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RESEARCH ARTICLE OPEN ACCESS

Forward-Looking ESG Relevance and Corporate Performance: Evidence From Credit Ratings

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ABSTRACT

How does the relevance of ESG issues relate to firm performance, and does ESG relevance moderate the relationship between ESG engagement and firm financial outcomes? Using a novel indicator introduced by Fitch Ratings, we provide new empirical evidence to answer these questions. The forward-looking indicator measures the relevance of ESG issues to firms' credit ratings. It captures firms' financial sensitivity to ESG-related issues from a credit-rating perspective. Utilising a sample of 663 firms from 55 countries, we examine the relationship between ESG relevance, its subcategories and firm performance. We find that environmental relevance has a significant negative association with firm performance. The results are economically meaningful as a one-standard-deviation increase in the environmental relevance score associated with decreases in Tobin's *Q* and return on assets (ROA) by 5.7% and 11.9%, respectively. Furthermore, we investigate how ESG relevance interacts with ESG performance in explaining firm performance. We find that environmental relevance significantly weakens the positive association between environmental performance and firm financial performance. The association between ESG relevance and firm performance is primarily concentrated in environmental relevance, while the moderating effect is concentrated in Tobin's *Q*. The findings remain broadly robust to instrumental variable regressions, propensity score matching and alternative measures of firm performance. Further analysis of the disaggregated components of environmental relevance indicates that the negative association is primarily concentrated in the relevance of greenhouse gas emissions. Our findings provide important insights into why ESG relevance matters for investors and firm performance, an issue that is often neglected in the literature.

JEL Classification: G24, G32, Q56

1 | Introduction

It is now widely acknowledged that firms' environmental, social and governance (ESG) performance may be crucial for their long-term survival. There is ample empirical evidence showing that higher ESG scores significantly improve firm financial performance (Clarkson et al. 2011; Cochran and Wood 1984; Dimson et al. 2015; Ferrell et al. 2016; Flammer 2013; Flammer 2015; Garel and Petit-Romec 2021; Hong and Kacperczyk 2009; Mackey et al. 2007; Ozkan et al. 2023). Investors are equally concerned about the financial implications of environment-related

risks (SustainAbility Institute 2022). There is also increasing legislative pressure on institutional investors and fund managers to consider ESG risk when investing.¹ The literature shows that investors are concerned about climate change and consider environmental issues to be one of the key drivers of stock prices (Bolton and Kacperczyk 2020; Chasiotis et al. 2024; Cohen 2023; Engle et al. 2020; Hsu et al. 2023).

A key question in this debate is whether all ESG issues matter for all firms. A related strand of the emerging literature sheds light on this issue by highlighting the value relevance

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of material and immaterial ESG issues. For example, Khan et al. (2016) find that the stock market returns of firms with better ESG materiality rankings significantly outperform those of firms with lower ratings. Furthermore, the authors show that immaterial ESG information is not reflected in stock prices. The findings of this limited literature are particularly important, as the empirical evidence shows that not all ESG issues are relevant to all firms. Relatedly, a recent study by Serafeim and Yoon (2022a) provides a framework to better understand the business relevance of ESG issues, highlighting the need for further research on ESG relevance and its implications. Apaydin et al. (2021) also argue that there needs to be better alignment between CSR and strategy for firms to reap the financial benefits.

Building on this insight, it is unlikely that ESG issues affect firms uniformly across industries or that all firms are equally sensitive to all ESG issues (Cohen 2023; Khan et al. 2016). In this study, we use ESG relevance to conceptualise this heterogeneity. ESG relevance indicates whether and to what extent ESG issues are considered relevant (i.e., important) to a firm's credit quality, as assessed by credit-rating agencies. As such, ESG relevance provides an external assessment of firms' financial sensitivity to ESG-related issues. Despite its importance, empirical evidence on whether and how firm-level ESG relevance is reflected in firms' market and accounting performance remains limited. Although the prior literature discusses how well firms perform on ESG metrics and the influence of ESG performance on their financial outcomes, far less is known about whether these ESG issues matter for firms and how their relevance is associated with corporate performance (see, e.g., Breuer et al. 2018; Chava 2014; El Ghoul et al. 2011; Hong and Kacperczyk 2009; Ng and Rezaee 2015).

We provide new empirical evidence on these questions using a novel, credit-focused ESG relevance score published by Fitch Ratings. The ESG relevance score captures the extent to which ESG-related issues are expected to influence a firm's credit rating. Specifically, the score reflects the anticipated sensitivity of a firm's credit rating to ESG issues that are financially relevant to its credit profile. The ESG relevance score comprises an aggregate ESG relevance score, as well as separate ESG relevance scores.

Conceptually, we define ESG relevance as the extent to which ESG-related issues are expected to have financial consequences for a firm because they are embedded in its business model, operating environment and credit-risk profile. ESG relevance captures a firm's financial sensitivity to ESG-related issues, particularly in relation to credit quality, financing conditions and downside risk, rather than the firm's normative ESG quality or practices. This distinction is important because two firms may have similar ESG performance scores but differ substantially in the extent to which ESG issues affect their businesses financially. Conversely, a firm may have strong ESG performance but remain highly sensitive to financially relevant ESG issues if such issues are structurally embedded in its operations, sectoral environment or regulatory context. Hence, ESG relevance scores capture the degree to which ESG-related issues are expected to affect firms' future financial outcomes from a credit perspective.

ESG relevance is related to, but conceptually distinct from, ESG performance, ESG exposure, ESG risk and ESG materiality. The distinction begins with ESG performance, which captures the extent to which firms engage in ESG practices through their policies, activities, disclosure quality and stakeholder-oriented initiatives. Therefore, it reflects what firms do in relation to ESG issues. In contrast, ESG exposure reflects the extent to which firms are subject to ESG-related conditions arising from their industry, geography, business model or regulatory environment. In this sense, exposure captures a firm's structural position in relation to ESG issues, rather than the quality of its ESG practices. ESG risk is also different, although closely connected. It refers to the possibility that ESG-related issues may adversely affect firms' operations, valuations, cash flows or financial stability. Therefore, it captures the potential occurrence and consequences of adverse ESG-related events. ESG materiality, in contrast, goes one step further by asking whether a particular ESG issue is financially important for a firm.

Our ESG relevance measure builds on this materiality perspective by capturing a more specific and forward-looking dimension, namely, the extent to which ESG-related issues are expected to affect firms' credit assessments, financing conditions and financial performance. In this sense, ESG relevance does not simply indicate whether a firm performs well on ESG metrics, whether it is exposed to ESG issues or whether ESG risks exist. Rather, it captures a firm's degree of financial sensitivity to ESG-related issues, particularly from a creditor-oriented and forward-looking perspective.

Therefore, the ESG relevance score offers several advantages over existing ESG measures. First, the ESG relevance score is an explicitly credit-focused measure of the financial relevance of ESG issues (Fitch Ratings 2020). Its construction is based on the sensitivity of firms' credit ratings to ESG-related issues, thereby reflecting creditors' perspectives. In contrast, several alternative ESG measures, such as ESG controversies from LSEG (previously Refinitiv) and ESG Risk Ratings from Sustainalytics, are generally developed from a more investor-oriented perspective and are less directly connected to credit-rating assessments.

Second, the ESG relevance score constitutes an expert-based assessment of firms' financial sensitivity to ESG-related issues. Existing studies investigating the relationship between ESG risk and firm performance employ a variety of ESG risk proxies that differ substantially from the ESG relevance score. Some measures capture physical risks, such as firm-level climate risk (Berkman et al. 2024) and country-level climate risk (Huang et al. 2018). Others proxy for regulatory or transition risks, including corporate carbon emissions (Bolton and Kacperczyk 2021) and toxic emission intensity (Hsu et al. 2023). Another commonly used measure, ESG controversies, is also used to capture ESG-related risk events or reputational shocks (Aouadi and Marsat 2018; Nirino et al. 2021), but this measure may be subject to substantial bias due to its reliance on traditional and social media coverage (Barkemeyer et al. 2023). In this respect, the ESG relevance score is distinct from most existing ESG risk proxies. Rather than measuring the occurrence of past ESG incidents, the level of ESG exposure or the magnitude

of specific risks, it reflects the extent to which ESG-related issues are expected to matter for firms' credit quality and financial conditions.

Third, the ESG relevance score is a forward-looking indicator. Its construction relies on the relationship between firms' credit ratings and ESG-related issues, capturing how such issues may affect future credit-risk assessments and financial conditions. This forward-looking nature distinguishes ESG relevance from event-based ESG measures, such as ESG controversies, which are typically derived from past incidents, firms' responses to those incidents and subsequent media or stakeholder attention. While controversy-based measures are useful for capturing realised ESG events and reputational shocks, they are backward-looking in nature. In contrast, ESG relevance captures the anticipated financial significance of ESG-related issues before such issues necessarily result in observable controversies or performance outcomes.

Finally, the ESG relevance score is value neutral. It does not assess whether a firm's ESG practices are favourable or unfavourable, nor does it measure the quality of the firm's ESG engagement. Instead, it captures the extent to which ESG-related issues are expected to be financially consequential for the firm's credit quality and financing conditions. This separation is central to our analysis because it allows us to distinguish ESG relevance from ESG performance. A firm may have strong ESG performance but high ESG relevance if ESG-related issues remain structurally important to its business model or credit profile. By separating these two concepts, we examine both their direct associations with firm performance and the way ESG-related financial sensitivity interacts with ESG engagement in shaping financial outcomes.

Utilising a sample of 663 nonfinancial firms from 55 countries, we begin our empirical analysis by examining the relationship of ESG relevance with firm financial performance. We utilise Fitch Ratings' credit-focused ESG relevance score as a proxy for firms' ESG relevance. Subsequently, we disaggregate the ESG relevance score into ESG relevance and examine their associations with firm financial performance separately. The extant literature on ESG performance and risk shows that the association of each component with financial outcomes may differ from that of the aggregate ESG score (Dimson et al. 2015; Ozkan et al. 2023). Finally, we examine the interplay between ESG relevance and ESG performance in explaining firm financial performance.

We do not find a significant association between aggregate ESG relevance and firm market and accounting performance. However, our results show a significant negative association between environmental relevance and firm performance. We find that, on average, a one-standard-deviation increase in the environmental relevance score is associated with decreases in Tobin's *Q* and return on assets (*ROA*) by 5.7% and 11.9%, respectively. In contrast, social and governance relevance are not significantly associated with firm performance. A plausible explanation for these findings is that creditors and investors may attach greater importance to financially relevant environmental issues, such as exposure to rising temperatures and extreme weather events. This result complements the findings of

prior studies documenting the negative financial implications of environmental issues for firm valuation (see, for example, Bolton and Kacperczyk 2021; Chava 2014; Krueger et al. 2020). Furthermore, we find that higher environmental relevance weakens the positive association between environmental performance and firm performance. This result implies that corporate social responsibility (*CSR*) should be considered in tandem with environmental relevance because the positive contribution of *CSR* engagement may be weakened when environmental issues are more financially relevant to the firm. Our additional analysis shows that this negative association is primarily concentrated in the relevance of greenhouse gas emissions. The direct relationship also remains broadly supported when we use alternative measures of firm performance and 1-year lagged ESG relevance scores. The governance-based analyses further suggest that environmental relevance is reflected more strongly in market-based performance in well-governed countries and in accounting performance in countries with weaker institutions. Our results are also robust to additional analysis to address endogeneity concerns.

Our contribution to the growing literature is fourfold. First, this study advances the literature by introducing a credit-focused and forward-looking perspective on ESG relevance. Existing studies have primarily examined whether firms perform well on ESG metrics, whether they are exposed to specific ESG risks or whether ESG issues are financially material based on industry-level classifications. However, these approaches do not fully capture the extent to which ESG-related issues are expected to affect firms' future credit quality, financing conditions and downside risk. We conceptualise this dimension as ESG relevance. The value of this perspective lies in shifting attention from ESG activities alone to firms' financial sensitivity to ESG-related issues. In doing so, the study extends the ESG literature beyond performance-based and investor-oriented perspectives by highlighting the credit-risk implications of ESG relevance.

Second, our study contributes methodologically by using an ESG relevance measure that enables us to observe a dimension of ESG-related financial relevance that is difficult to capture using existing ESG performance, controversy, risk or SASB-based materiality measures. While earlier studies identify materiality by manually mapping SASB industry-level guidance to firm-level ESG data (Grewal et al. 2019, 2021; Khan et al. 2016), this approach has been criticised for treating materiality as a static factor (Serafeim and Yoon 2022a). Responding to this concern, Ahn et al. (2024) propose four key requirements for accurately measuring ESG materiality, which the ESG relevance score used in this study satisfies. It captures anticipated credit-rating sensitivity to ESG-related issues and therefore reflects a more forward-looking and credit-oriented assessment of the financial relevance of ESG issues. The score also evaluates the subdimensions of ESG separately, incorporates the frequency of ESG credit drivers and combines publicly available information with professional credit assessment. These features allow us to examine whether ESG issues matter for firm outcomes through a creditor-oriented perspective, rather than treating ESG materiality only as an industry-level or equity-market concept.

