005)	− 0.0019 *** (0.0006)
policy_human_rights	−0.0615 (0.0490)	−0.1085 (0.0927)	−0.1088 (0.1096)	−0.0664 (0.1367)	0.0055 (0.0496)	0.0893 * (0.0507)	0.1072 * (0.0576)	−0.0506 (0.0650)	− 0.0047 * (0.0028)	0.0025 (0.0028)	0.0057 ** (0.0028)	0.0073 ** (0.0031)
csr_strategy_score	0.0004 (0.0098)	0.0019 (0.0168)	0.0181 (0.0192)	0.0195 (0.0177)	0.0048 (0.0064)	−0.0080 (0.0075)	− 0.0199 ** (0.0094)	−0.0001 (0.0118)	0.0002 (0.0004)	0.0007 * (0.0004)	0.0003 (0.0004)	0.0008 (0.0005)
policy_data_privacy	0.1131 (0.3883)	1.0246 (0.6526)	0.0614 (0.7662)	0.8117 (0.7132)	− 0.9076 *** (0.3119)	− 0.8392 *** (0.3197)	1.7017 *** (0.3669)	− 1.8198 *** (0.4252)	0.0353 ** (0.0164)	− 0.1415 *** (0.0163)	− 0.1922 *** (0.0211)	− 0.1042 *** (0.0224)
women_employees	0.1313 (0.1489)	0.1015 (0.1460)	−0.0631 (0.1536)	−0.0544 (0.1494)	−0.0264 (0.0687)	−0.0386 (0.0864)	0.0207 (0.0898)	−0.0048 (0.1000)	−0.0034 (0.0036)	− 0.0076 ** (0.0036)	0.0007 (0.0038)	−0.0043 (0.0043)
community_score × esg_controversies	−0.0063 (0.0098)	0.0079 (0.0145)	0.0068 (0.0162)	0.0019 (0.0180)	−0.0009 (0.0065)	−0.0007 (0.0089)	0.0096 (0.0088)	0.0044 (0.0112)	−0.0001 (0.0003)	−0.0006 (0.0004)	−0.0004 (0.0004)	0.0005 (0.0005)
policy_human_rights × esg_controversies	−0.0586 (0.0515)	−0.0227 (0.0970)	−0.0238 (0.1237)	0.0544 (0.1266)	0.0644 (0.0501)	0.0203 (0.0495)	− 0.1361 ** (0.0543)	0.0702 (0.0682)	0.0033 (0.0027)	−0.0008 (0.0028)	−0.0022 (0.0029)	−0.0041 (0.0030)
csr_strategy_score × esg_controversies	0.0082 (0.0109)	0.0032 (0.0166)	−0.0180 (0.0174)	−0.0185 (0.0188)	−0.0096 (0.0063)	0.0094 (0.0077)	0.0198 ** (0.0088)	0.0035 (0.0117)	−0.0003 (0.0003)	−0.0003 (0.0004)	0.0002 (0.0004)	0.0001 (0.0005)
policy_data_privacy × esg_controversies	0.1628 (0.3316)	0.7345 (0.5325)	0.5631 (0.5722)	0.7135 (0.5665)	0.3413 (0.2810)	− 0.6069 ** (0.3043)	− 0.6101 * (0.3553)	0.4370 (0.4254)	0.0022 (0.0143)	0.0427 *** (0.0160)	0.0432 ** (0.0182)	0.0329 * (0.0193)
women_employees × esg_controversies	0.0934 * (0.0573)	0.0689 (0.0772)	−0.0801 (0.0907)	0.0008 (0.0981)	−0.0384 (0.0337)	0.0359 (0.0476)	− 0.0885 ** (0.0352)	0.0109 (0.0634)	0.0020 (0.0018)	0.0044 ** (0.0020)	0.0001 (0.0021)	0.0020 (0.0021)
Working Capital/Total Assets	0.1072 (0.2763)	0.3635 (0.3762)	−0.0387 (0.4692)	0.1559 (0.3765)	−0.3167 (0.2085)	0.3857 * (0.2147)	0.4703 * (0.2802)	−0.4632 (0.3054)	−0.0078 (0.0102)	− 0.0444 *** (0.0099)	0.0056 (0.0088)	0.0184 (0.0113)
Asset Turnover	0.3906 *** (0.1277)	0.9250 *** (0.1631)	1.4321 *** (0.2409)	0.6669 *** (0.2039)	−0.0320 (0.0748)	− 0.4116 *** (0.0921)	0.0162 (0.0940)	0.0096 (0.0925)	0.0284 *** (0.0041)	0.0124 *** (0.0042)	− 0.0072 * (0.0039)	0.0002 (0.0057)
GDP	−0.0391 (0.1177)	0.4451 ** (0.1672)	− 0.5580 * (0.2978)	0.3601 (0.4532)	−0.0661 (0.0608)	− 0.2858 *** (0.0749)	0.8775 *** (0.1320)	−0.4207 (0.2629)	0.0356 *** (0.0037)	− 0.0145 *** (0.0038)	−0.0003 (0.0068)	0.1308 *** (0.0142)

Table 6. Cont.

Variables ↓/ Models →	Tobin's Q (<i>t</i>)	Tobin's Q (<i>t</i> + 1)	Tobin's Q (<i>t</i> + 2)	Tobin's Q (<i>t</i> + 3)	Return (<i>t</i>)	Return (<i>t</i> + 1)	Return (<i>t</i> + 2)	Return (<i>t</i> + 3)	WACC (<i>t</i>)	WACC (<i>t</i> + 1)	WACC (<i>t</i> + 2)	WACC (<i>t</i> + 3)
Price to Book	0.4456 *** (0.0327)	0.1559 *** (0.0208)	−0.0810 *** (0.0198)	−0.1193 *** (0.0219)	−0.0174 ** (0.0086)	0.0420 *** (0.0090)	−0.0295 ** (0.0117)	−0.0552 *** (0.0106)	−0.0022 *** (0.0004)	−0.0009 ** (0.0004)	0.0023 *** (0.0003)	0.0004 (0.0004)
Revenue (total USD)	−0.2829 ** (0.1014)	−0.6821 *** (0.1490)	−0.9031 *** (0.1450)	−0.2788 ** (0.1044)	0.0995 ** (0.0400)	0.1284 ** (0.0422)	−0.0383 (0.0515)	0.0695 (0.0539)	−0.0020 (0.0029)	0.0051 ** (0.0024)	−0.0050 ** (0.0024)	−0.0030 (0.0029)
Constant	6.4688 (5.6403)	−1.5793 (6.7070)	36.7546 *** (10.3378)	−5.7884 (14.9151)	3.6304 (2.7159)	9.2259 ** (2.9706)	−30.9526 *** (4.2855)	18.4591 ** (8.5435)	−1.0504 *** (0.1578)	0.9619 *** (0.1509)	0.9512 *** (0.2425)	−3.1819 *** (0.4568)
Observations	4361	3738	3115	2492	4361	3738	3115	2492	4361	3738	3115	2492
Number of firms (groups)	623	623	623	623	623	623	623	623	623	623	623	623
Rho	0.79	0.83	0.93	0.92	0.26	0.63	0.94	0.82	0.93	0.75	0.66	0.99
R ² (within)	0.58	0.15	0.15	0.10	0.02	0.06	0.03	0.05	0.06	0.07	0.12	0.17

Notes: Robust standard errors are reported in parentheses. Bold values indicate statistically significant coefficients. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The downward arrow (↓) indicates variables listed by row, while the rightward arrow (→) indicates models listed by column.