Third, this paper provides new empirical evidence on the performance implications of ESG relevance. Prior studies document

that ESG risks influence asset pricing, investment decisions and firm valuation (Bolton and Kacperczyk 2021; Krueger et al. 2020), while studies on ESG materiality show that financially material ESG issues are more likely to affect firm outcomes (Eccles et al. 2012; Grewal et al. 2019, 2021; Khan et al. 2016; Serafeim and Yoon 2022b). Building on these two strands of research, we show that the association between credit-oriented ESG relevance and firm performance is primarily concentrated in environmental relevance, which has an economically meaningful negative association with both market-based and accounting-based firm performance. This evidence suggests that firms whose credit quality is more sensitive to environmental issues tend to exhibit weaker financial outcomes. In doing so, the study clarifies what can be learned from ESG relevance that cannot be inferred from ESG performance or conventional ESG risk measures alone.

Finally, we contribute to the CSR and ESG performance literature by examining whether ESG relevance moderates the value of ESG engagement. While prior studies largely focus on the direct relationship between ESG performance and financial outcomes,² less attention has been paid to whether the benefits of ESG engagement depend on the financial relevance of ESG issues to the firm. By utilising an ESG relevance measure that is conceptually distinct from ESG performance, we examine the interaction between firms' ESG engagement and their ESG-related financial sensitivity.

The structure of our paper is as follows. The next section provides a literature review and sets out our hypotheses. Subsequently, in Section 3, we present the data and methodological approaches utilised in the study. Section 4 presents the results, including robustness checks. Section 5 concludes.

2 | Literature Review and Hypothesis Development

2.1 | ESG-Related Financial Risks: Measurement and Financial Consequences

Although there is a well-established literature on the financial implications of ESG performance, a limited number of studies focus on the consequences of ESG risk exposure and examine how corporations could mitigate its negative consequences. Earlier studies on ESG risk utilise ESG controversy data, which are reported by various data providers such as LSEG (previously Refinitiv), as a proxy for ESG risk. ESG controversy scores are largely determined by negative news stories, such as those related to social or environmental misconduct, which attract investors' attention. However, the empirical evidence on the relationship between ESG controversies and firm value is largely mixed. In an earlier study, Aouadi and Marsat (2018) find that ESG controversies have a positive impact on firm performance. In contrast, Nirino et al. (2021), looking at European firms, show a strong negative impact of ESG controversies on financial performance. Dorfleitner et al. (2020), investigating the stock market performance of best and worst portfolios based on ESG performance and controversy scores, find that investors may benefit from opportunities by designing their portfolios in conjunction with ESG-based ratings. Chasiotis et al. (2024), examining US-listed

firms, find that ESG reputational risk increases agency problems and financial risk. Furthermore, a strand of the literature also investigates the impact of ESG controversies on analyst forecast accuracy (Schiemann and Tietmeyer 2022), bank risk-taking (Galletta and Mazzù 2023) and investor trading activity (Bang et al. 2023).

Although ESG controversies provide useful insights into firms' ESG-related incidents, there are important limitations that may lead to biased and inconsistent results, which are evident in the literature. For example, the selection of media outlets as a source of information can result in significant selection bias, as not all controversial events receive the same level of media attention (Barkemeyer et al. 2023). More importantly, these measures do not give any indication of how these controversies are perceived by external stakeholders, such as investors or creditors. Our ESG relevance measure differs significantly from ESG controversies, as it allows us to focus on the sensitivity of credit ratings to ESG issues that may arise in the future. Hence, it is a forward-looking measure of firms' financial sensitivity to ESG issues, and it captures the financial relevance of ESG issues from a creditor's perspective.

Apart from ESG controversies, several studies in the literature utilise ESG risk measures provided by Morningstar Sustainalytics and RepRisk (Cheng and Micale 2022; Cohen 2023). Morningstar Sustainalytics combines ESG risk and performance by evaluating a company's exposure to industry-related factors. It also considers how well a company is managing its environmental and social risks. Similarly, RepRisk measures ESG risk by screening public sources for material ESG violations that can have an impact on firm reputation. However, similar to ESG controversy measures, ESG risk measures from these external sources do not capture the relevance of ESG issues from a credit-oriented perspective.³ These limitations align with broader concerns about the conceptual heterogeneity and metric construction of ESG ratings (Lucarelli and Severini 2024). Moreover, ESG ratings can be related to real outcomes in non-linear ways, such as a U-shaped association with green innovation (Yang et al. 2024), highlighting the value of isolating forward-looking ESG relevance from generic ratings.

Most of the studies utilising the abovementioned ESG risk measures report a negative association between ESG risks and financial outcomes. For example, Cheng and Micale (2022), adopting RepRisk data, find that ESG risk increases the sensitivity of stock prices to earnings per share, making firm value more dependent on current earnings. Moreover, they show that ESG risk decreases stock prices in the short term. In a similar vein, Glossner (2019) finds that ESG risk leads to a decrease in stock returns, particularly in the long term, while Xiong (2021) reports that stocks with lower ESG risk generate higher returns than those with higher ESG risk. Cohen (2023) shows that environmental and social risks significantly reduce financial stability while considerably increasing firm default risk. Examining mutual equity funds, Ferriani and Natoli (2021) find that low-ESG-risk funds significantly outperformed their peers in terms of attracting capital inflows during the COVID-19 pandemic. Finally, Zhu et al. (2024) find that foreign acquirers' ESG misconduct negatively affects the completion of cross-border acquisitions in the Chinese market.

As climate change has become one of the most significant threats to businesses, there is also a growing literature on the financial implications of climate-related risks for firm performance. A strand of this literature looks at how climate change exposure affects the portfolio allocation decisions of investors. For example, Huang et al. (2018) find that firms located in countries with higher climate change exposure experience lower financial performance as well as higher earnings volatility. They also highlight the importance of climate-related risks in determining firms' financial policies, such as cash holdings and leverage. Similarly, Kling et al. (2021) find that climate vulnerability restricts access to finance and increases the cost of debt. Examining bank loans, Javadi and Masum (2021) provide evidence supporting these arguments and find that firms located in countries with higher exposure to climate risks pay higher interest rates. Huynh and Xia (2023), examining the impact of physical climate risks, such as natural disasters, on corporate stock and bond markets, find that investors significantly overreact to natural disasters, resulting in selling pressure on securities. More recently, Pankratz et al. (2023) find that exposure to extremely high temperatures reduces firms' revenues and earnings.

Studies also provide evidence of a significant relationship between climate risk, stock markets and investor preferences (Bansal et al. 2017; Daniel et al. 2016). Krueger et al. (2020) report that institutional investors, particularly long-term and ESG-oriented ones, consider climate risk a significant factor in their portfolio allocation decisions. These investors are found to employ risk management strategies to reduce the negative impact of climate risks on portfolio performance. In a similar vein, Stroebel and Wurgler (2021), surveying industry professionals, academics and sector regulators about the impact of climate risks on businesses, report physical and regulatory risks to be among the top climate-related risks expected to present significant challenges to firms. Reboredo and Otero (2021) empirically test these predictions and find that mutual fund managers consider climate-related transition risks an important factor in their investment decisions. Accordingly, they allocate more funds to firms with lower transition risks. Chen et al. (2023) investigate the impact of climate change attention on stock markets and find that downside risk significantly increases during periods of greater climate change attention and awareness.

The relationship of carbon risk, measured by firm-level carbon emissions and carbon intensity, with stock returns is also considered in the literature. Many studies provide evidence of a direct negative relationship between carbon emissions and stock returns. For example, Bolton and Kacperczyk (2021) show that carbon emissions significantly affect stock returns in the United States. They find that investors demand higher premiums for their exposure to carbon emissions risk. Similarly, Ilhan et al. (2021) find that the cost of option protection against downside risks is significantly higher for carbon-intensive firms, an effect that is further amplified when climate change awareness increases. Trinks et al. (2020) report that carbon-efficient firms experience higher operating performance and lower systematic risk. Shive and Forster (2020) also show that firms with higher carbon emissions exhibit lower mutual fund ownership. In contrast to these studies, Aswani et al. (2024), using different

measures of carbon risk, conclude that stock returns are only correlated with unscaled carbon emissions. However, this relationship disappears when emissions intensity is used as a proxy for carbon risk.

2.2 | ESG Materiality, Relevance and Firm Performance

Unlike the well-established literature on ESG-related issues, there is an ongoing discussion about the business relevance and materiality of ESG issues. Hence, it is argued that not all ESG issues are equally relevant or material to businesses (Khan et al. 2016; Serafeim and Yoon 2022a). More importantly, there is a dearth of studies examining how ESG relevance and materiality are perceived by stakeholders and whether these considerations are reflected in firms' financial outcomes.

In a seminal paper on ESG materiality, Khan et al. (2016) discuss the importance of the business relevance of ESG issues and provide evidence of a significant relationship between ESG materiality and firm performance. They construct a firm-level ESG materiality measure based on industry-level materiality guidance issued by the Sustainability Accounting Standards Board (SASB) and investigate the relationship of material and immaterial sustainability with firm performance. They find that firms with higher material sustainability scores outperform their peers with lower scores. However, they also find that immaterial sustainability scores are not significantly associated with firm performance. Their findings are important for understanding the business relevance of sustainability issues and how they may be reflected in business performance. In another study on ESG materiality, Serafeim and Yoon (2022a) investigate market reactions to different types of ESG news. They report that stock markets only react to financially material ESG news, supporting the prior findings of Khan et al. (2016). More recently, Ahn et al. (2024) replicate earlier findings that portfolios composed of firms exhibiting improvements in ratings on financially material ESG issues generate positive financial returns. However, their results also indicate that investing in portfolios based on material ESG issues alone does not uniformly guarantee financial gains. Instead, the observed benefits are concentrated among more financially established firms, which are better positioned to develop material strengths and address material weaknesses in their ESG performance. Götsche et al. (2025) examine managerial and investor behaviour following the publication of the SASB materiality framework. They find that negative sustainability incidents are less likely to occur when issues are classified as financially material, suggesting that both managers and investors prioritise material over immaterial ESG issues.

The abovementioned studies provide useful insights into how investors react to material and immaterial sustainability issues; however, there is an important issue that needs to be addressed in the literature. Specifically, material sustainability is a backward-looking, performance-based measure of the business relevance of ESG issues. It utilises performance-based ESG data and does not give any indication of the anticipated financial relevance of ESG-related issues from a creditor's perspective. This limitation is evident in Ahn et al. (2024), who show that changes in material ESG issues primarily reflect

underlying firm characteristics, such as lower growth, larger firm size and higher profitability relative to industry peers. Accordingly, they criticise the SASB materiality classification for not capturing the dynamic nature of materiality. This concern is echoed by Göttsche et al. (2025), who emphasise that issues considered material at one point may become immaterial as firms' operations evolve. Importantly, firm-specific factors are expected to influence the materiality and business relevance of ESG issues in ways that are not captured by measures based on industry-level guidance. Our study addresses this gap by using a firm-specific measure of ESG relevance that extends beyond industry-level classifications.

2.3 | Hypotheses

The direct relationship of ESG relevance with firm performance can be explained through risk-pricing and financing mechanisms. ESG relevance reflects the extent to which ESG-related issues are expected to affect a firm's future credit quality, financing conditions and downside risk. Therefore, higher ESG relevance is not simply an indication that ESG issues exist but a signal that such issues are financially consequential for the firm. We build this argument by integrating insights from stakeholder theory and signalling theory.

Stakeholder theory provides the foundation for why ESG relevance becomes economically significant. Firms operate within relationships with different stakeholders (Freeman 1984), who increasingly demand that firms identify, manage and disclose material ESG issues, particularly those that are financially relevant to firm value (Eccles et al. 2012). When ESG-related issues are more relevant to a firm's credit quality, stakeholders may perceive the firm as more vulnerable to regulatory pressures, operational disruptions or reputational costs. These adverse stakeholder assessments can weaken firm value by increasing uncertainty about future cash flows and the firm's ability to maintain stable financial performance.

Signalling theory explains how this stakeholder concern is incorporated into capital-market and financing decisions. Under information asymmetry, ESG relevance serves as a forward-looking signal of the firm's financial sensitivity to ESG-related issues (Connelly et al. 2011). Investors and creditors may interpret higher ESG relevance as evidence that ESG-related issues are more likely to affect the firm's credit profile and default risk. As a result, capital providers may demand a higher risk premium. This mechanism is particularly relevant in our setting because the ESG relevance score is explicitly linked to credit-rating sensitivity, as higher ESG relevance can indicate greater uncertainty about future credit assessments. Prior literature shows that higher financing costs, tighter financing constraints and rating-related uncertainty can reduce investment capacity and weaken future profitability and valuation (Baghai et al. 2014; Kisgen 2006). Therefore, we hypothesise that firms with higher ESG relevance exhibit lower firm performance.

H1. *ESG relevance is negatively associated with firm performance.*

In addition to its direct relationship with firm valuation, ESG relevance may also moderate the relationship between ESG engagement and firm performance. The resource-based view suggests that firms can develop ESG-related capabilities, such as climate risk management systems and sustainability-oriented operational practices, which may help them build a competitive advantage and improve financial performance (Albuquerque et al. 2019; Barney 1991; Dimson et al. 2015; Fatemi et al. 2015; Hong and Kacperczyk 2009; Mackey et al. 2007). From this perspective, stronger ESG engagement can enhance firm value by improving stakeholder relationships, reducing operational risks, strengthening legitimacy and supporting long-term resilience.