Table 7. Governance Indicators and Financial Outcomes: Fixed Effects Regression Results with ESG Controversies Interaction (*t* to *t* + 3 Horizons).

Variables ↓/ Models →	Tobin's Q (<i>t</i>)	Tobin's Q (<i>t</i> + 1)	Tobin's Q (<i>t</i> + 2)	Tobin's Q (<i>t</i> + 3)	Return (<i>t</i>)	Return (<i>t</i> + 1)	Return (<i>t</i> + 2)	Return (<i>t</i> + 3)	WACC (<i>t</i>)	WACC (<i>t</i> + 1)	WACC (<i>t</i> + 2)	WACC (<i>t</i> + 3)
Board Size	0.0485 (0.0716)	−0.1163 (0.1262)	−0.0687 (0.1323)	−0.0346 (0.1357)	−0.0544 (0.0538)	0.0929 (0.0734)	0.1702 ** (0.0731)	−0.0621 (0.0946)	−0.0040 (0.0032)	−0.0083 ** (0.0036)	0.0008 (0.0034)	0.0054 (0.0042)
Board Gender Diversity Percent	−0.0046 *** (0.0016)	−0.0079 *** (0.0023)	−0.0031 (0.0027)	0.0068 ** (0.0030)	0.0017 * (0.0010)	0.0019 (0.0015)	−0.0030 ** (0.0014)	0.0038 * (0.0021)	−0.0002 *** (0.0001)	0.0004 *** (0.0001)	0.0006 *** (0.0001)	0.0004 *** (0.0001)
Shareholder Rights Policy Score	0.1187 (0.1984)	0.4933 * (0.2858)	0.2203 (0.3073)	0.5194 * (0.2932)	0.2274 (0.2043)	−0.3624 * (0.2159)	0.1970 (0.1928)	−0.4970 ** (0.2433)	−0.0390 *** (0.0102)	−0.0575 *** (0.0104)	0.0440 *** (0.0109)	0.0995 *** (0.0118)
Shareholders Score Grade	0.0054 (0.0056)	0.0073 (0.0090)	−0.0136 (0.0100)	−0.0086 (0.0106)	−0.0029 (0.0038)	0.0006 (0.0057)	0.0047 (0.0059)	0.0121 (0.0081)	−0.0001 (0.0002)	0.0006 ** (0.0003)	−0.0001 (0.0003)	0.0001 (0.0004)
Board Size × ESG Controversies	−0.1182 ** (0.0598)	−0.0226 (0.1041)	0.0162 (0.1078)	−0.0114 (0.1254)	0.0976 ** (0.0481)	0.0208 (0.0677)	−0.1359 ** (0.0634)	0.0864 (0.0842)	0.0026 (0.0026)	0.0054 * (0.0032)	0.0008 (0.0030)	−0.0037 (0.0036)

Table 7. Cont.

Variables ↓/ Models →	Tobin's Q (<i>t</i>)	Tobin's Q (<i>t</i> + 1)	Tobin's Q (<i>t</i> + 2)	Tobin's Q (<i>t</i> + 3)	Return (<i>t</i>)	Return (<i>t</i> + 1)	Return (<i>t</i> + 2)	Return (<i>t</i> + 3)	WACC (<i>t</i>)	WACC (<i>t</i> + 1)	WACC (<i>t</i> + 2)	WACC (<i>t</i> + 3)
Board Gender Diversity Percent × ESG Controversies	0.0024 (0.0015)	0.0018 (0.0022)	−0.0023 (0.0024)	−0.0067 ** (0.0029)	0.0001 (0.0010)	0.0001 (0.0014)	0.0005 (0.0014)	−0.0029 (0.0021)	−0.0001 ** (0.0001)	−0.0001 * (0.0001)	−0.0001 (0.0001)	0.0002 * (0.0001)
Shareholder Rights Policy Score × ESG Controversies	0.0226 (0.1634)	0.0712 (0.2723)	0.2114 (0.2409)	0.0033 (0.2025)	−0.0377 (0.1904)	−0.2995 (0.2047)	0.3925 ** (0.1789)	−0.4137 * (0.2304)	0.0098 (0.0089)	0.0008 (0.0094)	−0.0130 (0.0099)	0.0092 (0.0098)
Shareholders Score Grade × ESG Controversies	−0.0049 (0.0051)	−0.0057 (0.0084)	0.0097 (0.0097)	0.0087 (0.0100)	0.0022 (0.0038)	−0.0005 (0.0055)	−0.0004 (0.0056)	−0.0114 (0.0079)	−0.0002 (0.0002)	−0.0003 (0.0002)	−0.0001 (0.0003)	−0.0001 (0.0003)
Working Capital/Total Assets	−0.0989 (0.1411)	0.2781 (0.2026)	0.1308 (0.2194)	0.3339 (0.2215)	−0.0366 (0.1150)	0.1445 (0.1258)	0.3111 ** (0.1394)	−0.1710 (0.1682)	−0.0059 (0.0065)	−0.0557 *** (0.0069)	0.0038 (0.0067)	0.0058 (0.0074)
Asset Turnover	0.3279 *** (0.0693)	0.5959 *** (0.1015)	1.1548 *** (0.1250)	0.4879 *** (0.1012)	−0.0947 ** (0.0405)	−0.4400 *** (0.0522)	0.0831 (0.0518)	0.0727 (0.0609)	0.0294 *** (0.0026)	0.0197 *** (0.0024)	−0.0074 *** (0.0023)	−0.0207 *** (0.0031)
GDP	−0.1213 ** (0.0555)	−0.0761 (0.0910)	−1.0802 *** (0.1568)	−1.2753 *** (0.2069)	0.0803 ** (0.0357)	0.1581 *** (0.0436)	0.5428 *** (0.0743)	−0.4992 *** (0.1277)	0.0380 *** (0.0023)	0.0020 (0.0024)	0.0380 *** (0.0033)	0.2285 *** (0.0093)
Price to Book	0.4644 *** (0.0146)	0.1748 *** (0.0107)	−0.0904 *** (0.0110)	−0.1213 *** (0.0129)	−0.0081 (0.0051)	0.0464 *** (0.0053)	−0.0491 *** (0.0065)	−0.0591 *** (0.0063)	−0.0019 *** (0.0002)	−0.0019 *** (0.0003)	0.0014 *** (0.0002)	0.0002 (0.0003)
Revenue (total USD)	−0.0789 ** (0.0323)	−0.4158 *** (0.0619)	−0.6363 *** (0.0838)	−0.2868 *** (0.0587)	0.0761 *** (0.0234)	0.1026 *** (0.0277)	−0.1253 *** (0.0272)	0.0303 (0.0342)	−0.0074 *** (0.0014)	0.0029 * (0.0015)	0.0020 (0.0013)	0.0058 *** (0.0016)
Constant	4.8088 ** (1.9349)	10.1150 *** (2.8030)	45.8029 *** (4.7120)	43.1993 *** (6.3396)	−4.5293 *** (1.2635)	−5.3686 *** (1.4833)	−14.2612 *** (2.1560)	16.3110 *** (3.8699)	−0.7478 *** (0.0723)	0.1752 ** (0.0781)	−1.2832 *** (0.1068)	−7.1966 *** (0.2736)
Observations	13,006	11,148	9290	7432	13,006	11,148	9290	7432	13,006	11,148	9290	7432
Number of firms (groups)	1858	1858	1858	1858	1858	1858	1858	1858	1858	1858	1858	1858
Rho	0.74	0.77	0.94	0.96	0.23	0.46	0.83	0.83	0.90	0.55	0.91	1.00
R ² (within)	0.62	0.14	0.14	0.11	0.01	0.04	0.04	0.04	0.06	0.05	0.06	0.29

Notes: Robust standard errors are reported in parentheses. Bold values indicate statistically significant coefficients. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The downward arrow (↓) indicates variables listed by row, while the rightward arrow (→) indicates models listed by column.

For Tobin's Q, the variable Board Gender Diversity Percent is significant at horizons t , $t + 1$, and again at $t + 3$, while it is not significant at $t + 2$. Shareholder Rights Policy Score is significant at $t + 1$ and $t + 3$, whereas Board Size and Shareholders Score Grade are not significant across all horizons in the main model. When interactions with ESG controversies are included, Board Size $\times$ ESG Controversies becomes significant at t , while other interaction terms for Tobin's Q do not show consistent significance. Thus, for firm value, only a subset of governance indicators appears relevant, and the moderating effect of ESG controversies is relatively limited.

For Total Return, the results show that Board Size is significant at $t + 2$, while Board Gender Diversity Percent is significant at t and $t + 3$, and shows negative significance at $t + 2$. Shareholder Rights Policy Score is significant at $t + 1$ and $t + 3$, whereas Shareholders Score Grade remains insignificant across all horizons. In the interaction model, Board Size $\times$ ESG Controversies is significant at t and $t + 2$, while Shareholder Rights Policy Score $\times$ ESG Controversies is significant at $t + 2$ and $t + 3$. Other interaction terms do not exhibit stable significance. This indicates that for stock returns, some governance indicators exert effects at specific horizons, and some of these effects change when moderated by ESG controversies.

For WACC, the pattern of significance appears more consistent compared to the other dependent variables. Board Size is significant at $t + 1$, while Board Gender Diversity Percent is significant across all horizons (t to $t + 3$). Shareholder Rights Policy Score is also significant across all horizons, whereas Shareholders Score Grade is only significant at $t + 1$. In the interaction model, Board Size $\times$ ESG Controversies is significant at $t + 1$, and Board Gender Diversity Percent $\times$ ESG Controversies is significant at t , $t + 1$, and $t + 3$. Meanwhile, the interaction terms for Shareholder Rights Policy Score and Shareholders Score Grade do not show consistent significance. Thus, for cost of capital, governance indicators—particularly Board Gender Diversity Percent and Shareholder Rights Policy Score—demonstrate a more stable relationship compared to other outcomes.

Overall, this table indicates that Board Gender Diversity Percent is the most consistently significant variable, especially for WACC, followed by Shareholder Rights Policy Score, which also shows relatively stable significance for cost of capital and partially for returns. In contrast, Board Size and Shareholders Score Grade exhibit more limited significance and tend to depend on specific time horizons. The role of interaction with ESG Controversies Score appears selective, primarily affecting Board Size and Board Gender Diversity Percent, while the moderating effect on other governance variables is relatively weak.

It is important to distinguish statistical from economic significance in interpreting the results above. A coefficient can be statistically significant at the 5% level while representing a negligible change in Tobin's Q, total return, or WACC in economic terms, and conversely a coefficient significant only at the 10% level may still correspond to an economically meaningful shift in valuation or financing cost. The discussion that follows in Section 6 therefore foregrounds results significant at the 1% level (**) as the primary evidence, treats 5% results as corroborating, and interprets weaker results with caution, while also commenting on coefficient magnitude rather than significance alone wherever the underlying table permits.

6. Discussion

6.1. Environmental Indicators and Financial Outcomes: With & Without Interaction

Table 8 compares the environmental indicator results between the specifications without ESG controversies and those including ESG controversies interactions. The comparison shows that the inclusion of ESG controversies is not merely a technical modification, but reflects a fundamental difference in how the market interprets environmental signals. In

the baseline model, environmental indicators are interpreted as signals of efficiency, stakeholder commitment, or operational quality. Once ESG controversies are introduced into the specification, the same signals are no longer evaluated neutrally, but through the lens of credibility, reputation, and litigation risk. In this sense, controversies act as a credibility filter: they can amplify penalties associated with emissions and risky practices, while also transforming remedial actions such as waste reduction and restoration from mere costs into signals of legitimacy recovery. This pattern is consistent with signaling theory and stakeholder theory, as well as with literature emphasizing that ESG is valued only when signals are credible, material, and difficult to mimic symbolically (Krüger, 2015; Godfrey et al., 2009; Cheng et al., 2013).

Table 8. Environmental Indicators and Financial Outcomes: Evidence With and Without ESG Controversies Interaction.