However, the value-enhancing effect of ESG engagement is likely to depend on the extent to which ESG-related issues are financially relevant to the firm. While ESG performance captures firms' current and historical ESG activities and capabilities, ESG relevance captures a firm's expected financial sensitivity to ESG-related issues. When ESG relevance is high, ESG-related issues are more likely to be perceived as structurally important to the firm's credit profile, financing conditions and downside risk. Under such conditions, the positive effect of ESG engagement may be weakened because investors and creditors may continue to price the firm's underlying ESG-related financial sensitivity, even when the firm demonstrates stronger ESG performance.

This argument is consistent with the risk-pricing and financing channel. Accordingly, ESG engagement may signal commitment to sustainability and stakeholder responsiveness, but high ESG relevance signals that financially relevant ESG issues remain embedded in the firm's business model, operating environment or credit-risk profile. As a result, the benefits of ESG engagement may be partially offset by higher monitoring costs, risk premiums or financing frictions. Existing studies show that the valuation effect of ESG performance can be weakened when firms face greater exposure to climate or environmental risks (Huynh and Xia 2021; Ozkan et al. 2023). Therefore, ESG relevance is expected to weaken firms' ability to convert ESG engagement into superior financial outcomes.

H2. *ESG relevance weakens the positive association between ESG engagement and firm performance.*

3 | Data and Methodology

3.1 | ESG Relevance

We use Fitch Ratings⁴ credit-focused ESG relevance data as a proxy for our ESG relevance measure. Fitch Ratings is a globally recognised credit-rating agency and financial data provider. Established in 1914, Fitch Ratings, together with Moody's and Standard & Poor's, is one of the three major international credit-rating agencies and is registered as a Nationally Recognized Statistical Rating Organization (NRSRO) with the US Securities and Exchange Commission. With a long-standing history in credit-risk assessment, Fitch Ratings provides forward-looking credit ratings for more than 20,000 entities worldwide. In response to the growing recognition of the link between ESG

factors and creditworthiness, Fitch Ratings introduced ESG Relevance Scores to systematically integrate the financial relevance of ESG-related issues into its credit-risk assessment.

The ESG relevance score was introduced in 2019 and provides a systematic and robust assessment of the relevance of ESG-related issues to a firm's credit profile. Compared with alternative ESG measures, it offers some distinct advantages. It is a credit-oriented, forward-looking and value-neutral indicator grounded in professional credit analysis. Moreover, the scoring system is applied consistently across industries and regions, enabling meaningful comparisons of ESG relevance. Specifically, Fitch Ratings' ESG relevance score indicates the extent to which ESG issues are financially relevant to firms' credit-rating decisions.⁵ Fitch Ratings (2020) explain that the ESG relevance score is derived from the same information sources used to assess overall credit ratings, which mainly include private and public sources such as financial statements, strategic objectives and/or investor presentations. ESG relevance scores are identified and grouped based on headline ESG elements, for instance, energy management, labour relations, employee well-being and financial transparency. This exercise helps to separate out the ESG elements that are relevant to credit analysis at a sector level and, therefore, identifies whether and how various ESG issues are reflected in. Moreover, the score enables market participants to understand and identify whether and how each of the ESG elements is reflected in a firm's credit-rating decisions. It also provides details on why ratings change, thereby enhancing transparency regarding how ESG relevance is incorporated into rating decisions.

The ESG relevance score comprises three subindicators: environmental, social and governance relevance. Each ESG dimension has five general categories and 96 unique ESG sector templates that identify industry-specific ESG credit issues related to the general categories of the ESG relevance framework. In addition to the aggregate ESG relevance score, Fitch Ratings also publishes individual relevance scores for the environmental, social and governance dimensions of ESG.

ESG relevance scores range from 1 to 5, while the decimal component of the overall score provides additional information on the frequency of the highest relevance score. A relevance score of 1 indicates that ESG issues are irrelevant to the sector and, therefore, the firm's credit-rating decision. A relevance score of 5 indicates that ESG issues are highly relevant and a key driver of a firm's credit rating. Fitch Ratings' ESG relevance scores also include decimal places to provide greater granularity regarding the relevance of ESG-related issues to the firm's credit rating. The decimal place in the overall score does not indicate a fraction but rather reflects the frequency of the highest ESG relevance scores across Fitch Ratings categorisation of ESG-related issues. In other words, the value of each indicator is determined by taking the highest score observed across all subdimensions, and the decimal represents the frequency of that score. Therefore, multiple occurrences of the highest ESG relevance score indicate greater relevance of ESG issues to a firm's credit rating compared with a firm that may only have one general issue receiving the highest score. Hence, in our sample, taking the implications of the decimal place into account, firms' ESG relevance scores vary from 0.80 to 5.60. It is also important to

note that the aggregate ESG relevance score is not a simple or weighted average of its individual components (i.e., ESG relevance scores). Instead, Fitch Ratings uses an additive approach, which is based on the highest number of general issues scored at each level. This is due to the misleading nature of averaging, as the lower relevance of other ESG issues does not offset the higher relevance of any ESG issue.

More importantly, unlike other ESG performance measures available, ESG relevance is a value-neutral measure that does not indicate whether a company is performing well or poorly in terms of social, environmental and governance issues. This is particularly important for our analysis as it allows us to isolate the association of ESG relevance with firm performance from the association of ESG performance with firm performance. It is also different from ESG risk measures provided by other agencies, as it does not quantify ESG risk factors. Instead, the ESG relevance score indicates the extent to which ESG-related issues are relevant to a firm's credit rating. Fitch Ratings describes the score as evaluating ESG issues from a credit-rating perspective while employing a value-neutral approach.

Despite these advantages, the ESG relevance score is also subject to several limitations. First, because the score is derived from information used in credit-rating analysis, it may partly overlap with firms' broader credit-risk assessments. Conceptually, however, ESG relevance captures the ESG-related component of firms' financial sensitivity rather than their overall credit quality. Empirically, we further assess this concern by including credit ratings in additional specifications and by implementing instrumental variable (IV) and propensity score matching (PSM) analyses. Second, although the use of professional analyst assessments can reduce some of the media-driven biases associated with event-based ESG measures, it may also reflect rating-agency methodologies, analyst subjectivity and institutional assumptions. Third, the measure reflects a creditor-oriented perspective and therefore captures the relevance of ESG issues to credit quality rather than providing a comprehensive assessment of ESG relevance from the perspective of all stakeholders. Finally, ESG relevance data are available only for firms covered by Fitch Ratings, which are generally larger and more active in capital markets. Therefore, our findings should be interpreted as evidence for rated firms and may not fully generalise to smaller or unrated firms.

3.2 | Sample Construction

Our sample construction process starts with obtaining firm-level ESG relevance scores (*ESG_RS*), including the subcategories of environmental relevance (*ENV_RS*), social relevance (*SOC_RS*) and governance relevance (*GOV_RS*). The sample period is from 2019 to 2021, as 2019 is the first year in which ESG relevance data were published by Fitch Ratings. Financial institutions, including banks and insurance firms, are excluded from the sample because their structural features differ from those of other industries. We therefore obtain ESG relevance data from Fitch Ratings for more than 900 firms from 55 countries. Subsequently, we collect financial and nonfinancial data from LSEG, including ESG scores (capturing ESG performance), firm financial measures and other control variables that may be

associated with firm performance. After using firms' names to match ESG relevance scores with data from LSEG (previously Refinitiv), we obtain a sample of 739 firms and 1496 firm-year observations. We also include corporate governance control variables may be associated with firm performance. We then remove observations with missing data from the dataset. This exercise reduces our final sample to 663 firms from 55 countries and 1315 firm-year observations. In addition, we winsorise the financial data at the 1st and 99th percentiles to mitigate the potential impact of outliers.

Table 1 presents the distribution of the sample and average ESG relevance scores, including their subcategories, across industries. The highest and lowest mean *ESG_RS* values are observed in the Health Care (3.982) and Technology (3.797) industries, respectively. We observe that the Energy sector has the highest environmental relevance score (*ENV_RS*) at 3.753. As energy firms are at the centre of the discussion on climate change, it is not surprising that environmental issues are particularly relevant to their credit-rating decisions. Furthermore, the Health Care industry has the highest social relevance score (*SOC_RS*) at 3.875. Health Care firms play a crucial role in society and are particularly sensitive to social issues. Factors such as aging populations, tight government pricing and new regulations on therapies and medicines may have significant implications for their financial positions. Furthermore, data security has become another important social issue because of recent data protection laws. Regarding governance relevance, all industries have similar *GOV_RS* scores. This suggests that governance issues are relevant across sectors from a credit-rating perspective. The Energy and Technology industries have the highest and lowest *GOV_RS* scores, respectively.

Table 2 presents the distribution of the sample and average ESG relevance scores across countries. UK firms have the highest *ESG_RS* and *GOV_RS* scores, while firms located in Czechia have the highest *ENV_RS* score (4.200). Regarding social relevance, firms domiciled in Vietnam and Israel have the highest social relevance scores from a credit-rating perspective. However, it is important to note that some of these countries

have a small number of observations in our sample, which may affect the average scores reported. Among the countries with a higher number of observations, firms from Australia, Brazil and Germany have relatively higher *ESG_RS* scores compared with firms from other developed and developing countries.

3.3 | Methodology

Following the literature, we estimate the model below to investigate the relationship between ESG relevance and firm performance (Lins et al. 2017; Ozkan et al. 2023):

$$Performance_{i,t} = ESG_RS_{i,t} + ESG_{i,t} + X_{i,t} + \epsilon_{i,t} \quad (1)$$

Following Di Giuli and Kostovetsky (2014), we employ pooled ordinary least squares (pooled OLS) to estimate our baseline models. This approach is well suited to the structure of our sample of 663 firms observed over 3 years and its short time dimension (Wooldridge 2010). To account for within-firm serial correlation, standard errors are clustered at the firm level, allowing for arbitrary correlation within firms over time while maintaining independence across firms (Petersen 2009).

Moreover, prior studies document systematic industry and country-level heterogeneity (e.g., Borghesi et al. 2014; Ghoul et al. 2017). To account for such heterogeneity, we follow Chang et al. (2019) and include industry, country and year fixed effects in all specifications. These fixed effects absorb unobserved and time-invariant industry and country characteristics and common temporal shocks, thereby enabling more precise estimation of the associations between the independent variables and firm performance.

In Equation (1), *Performance* represents measures of firm financial performance. Following the literature, we measure firm performance using Tobin's Q (*TOBIN's Q*) and ROA (Albuquerque et al. 2019; Ozkan et al. 2023). Tobin's Q is a widely used market-based financial performance indicator that measures the market value of the company in relation to replacement cost of its assets.

TABLE 1 | Sample distribution across industries.

Industry	N	ESG_RS	ENV_RS	SOC_RS	GOV_RS
Basic Materials	149	3.860	3.596	3.481	3.856
Consumer Discretionary	235	3.853	3.131	3.404	3.852
Consumer Staples	115	3.927	3.296	3.518	3.866
Energy	146	3.910	3.753	3.489	3.878
Health Care	67	3.982	3.140	3.875	3.833
Industrials	197	3.831	3.277	3.267	3.831
Real Estate	118	3.866	3.231	3.251	3.842
Technology	68	3.797	3.315	3.356	3.794
Telecommunication	98	3.835	3.188	3.214	3.851
Utilities	122	3.879	3.564	3.616	3.828

Note: This table presents the distribution of the sample firms and average *ESG_RS*, *ENV_RS* and *GOV_RS* scores across industries. Industries are categorised based on the Industry Classification Benchmark (ICB).

TABLE 2 | Sample distribution across countries.