Variables ↓/ Models →	Dependent	Without ESG Controversies				Interaction with ESG Controversies			
		<i>t</i> + 0	<i>t</i> + 1	<i>t</i> + 2	<i>t</i> + 3	<i>t</i> + 0	<i>t</i> + 1	<i>t</i> + 2	<i>t</i> + 3
env_restoration	Tobin's Q	−0.0130 (0.0378)	0.0075 (0.0560)	0.0114 (0.0635)	0.0338 (0.0658)	−0.0050 (0.0352)	0.0037 (0.0550)	0.0362 (0.0606)	0.0009 (0.0573)
policy_emissions	Tobin's Q	−0.0144 (0.0901)	−0.0325 (0.1163)	0.0658 (0.0959)	0.0642 (0.0980)	−0.0025 (0.0876)	0.0551 (0.1103)	0.0168 (0.0874)	−0.0401 (0.0963)
emissions_score	Tobin's Q	−0.0012 (0.0080)	−0.0175 (0.0141)	−0.0099 (0.0152)	0.0020 (0.0132)	−0.0042 (0.0078)	−0.0049 (0.0133)	−0.0116 (0.0128)	−0.0183 (0.0117)
co2_total	Tobin's Q	0.0352 *** (0.0133)	−0.0079 (0.0220)	−0.0312 (0.0279)	−0.0313 (0.0241)	−0.0345 *** (0.0097)	−0.0096 (0.0140)	0.0019 (0.0176)	0.0082 (0.0167)
resource_use_score	Tobin's Q	−0.0006 (0.0087)	−0.0114 (0.0137)	−0.0196 (0.0122)	0.0049 (0.0128)	0.0007 (0.0079)	−0.0185 (0.0125)	−0.0136 (0.0105)	−0.0091 (0.0116)
waste_reduction	Tobin's Q	−0.2427 *** (0.0927)	−0.0766 (0.1140)	−0.1886 * (0.1143)	−0.1204 (0.1155)	0.2328 *** (0.0883)	0.0614 (0.1099)	0.1871 * (0.1128)	0.1302 (0.1139)
env_restoration	Total Return	0.0097 (0.0236)	0.0773 ** (0.0311)	−0.0553 * (0.0327)	0.0716 (0.0465)	−0.0091 (0.0242)	−0.0442 (0.0321)	0.0492 (0.0327)	−0.0243 (0.0458)
policy_emissions	Total Return	−0.0108 (0.0477)	0.0943 * (0.0518)	−0.0700 (0.0528)	0.0183 (0.0781)	0.0230 (0.0495)	−0.0865 (0.0530)	0.0627 (0.0534)	−0.0436 (0.0790)
emissions_score	Total Return	0.0075 (0.0055)	0.0057 (0.0073)	−0.0127 (0.0083)	0.0039 (0.0102)	−0.0016 (0.0055)	0.0016 (0.0072)	0.0073 (0.0078)	0.0071 (0.0101)
co2_total	Total Return	−0.0124 (0.0089)	0.0084 (0.0114)	0.0560 *** (0.0114)	−0.0144 (0.0147)	0.0090 (0.0062)	−0.0021 (0.0084)	−0.0145 * (0.0081)	0.0171 (0.0113)
resource_use_score	Total Return	0.0005 (0.0050)	0.0061 (0.0060)	0.0012 (0.0076)	0.0031 (0.0091)	0.0090 * (0.0050)	0.0039 (0.0061)	−0.0037 (0.0069)	0.0067 (0.0087)
waste_reduction	Total Return	0.0807 * (0.0445)	−0.1075 * (0.0627)	0.1161 * (0.0649)	0.1085 (0.0807)	−0.0933 ** (0.0459)	0.1466 ** (0.0647)	−0.1450 ** (0.0649)	−0.1123 (0.0826)
env_restoration	WACC	−0.0005 (0.0013)	0.0042 ** (0.0017)	0.0020 (0.0020)	0.0052 ** (0.0024)	0.0010 (0.0013)	−0.0020 (0.0017)	0.0003 (0.0021)	−0.0042 * (0.0023)
policy_emissions	WACC	−0.0022 (0.0025)	0.0033 (0.0028)	0.0037 (0.0031)	0.0053 (0.0033)	0.0004 (0.0026)	−0.0020 (0.0028)	−0.0005 (0.0032)	−0.0010 (0.0034)
emissions_score	WACC	−0.0004 (0.0003)	0.0002 (0.0004)	0.0002 (0.0005)	−0.0006 (0.0005)	0.0002 (0.0003)	0.0003 (0.0004)	−0.0004 (0.0004)	0.0001 (0.0005)
co2_total	WACC	0.0002 (0.0005)	−0.0024 *** (0.0005)	−0.0036 *** (0.0006)	−0.0011 (0.0007)	−0.0002 (0.0003)	0.0001 (0.0004)	0.0002 (0.0004)	0.0001 (0.0005)
resource_use_score	WACC	−0.0006 ** (0.0003)	0.0005 (0.0004)	0.0009 ** (0.0004)	0.0001 (0.0005)	−0.0003 (0.0003)	−0.0001 (0.0004)	0.0002 (0.0004)	−0.0004 (0.0005)
waste_reduction	WACC	−0.0052 * (0.0029)	0.0013 (0.0032)	−0.0015 (0.0029)	−0.0006 (0.0038)	0.0012 (0.0029)	0.0011 (0.0032)	0.0062 ** (0.0031)	0.0030 (0.0039)

Notes: Robust standard errors are reported in parentheses. Bold values indicate statistically significant coefficients. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The downward arrow (↓) indicates variables listed by row, while the rightward arrow (→) indicates models listed by column.

Beyond the statistical pattern of significance, the economic interpretation of this comparison is that ESG controversies function as a credibility filter: absent controversies, the market appears willing to price environmental signals at face value, but once controversies are present, the same signals are re-evaluated through a more skeptical lens, consistent with the credibility-erosion and information-asymmetry channels discussed in Section 2. This reframing—rather than the significance pattern in isolation—is the substantive contribution of the with/without-interaction comparison reported in this section.

For Tobin's Q , the model without controversies shows highly selective effects: total CO_2 at horizon t is positively associated with firm value, while waste reduction tends to be negative at t and $t + 2$. This pattern should not be interpreted as “emissions are good,” but rather as a proxy for production scale, activity intensity, or growth options that are temporarily perceived by the market as supporting valuation. However, once ESG controversies are included, the sign of CO_2 total at $t + 0$ reverses to negative, while waste reduction becomes positive at t and $t + 2$. This reversal is economically significant. In the presence of controversies, emissions are no longer interpreted as signals of production capacity, but as sources of liability, reputational damage, and higher risk premiums. Conversely, waste reduction shifts from being viewed as a discounted operational cost to a credible remedial action with economic value, as the market interprets it as an effort to restore legitimacy following reputational damage. This shift indicates that controversies not only amplify negative effects but can also reverse market interpretations of certain environmental practices. This is consistent with literature showing that when corporate reputation is contaminated, investors become more responsive to signals that provide tangible evidence of recovery rather than normative commitments (Servaes & Tamayo, 2013; Lins et al., 2017; Ferrell et al., 2016).

Other variables in Tobin's Q —such as `env_restoration`, `policy_emissions`, `emissions_score`, and `resource_use_score`—do not exhibit robust patterns across both specifications. This lack of significance is important: the market does not appear to consider these indicators sufficiently material to influence firm valuation, at least as captured by this model. Economically, this may occur for two reasons. First, these indicators may be too aggregate or too distant from cash-flow channels, limiting their informational value. Second, in an environment prone to greenwashing, policy-based measures and score-based indicators are more easily perceived as symbolic rather than substantive. In other words, the market waits for signals that are more “costly” and directly linked to economic risk—such as actual emissions reductions or repeated restoration actions—before adjusting Tobin's Q . The materiality literature supports this interpretation: only ESG issues that are truly material tend to produce consistent valuation effects (Khan et al., 2016; Albuquerque et al., 2019).

For Total Return, the observed dynamics are more volatile and more sensitive to time horizons. Without ESG controversies, `env_restoration` is positive at $t + 1$ but negative at $t + 2$; `policy_emissions` is positive only at $t + 1$; CO_2 total is positive at $t + 2$; and waste reduction shifts from positive to negative and back to positive. Such patterns suggest an announcement effect in the short term followed by market correction. That is, the market may initially reward environmental actions as short-term signals, but the effect is not persistent. Once controversies are introduced, many of these positive effects weaken or disappear. `Env_restoration` and `policy_emissions` become insignificant; CO_2 total turns negative at $t + 2$; and `resource_use_score` is only briefly positive at $t + 0$. This indicates that controversies accelerate market skepticism. Environmental information that was previously interpreted as positive news is now more likely viewed as defensive action, delayed response, or damage control. Thus, controversies act as attenuators of positive signals and amplifiers of negative signals. This is consistent with findings that

reputational capital and trust are key mechanisms determining whether ESG disclosures generate abnormal returns or are quickly corrected by the market (Krüger, 2015; Bolton & Kacperczyk, 2021; Godfrey et al., 2009).

The waste reduction variable in Total Return most clearly demonstrates nonlinear interaction effects. Without controversies, its coefficient shifts from positive to negative and back to positive, suggesting unstable market interpretation—possibly because it is perceived as efficient on one hand but costly to implement on the other. Once controversies are introduced, the pattern becomes sharper: negative at $t + 0$, positive at $t + 1$, and negative again at $t + 2$. This reflects a tension in market interpretation. When controversies are recent, waste reduction may be seen as an attempt to patch reputational damage, leading to initial skepticism. However, when the market observes that such actions reduce stakeholder friction, the effect becomes positive. Subsequently, the effect weakens again as investors account for the ongoing costs of these improvements. Thus, controversies not only alter direction but also shorten the duration of market reactions and increase the likelihood of return reversals.