Country	<i>N</i>	<i>ESG_RS</i>	<i>ENV_RS</i>	<i>SOC_RS</i>	<i>GOV_RS</i>
Argentina	9	3.911	3.422	3.333	3.978
Australia	24	4.108	3.567	3.708	4.033
Austria	2	3.800	3.800	3.400	3.800
Bahrain	1	3.800	3.200	3.200	3.800
Belgium	7	3.800	3.400	3.343	3.800
Bermuda	5	3.920	3.400	3.640	3.880
Brazil	45	4.067	3.471	3.551	4.129
Canada	44	3.859	3.464	3.559	3.800
Cayman Islands	1	3.800	1.800	3.200	3.800
Chile	25	3.952	3.696	3.504	3.848
China	81	3.800	3.244	3.368	3.793
Colombia	10	3.980	3.680	3.720	3.920
Cyprus	3	3.733	2.533	2.467	3.800
Czechia	2	4.200	4.200	3.600	3.800
Denmark	7	3.800	3.371	3.486	3.800
Finland	6	3.900	3.033	3.733	3.800
France	38	3.868	3.200	3.389	3.863
Germany	35	4.017	3.389	3.531	3.897
Hong Kong	27	3.800	3.407	3.363	3.800
Hungary	2	3.800	3.800	3.400	3.800
India	33	3.800	3.509	3.479	3.800
Indonesia	8	4.000	3.200	3.200	4.025
Ireland	14	3.857	3.257	3.543	3.800
Isle of Man	4	3.850	3.100	3.350	3.800
Israel	3	4.133	3.333	3.800	4.133
Italy	23	3.870	3.443	3.443	3.870
Japan	10	3.800	3.320	3.400	3.800
Jersey	3	3.800	3.400	3.400	3.800
Kazakhstan	2	3.800	3.800	3.600	3.800
Korea, South	16	3.800	3.275	3.425	3.800
Luxembourg	4	3.800	3.400	3.300	3.800
Malaysia	9	3.867	3.489	3.400	3.911
Mexico	32	3.813	3.275	3.331	3.825
Netherlands	26	3.823	3.438	3.315	3.815
Norway	2	3.800	3.800	3.400	3.800
Oman	2	3.800	3.200	3.200	3.800
Peru	8	3.875	3.500	3.400	3.950
Philippines	4	3.800	3.200	3.200	3.800

(Continues)

TABLE 2 | (Continued)

Country	N	ESG_RS	ENV_RS	SOC_RS	GOV_RS
Poland	2	3.800	3.800	3.400	3.800
Portugal	6	3.800	3.267	3.467	3.800
Russian Federation	28	3.807	3.586	3.429	3.814
Saudi Arabia	6	3.800	3.667	3.467	3.800
Singapore	11	3.800	3.255	3.109	3.800
South Africa	2	3.800	3.800	3.600	3.800
Spain	30	3.847	3.413	3.420	3.827
Sweden	14	3.886	3.400	3.243	3.914
Switzerland	14	3.871	3.357	3.557	3.800
Taiwan, China	1	2.000	2.000	1.200	1.000
Thailand	9	3.800	3.533	3.356	3.800
Türkiye	16	3.825	3.388	3.313	3.850
Ukraine	2	4.300	3.800	3.600	4.500
United Arab Emirates	1	3.800	3.800	3.400	3.800
United Kingdom	97	3.868	3.235	3.412	3.808
United States	498	3.866	3.308	3.416	3.841
Vietnam	1	3.800	3.800	3.800	3.800

Note: This table presents the distribution of the sample firms and average *ESG_RS*, *ENV_RS*, *SOC_RS* and *GOV_RS* scores across countries.

TOBIN's Q is measured as the book value of assets minus the book value of equity plus the market value of equity, divided by the book value of assets. *ROA* is a commonly used accounting-based performance measure (see, e.g., Gao and Zhang 2015; Lins et al. 2017). It is measured as net income before extraordinary items divided by the firm's total assets.

ESG_RS is the aggregate credit-focused ESG relevance score obtained from Fitch Ratings. We utilise this score as a proxy for firms' ESG relevance. *ESG* represents the aggregate ESG performance score of the firm, which is obtained from LSEG (previously Refinitiv). Furthermore, *X* denotes the financial and governance control variables that are potentially associated with firm performance (see, for example, Biju et al. 2025). Following prior studies, we employ firm size (*SIZE*), financial leverage (*LEV*), cash holdings (*CASH*), dividend payments (*DIV*) and R&D investments (*R&D*) as financial control variables. We also include corporate governance control variables in our model, including board size (*BSIZE*), board independence (*BIND*), board gender diversity (*GENDER*), CEO–chair duality (*DUALITY*) and average board tenure (*TENURE*). Subscripts *i* and *t* represent firm and year indices, respectively, and ϵ represents the error term of the regression equation. Finally, we control for year, industry and country fixed effects in all estimations.⁶ Definitions of the variables and their data sources are provided in Table 3.

In the second stage of our analysis, we investigate the relationship of the subcategories of *ESG_RS*, namely, environmental (*ENV_RS*), social (*SOC_RS*) and governance (*GOV_RS*) relevance, with firm performance. Prior studies suggest that the environmental, social and governance dimensions of ESG can

have differing associations with firms' financial outcomes (Bae et al. 2021; Ozkan et al. 2023). In the third stage of our analysis, we examine the moderating role of ESG relevance in the relationship between ESG performance and firm performance.

4 | Empirical Results

4.1 | Descriptive Statistics

In Table 4, we present the descriptive statistics for all the variables used in the analysis. The mean values of *TOBIN's Q* and *ROA* are 1.617 and 4.7%, respectively. Regarding the relevance measures, *ESG_RS* has a mean and standard deviation of 3.869 and 0.224, respectively. The governance subcategory of ESG relevance (*GOV_RS*) has a higher average value (3.846) compared with *ENV_RS* (3.352) and *SOC_RS* (3.425). This is in line with our expectations as governance issues are relevant across firms and are considered by analysts in credit-rating decisions. Furthermore, *GOV_RS* has a lower standard deviation than the other subcategories of ESG relevance, indicating lower variability in *GOV_RS*. Regarding ESG performance scores, the sample firms have mean *ESG*, *ENV*, *SOC* and *GOV* scores of 62.388, 59.407, 64.807 and 62.770, respectively.

The correlation matrix, presented in Table 5, provides valuable insights. First, *ESG_RS* is negatively correlated with *TOBIN's Q* and *ROA*; however, the correlation is statistically significant only for *ROA*. *ENV_RS* has a statistically significant negative correlation with both performance measures. Furthermore, *SOC_RS* is not significantly correlated with either *TOBIN's Q* or

TABLE 3 | Definitions of the variables.

Variable	Definition	Source
<i>TOBIN's Q</i>	The ratio of book value of assets minus book value of equity plus market value of equity to book value of assets.	LSEG (formerly Refinitiv)
<i>ROA</i>	Net income before extraordinary items scaled by total assets.	LSEG
<i>ESG_RS</i>	Aggregate environmental, social and governance (ESG) relevance score reported by Fitch Ratings. It indicates the relevance and materiality of ESG risks on credit-rating decisions. Higher scores indicate higher ESG relevance.	Fitch Ratings
<i>ENV_RS</i>	Environmental relevance score reported by Fitch Ratings. It indicates the relevance of materiality of environmental risks on credit ratings decisions. Higher scores indicate higher environmental relevance.	Fitch Ratings
<i>SOC_RS</i>	Social relevance score reported by Fitch Ratings. It indicates the relevance of materiality of social risks on credit ratings decisions. Higher scores indicate higher social relevance.	Fitch Ratings
<i>GOV_RS</i>	Governance relevance score reported by Fitch Ratings. It indicates the relevance of materiality of governance risks on credit-rating decisions. Higher scores indicate higher governance relevance.	Fitch Ratings
<i>ESG</i>	Aggregate ESG performance score.	LSEG
<i>ENV</i>	Environmental performance score, which is a subcategory of aggregate ESG score.	LSEG
<i>SOC</i>	Social performance score, which is a subcategory of aggregate ESG score.	LSEG
<i>GOV</i>	Governance performance score, which is a subcategory of aggregate ESG score.	LSEG

(Continues)

TABLE 3 | (Continued)

Variable	Definition	Source
<i>CASH</i>	Cash and equivalents scaled by total assets.	LSEG
<i>LEV</i>	The ratio of total debt to total assets.	LSEG
<i>R&D</i>	Dummy variable equals 1 if the firm has R&D investments reported in financial statements and 0 otherwise.	LSEG
<i>SIZE</i>	Natural logarithm of total assets in US dollars.	LSEG
<i>DIV</i>	Dummy variable equals 1 if the firm pays dividends and 0 otherwise.	LSEG
<i>BSIZE</i>	Total number of board members.	LSEG
<i>BIND</i>	The ratio of independent board members to board size.	LSEG
<i>GENDER</i>	The proportion of woman board members to board size.	LSEG
<i>DUALITY</i>	Dummy variable equals 1 if CEO is a board member and 0 otherwise.	LSEG
<i>TENURE</i>	Average tenure of the board members within the firm.	LSEG

Note: This table presents the definitions of the variables and data sources.

ROA. Like *ESG_RS*, *GOV_RS* is negatively correlated with both firm performance measures, but the correlation is statistically significant only for *ROA*. These initial findings are important, as they support the view that ESG subcategories have different associations with firm performance and that the aggregation of ESG relevance measures may obscure important information regarding their separate relationships with firm performance. Before estimating the regression models, we also examine variance inflation factors (VIFs) to assess potential multicollinearity among the explanatory variables. The results, reported in Table A1, show that all VIF values are below conventional thresholds, suggesting that multicollinearity is not a significant concern in our analysis.

4.2 | Main Regression Results

In Table 6, we present the results on the relationship between ESG relevance and our market-based performance measure, *TOBIN's Q*. The results provide several important insights. First, we find no statistically significant relationship between *ESG_RS* and *TOBIN's Q* (Column 1). This suggests that aggregate ESG relevance is not significantly associated with market-based firm performance. In contrast, we find that

TABLE 4 | Summary statistics.

Variable	Mean	STD	Median	Minimum	Maximum
<i>TOBIN's Q</i>	1.617	1.009	1.284	0.606	6.700
<i>ROA (%)</i>	4.709	7.133	4.540	−18.440	30.740
<i>ESG_RS</i>	3.869	0.224	3.800	0.800	5.400
<i>ENV_RS</i>	3.352	0.405	3.400	0.800	5.000
<i>SOC_RS</i>	3.425	0.307	3.400	0.800	5.200
<i>GOV_RS</i>	3.846	0.229	3.800	1.000	5.600
<i>ESG</i>	62.388	18.660	64.890	4.830	95.710
<i>ENV</i>	59.407	24.614	63.480	0.000	98.910
<i>SOC</i>	64.807	21.134	68.320	2.520	97.880
<i>GOV</i>	62.770	21.475	66.850	4.250	98.560
<i>CASH</i>	0.109	0.087	0.092	0.002	0.480
<i>LEV</i>	0.355	0.159	0.336	0.001	0.907
<i>R&D</i>	0.434	0.496	0.000	0.000	1.000
<i>SIZE</i>	17.592	2.232	17.254	13.231	24.894
<i>DIV</i>	0.798	0.402	1.000	0.000	1.000
<i>BSIZE</i>	10.878	2.980	11.000	4.000	24.000
<i>BIND (%)</i>	66.644	23.245	71.430	0.000	100.000
<i>GENDER (%)</i>	23.343	13.403	25.000	0.000	63.640
<i>DUALITY</i>	0.830	0.375	1.000	0.000	1.000
<i>TENURE</i>	7.051	3.573	6.410	0.000	28.580

Note: This table presents the summary statistics of the variables used in the study. Definitions of the variables are provided in Table 3.

firms with higher aggregate ESG performance exhibit significantly higher market-based performance than their peers with lower ESG performance. This latter result is in line with the findings of prior literature (Albuquerque et al. 2019; Borghesi et al. 2014; Dimson et al. 2015; Hong and Kacperczyk 2009; Jo and Harjoto 2011; Mackey et al. 2007). From a stakeholder theory perspective, ESG activities may serve as a complementary tool to capture the mutual benefits among firms' employees, customers and suppliers. They may also mitigate conflicts of interest between owners and managers, resulting in more efficient and effective management systems (Cavaco and Crifo 2014; Ferrell et al. 2016). Firms with stronger ESG performance have the potential to maintain good relationships with their stakeholders, such as investors, customers, suppliers and competitors (Servaes and Tamayo 2013). They can boost employees' motivation, attract more capable employees and foster employee loyalty, all of which may result in superior firm financial outcomes. Regarding the control variables, we find that *SIZE*, *CASH*, *R&D* and *LEV* are significantly associated with market performance. Specifically, firms with higher cash holdings, leverage and R&D investments exhibit higher market performance. We also observe that smaller firms exhibit higher performance than larger ones in terms of *TOBIN's Q*. Corporate governance variables are not significantly associated with firms' market performance.

In Columns 2–4 of Table 6 we present the results on the relationship between the ESG relevance subcategories, that is, *ENV_RS*, *SOC_RS* and *GOV_RS*, and firm market performance. The results in Column 2 suggest that environmental relevance has a significant negative association with *TOBIN's Q*. Firms with higher environmental relevance scores (*ENV_RS*) exhibit significantly lower market performance than their peers with lower environmental relevance. This result is also economically significant. A one-standard-deviation increase in *ENV_RS* is associated with a decrease in *TOBIN's Q* of approximately 5.7%. Due to the growing attention to climate change and environmental issues in recent years, firms' financial sensitivity to environmental issues has become increasingly important to market participants and may be negatively associated with firm market performance. Put differently, the negative association between environmental relevance and market-based performance suggests that market participants may place lower valuations on firms that are more financially sensitive to environmental issues. Regarding the subcomponents of ESG performance, we find that environmental performance has a positive association with market performance. A one-standard-deviation increase in *ENV* is associated with and increase in *TOBIN's Q* of approximately 10.6%.

Regarding social and governance relevance, we do not find a significant association between *SOC_RS* or *GOV_RS* and firms'

TABLE 5 | Correlation matrix.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
(1) <i>TOBIN's Q</i>	1.00																			
(2) <i>ROA</i>	0.45	1.00																		
(3) <i>ESG_RS</i>	-0.03	-0.09	1.00																	
(4) <i>ENV_RS</i>	-0.15	-0.13	0.30	1.00																
(5) <i>SOC_RS</i>	0.03	0.02	0.57	0.29	1.00															
(6) <i>GOV_RS</i>	-0.04	-0.08	0.79	0.22	0.22	1.00														
(7) <i>ESG</i>	0.11	0.06	0.02	0.04	0.13	-0.07	1.00													
(8) <i>ENV</i>	0.07	0.05	0.03	0.11	0.09	-0.05	0.87	1.00												
(9) <i>SOC</i>	0.12	0.07	0.05	0.02	0.14	-0.04	0.90	0.75	1.00											
(10) <i>GOV</i>	0.08	0.02	-0.03	-0.01	0.06	-0.08	0.64	0.35	0.39	1.00										
(11) <i>CASH</i>	0.31	0.19	-0.05	-0.12	-0.01	0.01	-0.01	0.01	-0.03	0.02	1.00									
(12) <i>LEV</i>	0.01	-0.16	0.06	-0.03	-0.02	0.07	-0.17	-0.15	-0.14	-0.12	-0.16	1.00								
(13) <i>R&D</i>	0.17	0.11	-0.01	-0.02	0.06	-0.02	0.26	0.25	0.26	0.08	0.09	-0.17	1.00							
(14) <i>SIZE</i>	-0.14	0.03	0.02	0.15	0.07	-0.02	0.24	0.28	0.23	0.03	-0.04	-0.12	0.15	1.00						
(15) <i>DIV</i>	-0.00	0.19	-0.05	0.02	-0.02	-0.07	0.20	0.26	0.17	0.04	-0.13	-0.13	0.03	0.18	1.00					
(16) <i>BSIZE</i>	-0.05	-0.03	0.02	0.05	0.05	-0.06	0.32	0.33	0.32	0.08	-0.04	-0.08	0.12	0.21	0.13	1.00				
(17) <i>BIND</i>	0.23	0.05	-0.03	-0.09	0.10	-0.09	0.23	0.07	0.19	0.35	-0.06	-0.04	0.11	-0.39	-0.03	-0.03	1.00			
(18) <i>GENDER</i>	0.11	-0.01	-0.02	-0.08	0.05	-0.06	0.42	0.30	0.38	0.37	-0.03	-0.10	0.09	-0.28	0.05	0.19	0.44	1.00		
(19) <i>DUALITY</i>	0.07	0.03	-0.11	-0.08	-0.04	-0.08	0.00	0.04	-0.01	-0.04	-0.01	-0.00	-0.00	-0.15	0.03	-0.03	0.20	0.09	1.00	
(20) <i>TENURE</i>	0.14	0.12	-0.05	-0.08	-0.07	-0.02	-0.11	-0.12	-0.10	-0.02	0.05	0.00	-0.12	-0.11	0.01	0.07	0.07	-0.06	0.07	1.00

Note: This table presents the Pearson correlation matrix. Bold values indicate that the coefficients are significant at the 5% level. Definitions of the variables are provided in Table 3.

TABLE 6 | ESG relevance and market performance.

	(1)	(2)	(3)	(4)
<i>ESG_RS</i>	0.070 (0.147)			
<i>ESG</i>	0.011*** (0.003)			
<i>ENV_RS</i>		−0.210** (0.092)		
<i>ENV</i>		0.007*** (0.002)		
<i>SOC_RS</i>			0.224 (0.145)	
<i>SOC</i>			0.008*** (0.002)	
<i>GOV_RS</i>				−0.069 (0.175)
<i>GOV</i>				0.003* (0.002)
<i>CASH</i>	4.015*** (0.683)	4.007*** (0.684)	4.018*** (0.676)	4.146*** (0.692)
<i>LEV</i>	0.824*** (0.270)	0.772*** (0.270)	0.807*** (0.268)	0.750*** (0.280)
<i>R&D</i>	0.245*** (0.081)	0.239*** (0.081)	0.251*** (0.081)	0.310*** (0.082)
<i>SIZE</i>	−0.071** (0.033)	−0.055* (0.032)	−0.064* (0.033)	−0.033 (0.032)
<i>DIV</i>	0.152 (0.096)	0.117 (0.094)	0.162* (0.097)	0.197** (0.098)
<i>BSIZE</i>	−0.010 (0.013)	−0.008 (0.013)	−0.012 (0.013)	0.001 (0.013)
<i>BIND</i>	−0.001 (0.002)	0.001 (0.002)	0.000 (0.002)	−0.000 (0.002)
<i>GENDER</i>	0.003 (0.003)	0.005 (0.003)	0.004 (0.003)	0.004 (0.004)
<i>DUALITY</i>	0.029 (0.109)	0.023 (0.108)	0.057 (0.110)	0.081 (0.101)
<i>TENURE</i>	0.017 (0.012)	0.018 (0.012)	0.020* (0.012)	0.019* (0.011)
Constant	1.048 (0.816)	1.950*** (0.729)	0.551 (0.769)	1.085 (0.983)

(Continues)

TABLE 6 | (Continued)

	(1)	(2)	(3)	(4)
Year fixed	Yes	Yes	Yes	Yes
Industry fixed	Yes	Yes	Yes	Yes
Country fixed	Yes	Yes	Yes	Yes
R^2	0.337	0.335	0.337	0.332
N	1315	1315	1315	1278

Note: This table presents the regression results for the relationship between ESG relevance (*ESG_RS*), its subcategories (*ENV_RS*, *SOC_RS* and *GOV_RS*) and firms' market performance. The dependent variable is *TOBIN's Q* in all regressions. Firm-level clustered standard errors are reported in parentheses. Definitions of the variables are provided in Table 3. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

market performance, as none of the estimated coefficients are statistically significant (Columns 3 and 4). In contrast, social and governance performance scores are positively and significantly associated with firm market performance.

We present the results for accounting performance (i.e., *ROA*) in Table 7. Consistent with the results reported in Table 6, *ENV_RS* has a significant negative association with *ROA*. Furthermore, *ESG_RS*, *SOC_RS* and *GOV_RS* are not significantly associated with accounting performance. The results for ESG performance scores are similar to those reported for *TOBIN's Q*. Both aggregate ESG performance (*ESG*) and the environmental and social performance scores (*ENV* and *SOC*) are positively and significantly associated with firm performance. In contrast, we do not find a significant relationship between the governance performance score (*GOV*) and *ROA*.

Overall, our results provide partial support for [H1](#), as the evidence is concentrated in environmental relevance. Moreover, they provide several important insights into how ESG relevance and ESG performance are associated with firms' financial performance. First, consistent with prior studies, firms engaging more in proenvironmental and social activities exhibit higher stock market valuations than firms with lower ESG engagement. Moreover, the subcategories of ESG performance are generally positively associated with firm performance.

Second, and perhaps more importantly in the context of our contribution to the literature, environmental relevance is significantly associated with firm performance. This result is particularly valuable, as it contributes to the ongoing discussion in the literature on the relevance and materiality of ESG issues. It complements prior studies highlighting the importance of understanding which ESG issues are relevant to firms' financial outcomes (Khan et al. 2016; Serafeim and Yoon 2022a).

Third, our findings suggest that, in addition to climate and carbon risks documented in prior studies, environmental relevance may be an important consideration for market participants. Therefore, managers should be aware of the relevance of environmental issues to their firms and the extent to which these issues may be reflected in the valuations of market participants. In addition, disaggregating ESG relevance is

TABLE 7 | ESG relevance and accounting performance.

	(1)	(2)	(3)	(4)
<i>ESG_RS</i>	−1.577 (1.259)			
<i>ESG</i>	0.034** (0.016)			
<i>ENV_RS</i>		−1.659** (0.669)		
<i>ENV</i>		0.024** (0.011)		
<i>SOC_RS</i>			0.680 (0.861)	
<i>SOC</i>			0.026* (0.014)	
<i>GOV_RS</i>				−2.135 (1.469)
<i>GOV</i>				0.004 (0.012)
<i>CASH</i>	16.819*** (4.097)	16.656*** (4.150)	16.823*** (4.112)	16.931*** (4.147)
<i>LEV</i>	−3.589** (1.820)	−3.813** (1.778)	−3.700** (1.807)	−4.238** (1.845)
<i>R&D</i>	0.729 (0.524)	0.675 (0.522)	0.743 (0.524)	0.990** (0.525)
<i>SIZE</i>	0.049 (0.220)	0.074 (0.207)	0.027 (0.218)	0.166 (0.216)
<i>DIV</i>	3.474*** (0.646)	3.315*** (0.640)	3.556*** (0.658)	3.710*** (0.670)
<i>BSIZE</i>	−0.247*** (0.090)	−0.239*** (0.091)	−0.258*** (0.092)	−0.230** (0.092)
<i>BIND</i>	−0.009 (0.015)	−0.003 (0.016)	−0.002 (0.016)	−0.008 (0.016)
<i>GENDER</i>	−0.015 (0.023)	−0.008 (0.023)	−0.011 (0.023)	−0.008 (0.025)
<i>DUALITY</i>	0.832 (0.934)	0.797 (0.928)	0.937 (0.937)	0.877 (0.957)
<i>TENURE</i>	0.151** (0.073)	0.157** (0.073)	0.164** (0.072)	0.167** (0.072)
Constant	6.988 (6.146)	6.426 (5.077)	−0.846 (5.132)	8.518 (7.167)

(Continues)

TABLE 7 | (Continued)

	(1)	(2)	(3)	(4)
Year fixed	Yes	Yes	Yes	Yes
Industry fixed	Yes	Yes	Yes	Yes
Country fixed	Yes	Yes	Yes	Yes
R^2	0.284	0.286	0.282	0.288
N	1315	1315	1315	1278

Note: This table presents the regression results for the relationship between ESG relevance (ESG_RS), its subcategories (ENV_RS , SOC_RS and GOV_RS) and firms' accounting performance. The dependent variable is ROA in all regressions. Firm-level clustered standard errors are reported in parentheses. Definitions of the variables are provided in Table 3. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

important for shedding light on the value relevance of each ESG dimension. While the subcategories of aggregate ESG performance are generally significantly associated with firm performance, only environmental relevance is significantly associated with market-based firm performance among the ESG relevance dimensions.

4.3 | Interaction Between ESG Relevance and ESG Performance

The extant literature suggests that ESG-related issues, such as climate risk and carbon risk, significantly interact with ESG performance in their associations with firm performance (Alessi et al. 2021; Huynh and Xia 2021; Ozkan et al. 2023). While our main regression results show a direct association between environmental relevance and firms' market and accounting performance, environmental relevance may also be associated with firm performance through its interaction with ESG performance.

In Table 8, we present the results of the interaction analysis for $TOBIN$'s Q (Panel A) and ROA (Panel B). Results for the control variables are not reported for brevity. For market-based performance, we find a significant interaction between ESG performance and ESG relevance in relation to $TOBIN$'s Q . The negative coefficient of $ESG_RS \times ESG$ in Column 1 suggests that ESG relevance weakens the positive association between ESG performance and firm market performance. This indicates that although ESG_RS is not directly associated with firm performance, it has a moderating role in the relationship between ESG performance and firm market performance. Similarly, we find a negative coefficient for $ENV_RS \times ENV$ in Column 2. This result suggests that environmental relevance weakens the positive association between environmental performance (ENV) and $TOBIN$'s Q . These findings are particularly important for two reasons. First, they provide evidence of both a direct association between environmental relevance and market-based firm performance and a moderating role of environmental relevance in the relationship between environmental performance and market-based firm performance. Second, they complement the findings of prior literature regarding the joint roles for environmental risks and environmental performance (Alessi et al. 2021; Huynh and Xia 2021; Ozkan et al. 2023). Therefore, environmental performance should be considered in conjunction with the relevance of environmental issues to better understand how ESG issues are associated with firms' financial outcomes.

Regarding social and governance relevance, we do not find any significant moderating roles for SOC_RS (Column 3) or GOV_RS (Column 4) in relation to firm market performance.

Finally, we do not find any significant interaction effects for ROA , our accounting performance measure (Panel B), unlike those reported for $TOBIN$'s Q . One plausible reason for this finding may be that ESG relevance is a forward-looking ESG measure of firms' financial sensitivity to ESG-related issues, which may be reflected in firms' accounting performance over a longer period than in market performance. While market participants may respond more promptly to information about ESG relevance, the financial consequences of ESG-related issues may not be reflected in accounting performance in the short term. These results provide partial support for H2, with the moderating effect primarily evident in the relationship between environmental performance and market-based firm performance.

4.4 | Endogeneity

We employ several robustness checks to address potential endogeneity concerns. While we control for several financial and governance variables in addition to year, industry and country fixed effects, our results might still be affected by omitted variables. One potential concern is that credit ratings may be associated with both ESG relevance scores and firm performance. To address this concern, we include credit rating ($RATING$) in our analysis as an additional control variable. In our setting, higher values of $RATING$ indicate higher credit ratings. The results, presented in Table 9, are consistent with our main findings.

To mitigate potential endogeneity arising from omitted variables, we employ an IV approach using two-stage least squares (2SLS) following Wooldridge (2016) and recent empirical studies (Awaysheh et al. 2020; Becchetti et al. 2022; Deng et al. 2013). This 2SLS approach also helps mitigate potential simultaneity bias in the estimated relationship (Gujarati 2015). Following Ozkan et al. (2023), we instrument ENV_RS with the country-level clustered industry-average environmental relevance ($INDENV_RS$) in the first stage. Instrument relevance and identification are assessed using the Kleibergen–Paap rk LM (KP LM) underidentification test and Kleibergen–Paap rk Wald F -statistic (KP WF) weak identification test. We present

TABLE 8 | Interaction of ESG relevance and ESG performance.