For WACC, the moderating role of controversies becomes particularly clear. In the baseline model, *env_restoration* increases WACC at $t + 1$ and $t + 3$, *CO₂ total* reduces WACC at $t + 1$ and $t + 2$, *resource_use_score* reduces WACC at $t + 0$ but increases it at $t + 2$, and waste reduction reduces WACC at $t + 0$. This reflects a classic trade-off between efficiency, implementation cost, and risk. However, once ESG controversies are included, many of these relationships weaken or reverse. *Env_restoration* now reduces WACC at $t + 3$, *CO₂ total* and *resource_use_score* lose significance, and waste reduction becomes positive at $t + 2$. This shift is economically meaningful. In a non-controversial environment, investors may interpret environmental actions as risk-reducing. But when firm reputation is compromised, efficiency signals lose credibility; the market may interpret environmental actions as compliance costs, forced adjustments, or responses to previously hidden issues. As a result, the cost-reducing effects of resource efficiency and carbon intensity diminish or disappear. Only actions perceived as long-term reputational recovery—such as restoration—eventually reduce WACC, and only at longer horizons. This is consistent with the risk-based view: controversies increase idiosyncratic risk, reputational risk, and information risk, leading investors to demand higher premiums unless credible recovery signals are observed (Cheng et al., 2013; Albuquerque et al., 2019; Dhaliwal et al., 2011).

Variables that are consistently insignificant—particularly *policy_emissions* and *emissions_score*—are also important to interpret. Their lack of significance does not imply irrelevance. Rather, it suggests that policy-based or aggregate score indicators are not sufficiently material to influence valuation, returns, or cost of capital. The market does not appear to reward policy statements that are easily produced or scores that are overly general, as both are more susceptible to measurement noise and greenwashing. Within signaling theory, such signals are neither costly nor specific enough to be credible. Within stakeholder theory, they may not resolve real conflicts of interest. Within the efficiency view, they do not necessarily alter cost structures or cash flows. In short, the market responds only when environmental signals have a clear and traceable link to economic risk.

Temporally, the results indicate that the associations between environmental indicators and financial outcomes are short-lived, conditional, and often subject to reversal. At horizons $t + 0$ and $t + 1$, the market responds more quickly to signals that appear credible. At $t + 2$ and $t + 3$, the market begins to differentiate between substantive and cosmetic signals. ESG controversies accelerate this filtering process: they shorten the lifespan of positive reactions, amplify penalties for emissions and less credible actions, and ensure that remedial actions such as restoration and waste reduction are valued only when interpreted as genuine legitimacy recovery.

Thus, the interaction model demonstrates that ESG–outcome associations are not linear or uniform. Instead, they are highly dependent on reputational credibility. When reputation is strong, environmental actions may be interpreted as efficiency signals. When controversies are high, environmental actions must work harder to function as recovery signals, and the market requires more time before assigning a premium.

6.2. Social Indicators and Financial Outcomes: With & Without Interaction

Table 9 compares the social indicator results between the specifications without ESG controversies and those including ESG controversies interactions. Conceptually, the difference between specifications without ESG controversies and those including ESG controversies interactions is not merely a technical change in regression, but a shift in how the market interprets firms' social signals. In the baseline model, social indicators are interpreted as signals of stakeholder commitment, reputation, or potential efficiency. Once ESG controversies are introduced, the same signals are processed through a credibility filter: whether these social practices are still perceived as substantive commitments, or instead as image repair efforts, damage control, or even symbolic actions. Recent literature on ESG controversies shows that their impact on firm value and performance depends heavily on visibility, market attention, and the severity of scandals, as controversies erode legitimacy and reputation, thereby altering investor responses to ESG actions that were previously neutral or positive (Aouadi & Marsat, 2018; Mendiratta et al., 2023; Jucá et al., 2024; Elamer & Boulhaga, 2024; Ma & Ma, 2025).

For Tobin's Q, the baseline model shows that *community_score* is only negatively significant at $t + 1$ and $t + 2$. This suggests that the market does not view community activities as direct value creation, but rather as resource allocation whose costs become visible after some time. However, once ESG controversies are included, this significance disappears entirely. Economically, this implies that the reputational capital from community engagement collapses when the firm is affected by controversies: the market no longer credits social expenditures that may be interpreted as symbolic compensation rather than substantive commitment. *Policy_human_rights* and *csr_strategy_score* also fail to receive consistent valuation support in Tobin's Q, both with and without controversies. The interpretation is straightforward: human rights policies and CSR strategies, being aggregate in nature, are too distant from cash-flow channels to convincingly translate into firm value, especially when investors suspect ESG washing. *Policy_data_privacy* is also insignificant in both models for Tobin's Q, indicating that the economic benefits of data protection do not immediately translate into market valuation, but likely operate through risk and cost-of-capital channels. The only variable emerging after controversies is *women_employees* at t_0 , with a positive coefficient. However, this effect is short-lived and not persistent, making it more reasonable to interpret it as a very short-term reputational repair signal rather than a fundamental shift in firm value. In this context, controversies act as attenuators of community-related benefits and as credibility filters that prevent generic social actions from being valued as drivers of firm value.

For Total Return, the moderating role of ESG controversies is much sharper. Without controversies, *policy_human_rights* is positively significant at $t + 1$ and $t + 2$, indicating that the market initially responds to human rights policies as signals of reputation and stakeholder orientation that can trigger stock price revaluation. However, once controversies are introduced, the coefficient at $t + 2$ turns significantly negative. This is not merely a statistical sign change; economically, it reflects a reversal effect: in a controversy-contaminated environment, human rights policies are no longer perceived as credible normative commitments, but rather as costly, delayed responses insufficient to restore broken trust. A similar pattern is observed for *csr_strategy_score*. In the baseline, CSR

strategy is negatively associated with return at $t + 2$, consistent with the agency view that generic CSR strategies may be perceived as diverting resources from core business activities. After controversies are included, the coefficient at $t + 2$ turns significantly positive. This implies that, in a damaged reputational context, the same CSR strategy shifts from being viewed as a “cost center” to a “recovery signal.” This demonstrates that controversies not only strengthen or weaken effects but can reverse market interpretations of the same social actions. Policy_data_privacy is the most volatile example. In the baseline, its coefficient is negative at $t0$ and $t + 1$, positive at $t + 2$, and negative again at $t + 3$. After controversies are included, the pattern becomes flatter and tends to be negative at medium horizons. This suggests that while data privacy is material, once a firm is involved in controversies, the market no longer allows for sustained positive reactions; privacy policies are more often interpreted as adjustment costs rather than sources of return. Women_employees also becomes significantly negative at $t + 2$ after controversies, indicating that increased female workforce participation may be perceived as a costly adjustment or a reputational rebuilding effort that is not yet fully credible. Thus, for stock returns, ESG controversies act as amplifiers of negative signals and attenuators of positive signals, as controversies accelerate market skepticism and shorten the lifespan of favorable reactions.

Table 9. Social Indicators and Financial Outcomes With and Without ESG Controversies Interaction.