	(1) Aggregate ESG	(2) Environment	(3) Social	(4) Governance
Panel A. Dependent variable is <i>TOBIN's Q</i>				
ESG	0.065** (0.033)	0.025** (0.009)	−0.013 (0.015)	0.026 (0.032)
Relevance	0.901 (0.561)	0.091 (0.157)	−0.210 (0.280)	0.298 (0.621)
Relevance × ESG	−0.014* (0.008)	−0.006** (0.003)	0.006 (0.004)	−0.006 (0.008)
Controls	Yes	Yes	Yes	Yes
Year fixed	Yes	Yes	Yes	Yes
Industry fixed	Yes	Yes	Yes	Yes
Country fixed	Yes	Yes	Yes	Yes
R^2	0.340	0.338	0.338	0.333
N	1315	1315	1315	1278
Panel B. Dependent variable is <i>ROA</i>				
ESG	−0.305 (0.293)	−0.036 (0.074)	−0.131 (0.119)	−0.207 (0.236)
Relevance	−6.769 (5.221)	−2.626* (1.498)	−2.509 (2.423)	−5.508 (4.849)
Relevance × ESG	0.087 (0.076)	0.018 (0.023)	0.046 (0.035)	0.055 (0.061)
Controls	Yes	Yes	Yes	Yes
Year fixed	Yes	Yes	Yes	Yes
Industry fixed	Yes	Yes	Yes	Yes
Country fixed	Yes	Yes	Yes	Yes
R^2	1315	1315	1315	1278
N	0.287	0.287	0.283	0.290

Note: This table presents the interaction effects between aggregate ESG relevance, aggregate ESG performance, their subcategories and firms' market and accounting performance. All regressions include control variables and year, industry and country fixed effects. Relevance indicates aggregate ESG relevance score (*ESG_RS*) in Column 1, environmental relevance score (*ENV_RS*) in Column 2, social relevance score (*SOC_RS*) in Column 3 and governance relevance score (*GOV_RS*) in Column 4. ESG indicates aggregate ESG performance score in Column 1, environmental performance score (*ENV*) in Column 2, social performance score (*SOC*) in Column 3 and governance performance score (*GOV*) in Column 4. Firm-level clustered standard errors are reported in parentheses. Definitions of the variables are provided in Table 3. ** and * denote significance at the 5% and 10% levels, respectively.

the test results in Table 10. The underidentification test (KP LM = 59.526) strongly rejects the null hypothesis of underidentification. In addition, the KP WF statistic (137.323) indicates that the instrument *INDENV_RS* is not weak, alleviating concerns about weak identification in our IV estimations.

In the second stage of the analysis, we use the predicted values of environmental relevance (*PREDENV_RS*). It is reasonable to expect a positive relationship between firm-level *ENV_RS* and *INDENV_RS* due to peer effects, which supports the relevance requirement of the IV analysis. We assume that industry-average environmental relevance does not directly affect firm performance other than through firm-level environmental relevance, consistent with the exclusion restriction of 2SLS IV

approach. We present the IV regression results in Table 10. In Column 1, we show the first stage regression results. The coefficient of *INDENV_RS* is positive and significant, which provides further support for the relevance criterion. The negative coefficient of *PREDENV_RS* in Columns 2 and 4 indicates that predicted environmental relevance is significantly and negatively associated with both *TOBIN's Q* and *ROA*, which is consistent with our main results. The interaction between *PREDENV_RS* and *ENV* is also significantly negative in Column 3, providing further evidence that environmental relevance weakens the positive association between environmental performance and market performance. Similar to our main results, environmental relevance does not have a significant moderating role in relation to accounting performance (Column 5).

TABLE 9 | Controlling for credit rating.

	(1) <i>TOBIN's Q</i>	(2) <i>TOBIN's Q</i>	(3) <i>ROA</i>	(4) <i>ROA</i>
<i>ENV_RS</i>	−0.167* (0.095)	0.042 (0.150)	−1.259* (0.671)	−1.521 (1.310)
<i>ENV</i>	0.005*** (0.002)	0.018** (0.008)	0.007 (0.011)	−0.009 (0.064)
<i>ENV_RS</i> × <i>ENV</i>		−0.004* (0.002)		0.005 (0.019)
<i>RATING</i>	0.094*** (0.013)	0.093*** (0.013)	0.564*** (0.093)	0.565*** (0.094)
Controls	Yes	Yes	Yes	Yes
Year fixed	Yes	Yes	Yes	Yes
Industry fixed	Yes	Yes	Yes	Yes
Country fixed	Yes	Yes	Yes	Yes
<i>R</i> ²	0.399	0.401	0.331	0.331
<i>N</i>	1255	1255	1255	1255

Note: This table presents the regression results for the relationship between environmental relevance (*ENV_RS*), its interaction with *ENV* and firms' market and accounting performance, controlling for credit rating (*RATING*). The dependent variable is *TOBIN's Q* in Columns 1 and 2 and *ROA* in Columns 3 and 4. Firm-level clustered standard errors are reported in parentheses. Definitions of the variables are provided in Table 3. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

TABLE 10 | Instrumental variable regressions.

	(1) First stage	(2) <i>TOBIN's Q</i>	(3) <i>TOBIN's Q</i>	(4) <i>ROA</i>	(5) <i>ROA</i>
<i>INDENV_RS</i>	0.983*** (0.084)				
<i>PREDENV_RS</i>		−0.556*** (0.198)	0.066 (0.279)	−3.230*** (1.221)	−5.933** (2.682)
<i>ENV</i>		0.007*** (0.002)	0.041*** (0.014)	0.022** (0.011)	−0.128 (0.119)
<i>PREDENV_RS</i> × <i>ENV</i>			−0.011*** (0.004)		0.046 (0.036)
Controls	Yes	Yes	Yes	Yes	Yes
Year fixed	Yes	Yes	Yes	Yes	Yes
Industry fixed	Yes	Yes	Yes	Yes	Yes
Country fixed	Yes	Yes	Yes	Yes	Yes
<i>R</i> ²	0.502	0.338	0.342	0.285	0.287
KP LM	59.526***				
KP WF	137.323				
<i>N</i>	1315	1315	1315	1315	1315

Note: This table presents the instrumental variable regression results for the relationship between environmental relevance (*ENV_RS*), its interaction with *ENV* and firms' market and accounting performance. The dependent variable is *ENV_RS* in the first stage. We use *INDENV_RS* as an instrument for *ENV_RS* in the first stage regressions. *INDENV_RS* is the country-industry average of *ENV_RS*. The main variable of interest in the second stage regressions (Columns 2–5) is *PREDENV_RS*, which is the predicted *ENV_RS* from the first stage regression. The dependent variables are *TOBIN's Q* in Columns 2 and 3 and *ROA* in Columns 4 and 5. Definitions of the variables are provided in Table 3. *** and ** denote significance at the 1% and 5% levels, respectively.

TABLE 11 | Covariate balance test.

Variable	Treatment	Control	Difference <i>p</i>	Variance ratio
<i>ENV</i>	60.206	58.81	0.321	0.79
<i>CASH</i>	0.111	0.108	0.625	0.94
<i>LEV</i>	0.349	0.361	0.180	0.96
<i>RND</i>	0.430	0.452	0.452	n.a.
<i>SIZE</i>	17.626	17.437	0.127	0.83
<i>DIV</i>	0.806	0.833	0.232	n.a.
<i>BSIZE</i>	10.886	10.76	0.453	1.13
<i>BIND</i>	66.169	67.958	0.175	1.07
<i>GENDER</i>	22.816	23.554	0.333	1.09
<i>DUALITY</i>	0.821	0.848	0.216	n.a.
<i>TENURE</i>	6.875	7.290	0.040	0.91
<i>RATING</i>	16.538	16.829	0.164	0.94

Note: This table presents the covariate balance test for our PSM analysis. The difference *p* value shows the *p* value of *t*-test for the differences in each variable between the treatment and control groups. The variance ratio is the ratio of variances of the variable between the treatment and control groups. Definitions of the variables are provided in Table 3.

TABLE 12 | Univariate PSM analysis.

Outcome	Treatment	Control	Difference	<i>t</i> value
<i>TOBIN's Q</i>	1.554	1.696	−0.143	−2.47***
<i>ROA</i>	4.294	5.667	−1.372	−3.46***

Note: This table presents the univariate PSM analysis. The treatment (control) group refers to firms with a higher (lower) *ENV_RS* score. Difference indicates the difference in the outcome variables between the two groups. Definitions of the variables are provided in Table 3. *** denote significance at the 1% level.

TABLE 13 | Matched sample regressions.

	(1) <i>TOBIN's Q</i>	(2) <i>TOBIN's Q</i>	(3) <i>ROA</i>	(4) <i>ROA</i>
<i>ENV_RS</i>	−0.256*** (0.098)	0.001 (0.152)	−1.703** (0.698)	−1.806 (1.406)
<i>ENV</i>	0.007*** (0.002)	0.024*** (0.009)	0.026** (0.012)	0.020 (0.070)
<i>ENV_RS</i> × <i>ENV</i>		−0.005* (0.003)		0.002 (0.021)
Controls	Yes	Yes	Yes	Yes
Year fixed	Yes	Yes	Yes	Yes
Industry fixed	Yes	Yes	Yes	Yes
Country fixed	Yes	Yes	Yes	Yes
<i>R</i> ²	0.335	0.337	0.281	0.281
<i>N</i>	1208	1208	1208	1208

Note: This table presents the regression results for the relationship between environmental relevance (*ENV_RS*), its interaction with *ENV* and firms' market and accounting performance for the matched sample. The dependent variable is *TOBIN's Q* in Columns 1 and 2 and *ROA* in Columns 3 and 4. Firm-level clustered standard errors are reported in parentheses. Definitions of the variables are provided in Table 3. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

Our final endogeneity analysis addresses potential selection bias. Selection bias may arise when firms with high and low ESG relevance scores have different characteristics, which may bias the estimated results. To address this concern, we employ PSM analysis, following Ghoul et al. (2017) and Buchanan et al. (2018).

PSM reduces the dimensionality of the matching problem by summarising multiple characteristics into a single propensity score. As a result, firms with different characteristics may receive similar propensity scores, substantially simplifying the matching procedure (Abadie and Imbens 2016). Observations outside the region of common support are excluded from the matched sample and therefore do not contribute to the estimation of the treatment effect (Dehejia and Wahba 2002). The PSM analysis, therefore, enables a cleaner comparison of firm performance between the two groups (i.e., high vs. low ESG relevance

scores) with similar observable characteristics. Specifically, we create two groups, the treatment group (higher relevance scores) and the control group (lower relevance scores) and compare their performance in both univariate and multivariate settings. We use the median value of *ESG_RS* to define the treatment and control groups. We match firms in each group using a nearest neighbourhood algorithm with one-to-one matching, without replacement and with common support. We use all previously used control variables, including ESG performance scores and credit ratings, to estimate the propensity scores. We find matches for 604 firms.

In Table 11, we present the results of the covariate balance tests, which indicate that firms in the treatment and control groups share similar observable characteristics. In addition, the variance ratio of each continuous variable is close to 1, further indicating good balance between the two groups.

TABLE 14 | US versus non-US samples.

	<i>TOBIN's Q</i>	<i>TOBIN's Q</i>	<i>ROA</i>	<i>ROA</i>
Panel A: US firms				
<i>ENV_RS</i>	−0.080 (0.143)	0.029 (0.233)	−1.561 (1.051)	−3.220 (1.971)
<i>ENV</i>	0.014*** (0.004)	0.021 (0.016)	0.043** (0.020)	−0.072 (0.121)
<i>ENV_RS</i> × <i>ENV</i>		−0.002 (0.005)		0.035 (0.037)
Control	Yes	Yes	Yes	Yes
Year fixed	Yes	Yes	Yes	Yes
Industry fixed	Yes	Yes	Yes	Yes
<i>R</i> ²	0.331	0.331	0.264	0.265
<i>N</i>	498	498	498	498
Panel B: Non-US firms				
<i>ENV_RS</i>	−0.210** (0.106)	0.050 (0.229)	−1.779** (0.884)	−2.125 (2.098)
<i>ENV</i>	−0.000 (0.002)	0.015 (0.011)	0.014 (0.013)	−0.006 (0.095)
<i>ENV_RS</i> × <i>ENV</i>		−0.005 (0.003)		0.006 (0.028)
Control	Yes	Yes	Yes	Yes
Year fixed	Yes	Yes	Yes	Yes
Industry fixed	Yes	Yes	Yes	Yes
Country fixed	Yes	Yes	Yes	Yes
<i>R</i> ²	0.256	0.257	0.234	0.235
<i>N</i>	817	817	817	817

Note: This table presents the regression results examining the relationship between environmental relevance (*ENV_RS*), its interaction with environmental performance (*ENV*) and firms' market and accounting performance for the US (Panel A) and non-US (Panel B) samples. Firm-level clustered standard errors are reported in parentheses. Definitions of the variables are provided in Table 3. *** and ** denote significance at the 1% and 5% levels, respectively.

Table 12 presents the results of the univariate PSM analysis for *ENV_RS*. The results indicate significant differences in *TOBIN's Q* and *ROA* between the treatment and control groups. Specifically, the mean values of both *TOBIN's Q* and *ROA* are lower in the treatment group, which includes firms with higher environmental relevance, consistent with our earlier results.

In Table 13, we present the regression results for *ENV_RS* using the PSM-matched sample. Our results are qualitatively similar to those from the full-sample estimations, providing further support for our earlier finding that *ENV_RS* is significantly and negatively associated with firm performance.

4.5 | Additional Analysis

In this section, we present additional analyses to provide deeper insights into our baseline findings through subsample analyses.

4.5.1 | US vs. Non-US Firms

Given that the US firms constitute the largest proportion of our sample, we divide the full sample into US and non-US firms and re-examine the association between environmental relevance and firm performance.

Table 14 reports a comparative analysis of the estimated associations of environmental relevance with Tobin's *Q* and *ROA* for US and non-US firms. The results suggest that environmental relevance is significantly associated with firm performance among non-US firms, while environmental performance is significantly related to firm performance among US firms. Although these subsample patterns do not establish statistically differences between US and non-US firms, one possible interpretation is that US firms might prioritise visible environmental initiatives as a strategic mechanism to enhance firm valuation, while the financial implications of environmental relevance may be less directly

TABLE 15 | The role of governance quality.

	<i>TOBIN's Q</i>	<i>TOBIN's Q</i>	<i>ROA</i>	<i>ROA</i>
Panel A: High governance quality				
<i>ENV_RS</i>	−0.325** (0.129)	−0.324 (0.285)	−1.425 (0.868)	−2.105 (2.644)
<i>ENV</i>	0.006** (0.003)	0.006 (0.016)	0.023 (0.018)	−0.012 (0.126)
<i>ENV_RS</i> × <i>ENV</i>		−0.000 (0.004)		0.011 (0.037)
Year fixed	Yes	Yes	Yes	Yes
Industry fixed	Yes	Yes	Yes	Yes
Country fixed	Yes	Yes	Yes	Yes
<i>R</i> ²	0.429	0.429	0.334	0.334
<i>N</i>	676	676	676	676
Panel B: Low governance quality				
<i>ENV_RS</i>	−0.109 (0.143)	0.142 (0.198)	−2.075** (0.989)	−3.067* (1.823)
<i>ENV</i>	0.008*** (0.002)	0.027** (0.011)	0.033** (0.016)	−0.043 (0.108)
<i>ENV_RS</i> × <i>ENV</i>		−0.006* (0.003)		0.023 (0.033)
Year fixed	Yes	Yes	Yes	Yes
Industry fixed	Yes	Yes	Yes	Yes
Country fixed	Yes	Yes	Yes	Yes
<i>R</i> ²	0.313	0.317	0.278	0.279
<i>N</i>	639	639	637	637

Note: This table presents the regression results examining the relationship between environmental relevance (*ENV_RS*), its interaction with environmental performance (*ENV*) and firms' market and accounting performance with high governance quality (Panel A) and low governance quality (Panel B). Firm-level clustered standard errors are reported in parentheses. Definitions of the variables are provided in Table 3. ***, ** and * denote significance level at the 1%, 5% and 10% levels, respectively.

TABLE 16 | Disaggregation of environmental relevance.

	<i>TOBIN's Q</i>	<i>TOBIN's Q</i>	<i>ROA</i>	<i>ROA</i>
Panel A: GHG emissions and air quality (<i>GHG_RS</i>)				
<i>GHG_RS</i>	−0.151*** (0.050)	0.047 (0.087)	−1.151*** (0.329)	−1.862** (0.769)
<i>ENV</i>	0.006*** (0.002)	0.013*** (0.003)	0.021* (0.011)	−0.004 (0.024)
<i>GHG_RS</i> × <i>ENV</i>		−0.003*** (0.001)		0.012 (0.010)
<i>R</i> ²	0.339	0.344	0.290	0.291
<i>N</i>	1315	1315	1315	1315
Panel B: Energy management (<i>ENERGY_RS</i>)				
<i>ENERGY_RS</i>	0.166* (0.089)	−0.006 (0.114)	−0.611 (0.517)	−3.607*** (0.918)
<i>ENV</i>	0.006*** (0.002)	−0.000 (0.004)	0.021* (0.011)	−0.095*** (0.029)
<i>ENERGY_RS</i> × <i>ENV</i>		0.003* (0.002)		0.052*** (0.013)
<i>R</i> ²	0.337	0.340	0.282	0.299
<i>N</i>	1314	1314	1314	1314
Panel C: Water and wastewater management (<i>WATER_RS</i>)				
<i>WATER_RS</i>	−0.066 (0.063)	0.005 (0.112)	−0.400 (0.372)	−0.959 (0.856)
<i>ENV</i>	0.006*** (0.002)	0.009** (0.004)	0.022* (0.011)	0.004 (0.026)
<i>WATER_RS</i> × <i>ENV</i>		−0.001 (0.002)		0.010 (0.012)
<i>R</i> ²	0.332	0.332	0.281	0.282
<i>N</i>	1314	1314	1314	1314
Panel D: Waste and hazardous materials management (<i>WASTE_RS</i>)				
<i>WASTE_RS</i>	−0.138 (0.087)	0.045 (0.102)	0.156 (0.477)	1.544* (0.839)
<i>ENV</i>	0.007*** (0.002)	0.015*** (0.005)	0.020* (0.011)	0.086** (0.034)
<i>WASTE_RS</i> × <i>ENV</i>		−0.003* (0.002)		−0.025** (0.013)
<i>R</i> ²	0.336	0.339	0.280	0.284
<i>N</i>	1314	1314	1314	1314
Panel E: Exposure to environmental impacts (<i>EXPOSURE_RS</i>)				

(Continues)

TABLE 16 | (Continued)

	<i>TOBIN's Q</i>	<i>TOBIN's Q</i>	<i>ROA</i>	<i>ROA</i>
<i>EXPOSURE_RS</i>	−0.107 (0.075)	0.073 (0.105)	−0.090 (0.420)	0.014 (0.828)
<i>ENV</i>	0.007*** (0.002)	0.014*** (0.005)	0.021* (0.011)	0.025 (0.029)
<i>EXPOSURE_RS</i> × <i>ENV</i>		−0.003* (0.002)		−0.002 (0.012)
<i>R</i> ²	0.334	0.338	0.280	0.280
<i>N</i>	1315	1315	1315	1315
Year fixed	Yes	Yes	Yes	Yes
Industry fixed	Yes	Yes	Yes	Yes
Country fixed	Yes	Yes	Yes	Yes

Note: This table presents the regression results examining the relationship between environmental relevance categories, their interaction with environmental performance (*ENV*) and firms' market and accounting performance. Firm-level clustered standard errors are reported in parentheses. Definitions of the variables are provided in Table 3. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

reflected in firm performance. This interpretation is consistent with prior studies that show that US firms often invest in environmentally friendly initiatives to improve their reputation and strengthen stakeholder trust (Di Giuli and Kostovetsky 2014; Servaes and Tamayo 2013).

In contrast, the results for non-US firms may reflect greater financial sensitivity to environmental issues, particularly in jurisdictions such as Europe, where firms operate under more stringent regulatory regimes and proactive climate policies. Notably, the European Union Emissions Trading System, which operates through a carbon allowance mechanism, has served as a central policy instrument encouraging firms to internalise environmental costs within their operational and investment decisions (Ellerman et al. 2010; Oestreich and Tsiakas 2015). Consequently, such institutional and regulatory conditions may increase the financial implications of environmental issues for firms.

4.5.2 | The Role of Governance Quality

Prior literature highlights the key role of corporate governance in shaping firms' exposure to and management of ESG-related issues (Albuquerque et al. 2019; Borghesi et al. 2014; Ferrell et al. 2016). To further examine whether the relationship between environmental relevance and firm performance varies with firm-level quality, we divide the sample into firms with high and low governance quality, using the sample mean of the LSEG Governance Score as the cut-off point.

The results are reported in Table 15. For firms with high governance quality, environmental relevance remains significantly and negatively associated with Tobin's *Q*, consistent with our baseline finding that greater financial sensitivity to environmental issues associated with lower market valuations. For firms with low governance quality, environmental relevance

is directly and negatively associated with *ROA* and, moreover, weakens the positive association of environmental performance with Tobin's *Q*, suggesting a weaker valuation benefit from environmental performance. These findings are broadly consistent with our main results, although the patterns vary across performance measures and governance groups. As an exploratory analysis, the results suggest that the relationship between environmental relevance and firm performance may vary with the quality of corporate governance. These findings, however, should be interpreted as suggestive rather than as evidence of statistically significant differences between the groups.

4.5.3 | Disaggregation of Environmental Relevance

Our baseline results show that environmental relevance is the only component of ESG relevance that has a consistent and statistically significant association with firm performance. To assess whether this central finding is concentrated in a specific component of environmental relevance, we replace the aggregate environmental relevance score with its five underlying categories published by Fitch Ratings. This disaggregated analysis allows us to identify whether the baseline result is concentrated in a particular environmental issue. We re-estimate our baseline models by replacing *ENV_RS*, separately with each environmental relevance category. The results are reported in Table 16.

The findings indicate that the relevance of greenhouse gas emissions has the strongest and most consistent negative association with firm performance. In contrast, the estimated associations of the other environmental relevance categories are generally weaker and largely statistically insignificant. This suggests that the negative association of environmental relevance with performance is not uniform across environmental issues and is primarily concentrated in the relevance

of greenhouse gas emissions. The result is economically intuitive, as greenhouse gas emissions are closely associated with regulatory pressures, transition requirements, operating costs and financing conditions. Firms whose credit profiles are more sensitive to emission-related issues may therefore face greater financial consequences. Overall, the analysis using disaggregated categories supports our main conclusion that environmental relevance is associated with firm performance, while identifying greenhouse gas emissions as the most important underlying dimension of this association.

4.5.4 | Alternative Performance Measures

Our main analysis employs Tobin's *Q* and *ROA* as market-based and accounting-based measures of firm performance. To examine whether the results are sensitive to the choice of performance measure, we re-estimate the models using earnings before interest and taxes (*EBIT*) and earnings before interest, taxes, depreciation and amortisation (*EBITDA*). Both measures are scaled by total assets. These measures provide alternative indicators of operating performance that are less affected by firms' financing structures,

TABLE 17 | Alternative measures of firm performance.

	(1) <i>EBIT</i>	(2) <i>EBIT</i>	(3) <i>EBITDA</i>	(4) <i>EBITDA</i>
<i>ENV_RS</i>	−2.300*** (0.865)	−8.070** (3.392)	−1.627* (0.921)	−6.129** (3.027)
<i>ENV</i>	0.044** (0.017)	−0.314* (0.174)	0.048*** (0.016)	−0.232 (0.152)
<i>ENV_RS</i> × <i>ENV</i>		0.109** (0.055)		0.085* (0.048)
Controls	Yes	Yes	Yes	Yes
Year fixed	Yes	Yes	Yes	Yes
Industry fixed	Yes	Yes	Yes	Yes
Country fixed	Yes	Yes	Yes	Yes
<i>R</i> ²	0.218	0.228	0.233	0.240
<i>N</i>	1313	1313	1309	1309

Note: This table presents the regression results examining the relationship between environmental relevance (*ENV_RS*), its interaction with *ENV* and operating profit measured by *EBIT* (Columns 1 and 2) and *EBITDA* (Columns 3 and 4). *EBIT* is the ratio of earnings before interest and tax to total assets. *EBITDA* is the ratio of earnings before interest, tax, depreciation and amortisation to total assets. Firm-level clustered standard errors are reported in parentheses. Definitions of the variables are provided in Table 3. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

TABLE 18 | Alternative model specification—Lagged covariates.

	(1) <i>TOBIN's Q</i>	(2) <i>TOBIN's Q</i>	(3) <i>ROA</i>	(4) <i>ROA</i>
<i>L.ENV_RS</i>	−0.148 (0.116)	0.258 (0.228)	−2.723*** (0.964)	−5.218** (2.265)
<i>L.ENV</i>	0.008*** (0.002)	0.033*** (0.012)	0.038** (0.016)	−0.115 (0.107)
<i>L.ENV_RS</i> × <i>L.ENV</i>		−0.008** (0.004)		0.046 (0.032)
Controls	Yes	Yes	Yes	Yes
Year fixed	Yes	Yes	Yes	Yes
Industry fixed	Yes	Yes	Yes	Yes
Country fixed	Yes	Yes	Yes	Yes
<i>R</i> ²	0.325	0.330	0.298	0.301
<i>N</i>	649	649	649	649

Note: This table presents the regression results examining the relationship between environmental relevance (*ENV_RS*), its interaction with environmental performance (*ENV*) and firms' market and accounting performance. All covariates are lagged by 1 year. Firm-level clustered standard errors are reported in parentheses. Definitions of the variables are provided in Table 3. *** and ** denote significance at the 1% and 5% levels, respectively.

taxation and, in the case of *EBITDA*, depreciation and amortisation expenses. The results are presented in Table 17.

The results broadly support our main findings. Environmental relevance remains negatively associated with firm operating performance, indicating that the negative association identified in the baseline analysis is not confined to *ROA* or Tobin's *Q*. Environmental performance also continues to exhibit a positive association with firm performance. The interaction results are less uniform across the alternative performance measures. While some specifications continue to indicate that environmental relevance weakens the positive association between environmental performance and firm performance, the interaction coefficients are not consistently significant across *EBIT* and *EBITDA*. These findings provide further support for the direct relationship between environmental relevance and firm performance, while suggesting that the moderating role should be interpreted more cautiously.