Variables ↓/ Models →	Dependent	Without ESG Controversies				Interaction with ESG Controversies			
		$t + 0$	$t + 1$	$t + 2$	$t + 3$	$t + 0$	$t + 1$	$t + 2$	$t + 3$
community_score	Tobins Q	−0.0008 (0.0096)	−0.0400 ** (0.0162)	−0.0538 *** (0.0205)	−0.0350 (0.0219)	−0.0063 (0.0098)	0.0079 (0.0145)	0.0068 (0.0162)	0.0019 (0.0180)
policy_human_rights	Tobins Q	−0.0615 (0.0490)	−0.1085 (0.0927)	−0.1088 (0.1096)	−0.0664 (0.1367)	−0.0586 (0.0515)	−0.0227 (0.0970)	−0.0238 (0.1237)	0.0544 (0.1266)
csr_strategy_score	Tobins Q	0.0004 (0.0098)	0.0019 (0.0168)	0.0181 (0.0192)	0.0195 (0.0177)	0.0082 (0.0109)	0.0032 (0.0166)	−0.0180 (0.0174)	−0.0185 (0.0188)
policy_data_privacy	Tobins Q	0.1131 (0.3883)	1.0246 (0.6526)	0.0614 (0.7662)	0.8117 (0.7132)	0.1628 (0.3316)	0.7345 (0.5325)	0.5631 (0.5722)	0.7135 (0.5665)
women_employees	Tobins Q	0.1313 (0.1489)	0.1015 (0.1460)	−0.0631 (0.1536)	−0.0544 (0.1494)	0.0934 * (0.0573)	0.0689 (0.0772)	−0.0801 (0.0907)	0.0008 (0.0981)
community_score	Total Return	0.0066 (0.0067)	0.0068 (0.0091)	−0.0066 (0.0098)	−0.0150 (0.0120)	−0.0009 (0.0065)	−0.0007 (0.0089)	0.0096 (0.0088)	0.0044 (0.0112)
policy_human_rights	Total Return	0.0055 (0.0496)	0.0893 * (0.0507)	0.1072 * (0.0576)	−0.0506 (0.0650)	0.0644 (0.0501)	0.0203 (0.0495)	−0.1361 ** (0.0543)	0.0702 (0.0682)
csr_strategy_score	Total Return	0.0048 (0.0064)	−0.0080 (0.0075)	−0.0199 ** (0.0094)	−0.0001 (0.0118)	−0.0096 (0.0063)	0.0094 (0.0077)	0.0198 ** (0.0088)	0.0035 (0.0117)
policy_data_privacy	Total Return	−0.9076 *** (0.3119)	−0.8392 *** (0.3197)	1.7017 *** (0.3669)	−1.8198 *** (0.4252)	0.3413 (0.2810)	−0.6069 ** (0.3043)	−0.6101 * (0.3553)	0.4370 (0.4254)
women_employees	Total Return	−0.0264 (0.0687)	−0.0386 (0.0864)	0.0207 (0.0898)	−0.0048 (0.1000)	−0.0384 (0.0337)	0.0359 (0.0476)	−0.0885 ** (0.0352)	0.0109 (0.0634)
community_score	WACC	−0.0003 (0.0004)	−0.0001 (0.0004)	0.0002 (0.0005)	−0.0019 *** (0.0006)	−0.0001 (0.0003)	−0.0006 (0.0004)	−0.0004 (0.0004)	0.0005 (0.0005)
policy_human_rights	WACC	−0.0047 * (0.0028)	0.0025 (0.0028)	0.0057 ** (0.0028)	0.0073 ** (0.0031)	0.0033 (0.0027)	−0.0008 (0.0028)	−0.0022 (0.0029)	−0.0041 (0.0030)
csr_strategy_score	WACC	0.0002 (0.0004)	0.0007 * (0.0004)	0.0003 (0.0004)	0.0008 (0.0005)	−0.0003 (0.0003)	−0.0003 (0.0004)	0.0002 (0.0004)	0.0001 (0.0005)
policy_data_privacy	WACC	0.0353 ** (0.0164)	−0.1415 *** (0.0163)	−0.1922 *** (0.0211)	−0.1042 *** (0.0224)	0.0022 (0.0143)	0.0427 *** (0.0160)	0.0432 ** (0.0182)	0.0329 * (0.0193)
women_employess	WACC	−0.0034 (0.0036)	−0.0076 ** (0.0036)	0.0007 (0.0038)	−0.0043 (0.0043)	0.0020 (0.0018)	0.0044 ** (0.0020)	0.0001 (0.0021)	0.0020 (0.0021)

Notes: Robust standard errors are reported in parentheses. Bold values indicate statistically significant coefficients. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The downward arrow (↓) indicates variables listed by row, while the rightward arrow (→) indicates models listed by column.

For WACC, the moderating effect of ESG controversies is most pronounced and economically meaningful. In the baseline model, *community_score* reduces the cost of capital at $t + 1$ and $t + 3$, reflecting reputational and legitimacy effects that lower perceived risk. However, after controversies are included, this effect disappears entirely. This implies that once trust is damaged, community engagement is no longer credible enough to reduce the risk premium. *Policy_human_rights* shows an ambiguous pattern in the baseline: negative at t_0 , but positive at $t + 2$ and $t + 3$, indicating a trade-off between litigation risk reduction and compliance costs. After controversies are introduced, all effects vanish. This suggests that controversies impair the market's ability to distinguish between reputational benefits and implementation costs, leading investors to refrain from granting cost-of-capital discounts for human rights policies. Similarly, *csr_strategy_score* loses all significance after interaction, reinforcing that generic CSR strategies are highly susceptible to being perceived as symbolic. *Policy_data_privacy* exhibits the strongest reversal. In the baseline, data privacy initially increases WACC at t_0 but reduces it from $t + 1$ to $t + 3$, consistent with an initial cost followed by risk reduction. After introducing controversies, the coefficient becomes significantly positive at $t + 1$ through $t + 3$. This indicates that for firms affected by controversies, data privacy policies are no longer perceived as risk-reducing, but rather as recovery costs insufficient to lower financing premiums. *Women_employees* also reverses direction: in the baseline, it reduces WACC at $t + 1$, but in the interaction model, it increases WACC at the same horizon. Economically, this suggests that gender inclusion is valued as a governance signal only when firm reputation is intact; after controversies, it is interpreted as a costly response that may not effectively restore legitimacy. Thus, for WACC, controversies act not only as attenuators but also as re-pricers, shifting social actions from risk-reducing channels to cost-increasing channels.

Across all results, no variable can be considered fully robust in the sense of being consistently significant with stable direction across both specifications and all outcomes. Instead, the most important finding is that ESG controversies fundamentally alter how the market prices social indicators. The most affected variables are *community_score*, *policy_human_rights*, *csr_strategy_score*, *policy_data_privacy*, and *women_employees*: some lose significance, some change sign, and others only persist in short horizons. This aligns with the literature emphasizing that ESG is valued only when signals are material, difficult to imitate, and relevant to investors or lenders; otherwise, markets tend to interpret them as symbolic actions or ESG washing. Within signaling theory, controversies reduce signal credibility; within stakeholder theory, they undermine legitimacy and trust; within the risk-based view, they increase idiosyncratic risk and risk premiums; and within the efficiency view, social benefits are only reflected when they genuinely reduce operational frictions and financing costs. Therefore, insignificance in some variables does not imply normative irrelevance, but rather indicates that markets fail to map their benefits into cash flows, valuation, or financing costs within the observed horizon. Prior research supports this interpretation: CSR and CSR-like actions tend to be valued when visibility and customer awareness are high, governance quality is strong, and issues are material; conversely, securities markets respond more quickly to punish controversies because reputation, information quality, and risk deteriorate simultaneously (Servaes & Tamayo, 2013; Khan et al., 2016; Godfrey et al., 2009; Ferrell et al., 2016; Ferreira & Laux, 2007; Klassen & McLaughlin, 1996).

6.3. Governance Indicators and Financial Outcomes: With & Without Interaction

Table 10 shows that the effectiveness of governance indicators in influencing corporate financial performance is highly contextual and strongly affected by the presence of ESG controversies as a moderating factor. Theoretically, governance functions as a mechanism

to reduce agency conflict and information asymmetry, which should increase firm value, stabilize returns, and lower the cost of capital. However, the empirical results indicate that these benefits are not universal, but depend on whether governance is perceived as credible by the market. ESG controversies, in this context, act as a credibility shock that disrupts the signaling mechanism, leading investors to evaluate governance not based on its formal structure, but on the firm's underlying reputation (Gompers et al., 2003; Bebchuk et al., 2009).

Table 10. Governance Indicators and Financial Outcomes: Evidence With and Without ESG Controversies Interaction.

Variables ↓/ Models →	Dependent	Without ESG Controversies				Interaction with ESG Controversies			
		<i>t</i> + 0	<i>t</i> + 1	<i>t</i> + 2	<i>t</i> + 3	<i>t</i> + 0	<i>t</i> + 1	<i>t</i> + 2	<i>t</i> + 3
Board Size	Tobins Q	0.0485 (0.0716)	−0.1163 (0.1262)	−0.0687 (0.1323)	−0.0346 (0.1357)	−0.1182 ** (0.0598)	−0.0226 (0.1041)	0.0162 (0.1078)	−0.0114 (0.1254)
Board Gender Diversity Percent	Tobins Q	−0.0046 *** (0.0016)	−0.0079 *** (0.0023)	−0.0031 (0.0027)	0.0068 ** (0.0030)	0.0024 (0.0015)	0.0018 (0.0022)	−0.0023 (0.0024)	−0.0067 ** (0.0029)
Shareholder Rights Policy Score	Tobins Q	0.1187 (0.1984)	0.4933 * (0.2858)	0.2203 (0.3073)	0.5194 * (0.2932)	0.0226 (0.1634)	0.0712 (0.2723)	0.2114 (0.2409)	0.0033 (0.2025)
Shareholders Score Grade	Tobins Q	0.0054 (0.0056)	0.0073 (0.0090)	−0.0136 (0.0100)	−0.0086 (0.0106)	−0.0049 (0.0051)	−0.0057 (0.0084)	0.0097 (0.0097)	0.0087 (0.0100)
Board Size	Total Return	−0.0544 (0.0538)	0.0929 (0.0734)	0.1702 ** (0.0731)	−0.0621 (0.0946)	0.0976 ** (0.0481)	0.0208 (0.0677)	−0.1359 ** (0.0634)	0.0864 (0.0842)
Board Gender Diversity Percent	Total Return	0.0017 * (0.0010)	0.0019 (0.0015)	−0.0030 ** (0.0014)	0.0038 * (0.0021)	0.0001 (0.0010)	0.0001 (0.0014)	0.0005 (0.0014)	−0.0029 (0.0021)
Shareholder Rights Policy Score	Total Return	0.2274 (0.2043)	−0.3624 * (0.2159)	0.1970 (0.1928)	−0.4970 ** (0.2433)	−0.0377 (0.1904)	−0.2995 (0.2047)	0.3925 ** (0.1789)	−0.4137 * (0.2304)
Shareholders Score Grade	Total Return	−0.0029 (0.0038)	0.0006 (0.0057)	0.0047 (0.0059)	0.0121 (0.0081)	0.0022 (0.0038)	−0.0005 (0.0055)	−0.0004 (0.0056)	−0.0114 (0.0079)
Board Size	WACC	−0.0040 (0.0032)	−0.0083 ** (0.0036)	0.0008 (0.0034)	0.0054 (0.0042)	0.0026 (0.0026)	0.0054 * (0.0032)	0.0008 (0.0030)	−0.0037 (0.0036)
Board Gender Diversity Percent	WACC	−0.0002 *** (0.0001)	0.0004 *** (0.0001)	0.0006 *** (0.0001)	0.0004 *** (0.0001)	−0.0001 ** (0.0001)	−0.0001 * (0.0001)	−0.0001 (0.0001)	0.0002 * (0.0001)
Shareholder Rights Policy Score	WACC	−0.0390 *** (0.0102)	−0.0575 *** (0.0104)	0.0440 *** (0.0109)	0.0995 *** (0.0118)	0.0098 (0.0089)	0.0008 (0.0094)	−0.0130 (0.0099)	0.0092 (0.0098)
Shareholders Score Grade	WACC	−0.0001 (0.0002)	0.0006 ** (0.0003)	−0.0001 (0.0003)	0.0001 (0.0004)	−0.0002 (0.0002)	−0.0003 (0.0002)	−0.0001 (0.0003)	−0.0001 (0.0003)

Notes: Robust standard errors are reported in parentheses. Bold values indicate statistically significant coefficients. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The downward arrow (↓) indicates variables listed by row, while the rightward arrow (→) indicates models listed by column.

For Tobin's Q, the variable Board Gender Diversity Percent shows negative significance at *t* and *t* + 1 in the model without interaction, indicating that increased gender diversity in the short term is perceived as a source of coordination costs or organizational adjustment. However, this effect turns positive at *t* + 3, suggesting that governance benefits are only internalized in the long run through improved monitoring quality and strategic decision-making (Adams & Ferreira, 2009). When ESG controversies are included, this significance weakens and only appears at *t* + 3 with a negative direction. This indicates that reputational damage hampers the internalization of long-term governance benefits, so the market no longer trusts that board diversity will generate sustainable economic value. Thus, ESG controversies act as an attenuator of structural and long-term governance effects.

The Shareholder Rights Policy Score variable in the baseline model is significantly positive at *t* + 1 and *t* + 3, reflecting that investor protection enhances valuation through reduced expropriation risk and increased investor confidence. However, in the interaction model, all

of this significance disappears. Economically, this indicates that under reputational distress, formal protection mechanisms are insufficient to offset reputational and litigation risks. Investors tend to discount the benefits of formal governance due to credibility erosion, so governance is no longer perceived as a guarantee of firm value protection.

For Total Return, the dynamics are more complex and reflect more sensitive short-term market responses. The variable Board Size in the baseline is only positively significant at $t + 2$, suggesting that a larger board enhances monitoring capacity in the medium term. However, after ESG controversies are introduced, this variable becomes positively significant at t but negatively significant at $t + 2$. This indicates a reversal effect: in the short term, a larger board signals stability, but in the medium term it increases coordination costs and slows decision-making, especially under reputational crisis conditions (Coles et al., 2008). Thus, ESG controversies amplify organizational costs that were previously not fully priced by the market.

The variable Board Gender Diversity Percent in Total Return shows significance in the baseline (positive at t and $t + 3$, negative at $t + 2$), but loses significance after interaction. This suggests that under normal conditions, the market responds to diversity as a dynamic governance signal, although not consistently. However, under controversy conditions, this signal loses relevance as investors shift their focus to more immediate reputational risks. This reflects that ESG controversies act as an attention reallocator, redirecting investor focus from governance structure to reputational issues.

The Shareholder Rights Policy Score variable in Total Return shows a sharp change in direction. In the baseline, it is significantly negative at $t + 1$ and $t + 3$, indicating that restrictions on management may reduce flexibility and growth opportunities. However, in the interaction model, it becomes positive at $t + 2$ before turning negative again at $t + 3$. This suggests that in a controversy context, strengthening shareholder rights may temporarily be perceived as a risk control mechanism, but the effect is not sustained. In other words, ESG controversies transform governance from an efficiency mechanism into a short-term risk mitigation tool.

For WACC, the moderating effect of ESG controversies is particularly evident in the determination of risk premiums. The variable Board Size in the baseline reduces the cost of capital at $t + 1$, indicating that larger boards improve monitoring and reduce risk. However, in the interaction model, this effect reverses to positive at $t + 1$. This is a clear reversal effect, where governance that previously reduced risk instead increases the cost of capital under controversy conditions, as it is perceived to slow strategic response and increase organizational complexity.

The variable Board Gender Diversity Percent shows relatively robust effects, with negative significance at t in the interaction model and positive significance at $t + 3$. This indicates that board diversity can reduce the cost of capital in the short term through enhanced credibility and governance perception, but may increase costs in the long term due to coordination complexity. This variable is among the closest to being robust, as it remains significant in both models, although the direction and timing of effects change. This suggests that its impact is fundamental but highly dependent on reputational context.

In contrast, the Shareholder Rights Policy Score, which is significant in the baseline (increasing WACC from $t + 1$ to $t + 3$), becomes insignificant in the interaction model. This indicates that under controversy conditions, formal governance is no longer a primary determinant of cost of capital. Investors focus more on reputational risks that cannot be fully mitigated by formal governance mechanisms. Thus, ESG controversies act as a risk amplifier that dominates governance factors in determining cost of capital.

The variable Shareholders Score Grade is consistently insignificant across most models. This suggests that aggregate governance indicators are not sufficiently informative for the

market. In the context of information asymmetry, investors pay more attention to specific and material governance mechanisms than to aggregate scores that are difficult to interpret. This also points to possible measurement issues or the perception that such indicators are symbolic (ESG washing).

From a time-horizon perspective, the results indicate that governance effects are dynamic and often subject to reversal. At t and $t + 1$, the market tends to respond to governance signals as stabilization or risk-control efforts. However, at $t + 2$ and $t + 3$, the market begins to evaluate the medium-term costs of governance, causing many effects to reverse or lose significance. ESG controversies accelerate this process by increasing market sensitivity to reputational risk and reducing tolerance for governance signals that lack sufficient credibility.

Overall, these results show that governance does not have a universal effect on financial performance. Its effectiveness depends heavily on the firm's reputational credibility. Within signaling theory, governance is only effective if its signals are trusted. Within stakeholder theory, legitimacy is a key prerequisite. Within the risk-based view, ESG controversies increase idiosyncratic risk and dominate governance effects. Meanwhile, in the efficiency view, governance only improves performance when it is not offset by coordination costs and reputational costs. Therefore, ESG controversies do not merely moderate, but fundamentally alter how the market evaluates governance.

7. Conclusions

This study aims to analyze the association between disaggregated ESG indicators and firm performance, measured by Tobin's Q, total return, and weighted average cost of capital (WACC), while accounting for the moderating role of ESG Controversies Score. Unlike aggregate approaches, this study demonstrates that the relationship between ESG and firm performance is heterogeneous, depending on the type of indicator, time horizon, and the presence of reputational risk reflected in ESG controversies.

The empirical results show that ESG indicators do not have uniform effects across all dimensions of firm performance. For firm value (Tobin's Q), only certain indicators—particularly within specific environmental and social pillars—are significant at particular time horizons, while others are not consistently priced by the market. This suggests that market valuation of ESG is selective and tends to reflect medium-term expectations rather than immediate responses.

For total return, the results exhibit a more dynamic and fluctuating pattern across time horizons. Some ESG indicators are significant at certain horizons but not persistently, indicating a distinction between short-term market reactions and more gradual price adjustments. This suggests that the market is not fully efficient in processing ESG information instantaneously, but rather requires time to incorporate such information into stock prices.

Meanwhile, for the cost of capital (WACC), the results are more consistent, particularly for governance indicators and some social indicators. These findings suggest that ESG is more strongly reflected in risk and financing cost dimensions than in valuation or stock returns. In other words, ESG is more quickly internalized as a risk factor by investors than as a driver of firm value growth.

Unpacking these results, three findings stand out as the strongest and most consistently significant across specifications: (i) governance indicators, and Board Gender Diversity Percent in particular, are the most robust predictors of the cost of capital across nearly all time horizons; (ii) environmental indicators lose explanatory power quickly once ESG controversies are introduced, indicating that their apparent value relevance in baseline models is partly an artifact of omitted reputational risk; and (iii) no single ESG indicator is significant, in the same direction, across all three financial outcomes and all four time

horizons—underscoring that claims of a general “ESG premium” are not supported once the analysis is disaggregated to the indicator level.

Furthermore, this study finds that ESG Controversies Score plays a significant moderating role, often altering the relationship between ESG indicators and firm performance. The presence of controversies tends to weaken, eliminate, or even reverse the effects of ESG indicators, particularly on total return and WACC. This indicates that the benefits of ESG are highly dependent on credibility; when firms face controversies, the market tends to discount ESG information due to increased uncertainty, reputational risk, and potential additional costs.

From a theoretical perspective, these findings support signaling theory and the risk-based view, where ESG functions as a signal of firm quality, but its effectiveness depends on market trust. ESG controversies act as negative signals that undermine the credibility of ESG information, thereby reducing or altering investor responses. In addition, the results are consistent with stakeholder theory, which emphasizes the importance of legitimacy and trust in determining how ESG activities translate into economic value.

Overall, this study concludes that the relationship between ESG and firm performance is neither linear nor universal. ESG–performance associations are highly contextual, depending on the type of indicator, the performance dimension measured, time dynamics, and the firm’s reputational condition. Therefore, aggregate ESG analyses risk obscuring important variations that can only be revealed through a more disaggregated approach that incorporates moderating factors such as ESG controversies.

The practical implication of this study is that firms need not only to improve ESG performance substantively, but also to maintain consistency and credibility in its implementation to avoid controversy risk. For investors, these findings highlight the importance of evaluating ESG at a more granular level and incorporating reputational risk into investment decision-making.

In practical terms, the disaggregated results suggest that managers operating under limited organizational resources should not treat ESG investment as a single undifferentiated budget line. Governance-related initiatives—particularly board gender diversity and shareholder rights protections—appear to generate the most consistent economic value through a lower cost of capital, and should be prioritized where financing cost reduction is the objective. Environmental initiatives, by contrast, are the most vulnerable to erosion once controversies arise, implying that firms with elevated controversy exposure should prioritize the credibility and verifiability of their environmental disclosures over the breadth of their environmental programs. This prioritization logic is consistent with recent evidence that CSR and ESG components differ systematically in their contribution to firm value and should be ranked accordingly rather than pursued uniformly (Jitmaneeroj, 2023). For practitioners more broadly, the results suggest that incorporating the ESG Controversies Score alongside, rather than as a simple input into, aggregate ESG ratings would better reflect how the market itself appears to price sustainability information.

A limitation of this study is that both the ESG indicators and the ESG Controversies Score are obtained from a single provider, Refinitiv; because ESG data providers are known to disagree substantially in both scoring methodology and coverage, the specific magnitudes reported here may not be fully comparable to studies relying on alternative ESG databases, and this should be kept in mind when generalizing the findings.

Future research could examine whether the heterogeneous ESG–controversies interactions documented here vary systematically across industries, institutional and regulatory environments, or when ESG performance and controversies are measured using alternative rating providers, which would help establish how much of the observed heterogeneity is

attributable to genuine economic mechanisms versus measurement artifacts of a single data source.

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