4.5.5 | Alternative Specifications

To examine whether our findings are sensitive to the timing of ESG relevance, we re-estimate the models using 1-year lagged ESG relevance measures. This specification also helps to mitigate concerns about potential reverse causality arising from the contemporaneous relationship between ESG relevance and firm performance. We report the results in Table 18.

The lagged results provide further, although not uniform, support for our main findings. Lagged environmental relevance remains negatively and significantly associated with *ROA*, indicating that the negative association of environmental relevance with firm performance may persist in subsequent periods. For Tobin's *Q*, the direct association is weaker, while the interaction between environmental relevance and environmental performance remains significant. This suggests that the moderating role of environmental relevance in the relationship between

TABLE 19 | The role of institutional factors—Regulatory quality.

	<i>TOBIN's Q</i>	<i>TOBIN's Q</i>	<i>ROA</i>	<i>ROA</i>
Panel A: High regulatory quality				
<i>ENV_RS</i>	−0.268** (0.128)	0.058 (0.216)	−0.543 (0.901)	−0.809 (2.030)
<i>ENV</i>	0.008*** (0.002)	0.027** (0.012)	0.026* (0.014)	0.010 (0.101)
<i>ENV_RS</i> × <i>ENV</i>		−0.006* (0.003)		0.005 (0.031)
Year fixed	Yes	Yes	Yes	Yes
Industry fixed	Yes	Yes	Yes	Yes
Country fixed	Yes	Yes	Yes	Yes
<i>R</i> ²	0.335	0.338	0.263	0.263
<i>N</i>	663	663	663	663
Panel B: Low regulatory quality				
<i>ENV_RS</i>	−0.140 (0.104)	0.100 (0.178)	−2.779*** (0.952)	−4.597** (1.891)
<i>ENV</i>	0.007*** (0.002)	0.022** (0.011)	0.024* (0.014)	−0.094 (0.096)
<i>ENV_RS</i> × <i>ENV</i>		−0.005 (0.003)		0.036 (0.029)
Year fixed	Yes	Yes	Yes	Yes
Industry fixed	Yes	Yes	Yes	Yes
Country fixed	Yes	Yes	Yes	Yes
<i>R</i> ²	0.351	0.354	0.357	0.359
<i>N</i>	652	652	652	652

Note: This table presents the regression results examining the relationship between environmental relevance (*ENV_RS*), its interaction with environmental performance (*ENV*) and firms' market and accounting performance in countries with high regulatory quality (Panel A) and low regulatory quality (Panel B). Firm-level clustered standard errors are reported in parentheses. Definitions of the variables are provided in Table 3. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

environmental performance and market performance persists with a lag. However, the results should be interpreted cautiously because introducing lagged variables substantially reduces the number of observations and may weaken statistical power. Overall, the lagged specifications provide partial support for the persistence of our main findings, although the strength of the associations differs across the market-based and accounting-based performance measures.

4.5.6 | The Role of Country Governance

The subsample analysis in Section 4.5.2 indicated that the relationship between environmental relevance and firm performance may vary with the firm-level of governance quality. However, governance is multidimensional, and the results may depend on the dimension of governance considered. To further assess the robustness of our analysis, we extend it by using three measures of

country-level governance quality, namely, regulatory quality, rule of law and voice and accountability. Regulatory quality captures the ability of governments to formulate and implement effective policies and regulations, while rule of law reflects the strength and enforcement of legal institutions. The voice and accountability dimension captures the extent of transparency, public participation and institutional scrutiny. Using the same mean-based splitting procedure employed in Section 4.5.2, we re-estimate the environmental relevance models separately for each subsample. We present the results in Tables 19–21.

Across the three country-level governance measures, the results suggest that institutional quality is associated with how environmental relevance is reflected in firm performance. In countries with higher governance quality, the negative association between environmental relevance and firm performance is more evident for Tobin's *Q*. In contrast, in countries with lower governance quality, the negative association is more apparent

TABLE 20 | The role of institutional factors—Rule of law.

	<i>TOBIN's Q</i>	<i>TOBIN's Q</i>	<i>ROA</i>	<i>ROA</i>
Panel A: High rule of law				
<i>ENV_RS</i>	−0.274** (0.120)	0.023 (0.215)	−0.986 (0.971)	−1.604 (2.342)
<i>ENV</i>	0.007*** (0.002)	0.024** (0.011)	0.023* (0.014)	−0.012 (0.107)
<i>ENV_RS</i> × <i>ENV</i>		−0.005 (0.003)		0.011 (0.033)
Year fixed	Yes	Yes	Yes	Yes
Industry fixed	Yes	Yes	Yes	Yes
Country fixed	Yes	Yes	Yes	Yes
<i>R</i> ²	0.339	0.342	0.261	0.261
<i>N</i>	696	696	696	696
Panel B: Low rule of law				
<i>ENV_RS</i>	−0.118 (0.107)	0.122 (0.181)	−2.345*** (0.885)	−4.267** (1.698)
<i>ENV</i>	0.007*** (0.002)	0.023* (0.012)	0.024* (0.014)	−0.103 (0.093)
<i>ENV_RS</i> × <i>ENV</i>		−0.005 (0.004)		0.039 (0.028)
Year fixed	Yes	Yes	Yes	Yes
Industry fixed	Yes	Yes	Yes	Yes
Country fixed	Yes	Yes	Yes	Yes
<i>R</i> ²	0.351	0.354	0.364	0.366
<i>N</i>	619	619	619	619

Note: This table presents the regression results examining the relationship between environmental relevance (*ENV_RS*), its interaction with environmental performance (*ENV*) and firms' market and accounting performance in countries with high rule of law (Panel A) and low rule of law (Panel B). Firm-level clustered standard errors are reported in parentheses. Definitions of the variables are provided in Table 3. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

TABLE 21 | The role of institutional factors—Voice and accountability.

	<i>TOBIN's Q</i>	<i>TOBIN's Q</i>	<i>ROA</i>	<i>ROA</i>
Panel A: High voice and accountability				
<i>ENV_RS</i>	−0.286*** (0.110)	−0.107 (0.226)	−1.871* (0.964)	−3.352 (2.585)
<i>ENV</i>	0.006*** (0.002)	0.016 (0.011)	0.025* (0.015)	−0.055 (0.114)
<i>ENV_RS</i> × <i>ENV</i>		−0.003 (0.003)		0.025 (0.035)
Year fixed	Yes	Yes	Yes	Yes
Industry fixed	Yes	Yes	Yes	Yes
Country fixed	Yes	Yes	Yes	Yes
<i>R</i> ²	0.364	0.365	0.287	0.289
<i>N</i>	664	664	664	664
Panel B: Low voice and accountability				
<i>ENV_RS</i>	−0.086 (0.118)	0.208 (0.174)	−1.462* (0.807)	−3.009** (1.467)
<i>ENV</i>	0.007*** (0.002)	0.028** (0.013)	0.022 (0.015)	−0.088 (0.095)
<i>ENV_RS</i> × <i>ENV</i>		−0.006 (0.004)		0.033 (0.029)
Year fixed	Yes	Yes	Yes	Yes
Industry fixed	Yes	Yes	Yes	Yes
Country fixed	Yes	Yes	Yes	Yes
<i>R</i> ²	0.331	0.334	0.315	0.317
<i>N</i>	651	651	651	651

Note: This table presents the regression results examining the relationship between environmental relevance (*ENV_RS*) and its interaction with environmental performance (*ENV*) and firms' market and accounting performance in countries with high voice and accountability (Panel A) and low voice and accountability (Panel B). Firm-level clustered standard errors are reported in parentheses. Definitions of the variables are provided in Table 3. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

for *ROA*. Therefore, the association of environmental relevance with firm performance does not appear to be uniformly stronger in one institutional setting. Rather, the findings suggest that the relationship between environmental relevance and firm performance may manifest differently across governance environments.

This pattern is consistent with stakeholder and signalling theories. Stronger regulatory institutions, legal enforcement and information environments may increase the visibility and credibility of ESG-related information, which may facilitate its incorporation into market valuations. In countries with weaker governance quality, ESG-related information may be incorporated into market prices less efficiently, while the operational and financial consequences of environmentally relevant issues may be reflected more directly in accounting performance. Overall, the broadly similar patterns obtained using regulatory quality, rule of law and voice and accountability suggest that the

governance-related findings are not specific to a single measure of institutional quality.

5 | Concluding Remarks

In this paper, we use Fitch Ratings' novel credit-focused, expert-based, forward-looking and value-neutral measure of ESG relevance to examine the relationship between ESG relevance and firm financial performance. We also investigate how ESG relevance moderates the relationship between ESG performance and firm financial performance. Our research is timely, as there is a rapidly expanding literature on the financial implications of ESG factors due to growing concerns about climate change and environmental issues globally. We contribute to this literature in several ways. While prior literature acknowledges the importance of the materiality of ESG issues for business performance, there is limited empirical

evidence on the relationship between ESG relevance and firm performance.

We find that environmental relevance is significantly and negatively associated with firm performance. Our findings show that firms with higher environmental relevance exhibit significantly lower market-based and accounting-based performance. In contrast, we do not find a significant association between aggregate ESG relevance or the social and governance components of ESG relevance and firm performance. The results also show that environmental relevance has a moderating role, weakening the positive association of firms' environmental performance with their market performance. Further analysis indicates that the negative relationship is primarily concentrated in the relevance of greenhouse gas emissions. The direct relationship remains broadly supported when we use alternative measures of firm performance and 1-year lagged ESG relevance scores. The country-level governance analyses provide suggestive evidence that the association between environmental relevance and firm performance is more evident in market-based performance in well-governed countries and in accounting performance in weakly governed countries. Overall, our findings are robust to additional analyses, including IV regressions, PSM, alternative performance measures and lagged specifications. The findings also provide partial support for H1 and H2. While environmental relevance is associated with firm performance, evidence for aggregate ESG, social and governance relevance is less consistent. Similarly, the moderating role of environmental relevance is more pronounced for market-based than for accounting-based performance measures.

Our findings have important implications for businesses, investors, policymakers and the public. First, firms should be aware of the relevance of environmental issues to their financial outcomes and how such relevance may be reflected in their credit ratings. In other words, managers need to understand ESG relevance and take appropriate actions to manage their financial sensitivity to ESG-related issues effectively. Managers are also encouraged to manage the financial risks associated with ESG-relevant issues, particularly those that may directly affect firms' creditworthiness. Recent frameworks emphasise that ESG issues should be assessed in a forward-looking manner and integrated into firms' risk management and strategic planning (TCFD 2017). Therefore, it may be equally important for managers to adopt a holistic approach to ESG issues by considering both their ESG performance and the relevance of ESG issues. Due to growing public attention to ESG issues, firms' survival and performance may be influenced by how managers consider ESG factors in their long-term strategies as well as day-to-day operations (OECD 2020). Our findings show that environmental relevance has the strongest negative association with firm performance, while also weakening the positive association between environmental performance and firm performance. Accordingly, firms are encouraged to consider their financial sensitivity to environmentally relevant issues as part of their financial risk assessment.

Second, our results suggest that ESG relevance, particularly environmental relevance, may be an important consideration for investors when making investment decisions, alongside climate and carbon risks. The negative association between environmental relevance and market valuation suggests that investors may place lower valuations on firms whose financial

outcomes are more sensitive to environmental issues. ESG relevance information may become increasingly important to investors as more data become available to stock market participants through mandatory disclosure regimes (European Commission 2021).

Third, policymakers may consider measures that encourage firms to identify, disclose and manage their financial sensitivity to ESG-related issues. While there are significant incentives for firms to engage in proenvironmental strategies, which may contribute positively to their performance, ESG relevance should also be included in policymakers' agendas as an important consideration in assessing firms' financial sensitivity to ESG-related issues. In this regard, our findings may inform sustainable disclosure requirements being introduced or strengthened in the European Union, the United States, the United Kingdom and elsewhere. Finally, the public can also benefit from increased transparency regarding ESG relevance. Greater access to ESG relevance information may enable stakeholders to make more informed decisions and hold firms accountable for how they manage ESG-related issues and the associated implications for long-term financial stability and sustainability (OECD 2020).

It is important to acknowledge the potential limitations of our work. The ESG relevance score is a novel indicator. Since its initial release in 2019, Fitch Ratings has progressively expanded its coverage across firms and credit ratings. Nevertheless, despite these efforts, the availability of ESG relevance data remains limited, both in terms of firm coverage and time-series depth. Consequently, a key limitation of this study is the relatively short sample period compared with those available for legacy ESG performance measures. This constraint may limit our ability to capture longer term dynamics in firms' financial sensitivity to ESG-related issues and the associated financial implications.

Future research could re-examine our findings using alternative ESG relevance measures to assess the robustness and generalisability of the results across different ESG data providers (e.g., Berg et al. 2022). Moreover, prior literature suggests that firm-specific cultural factors play an important role in shaping corporate behaviour and risk-taking (e.g., Guiso et al. 2015). As such, further studies could extend our analysis by incorporating measures of corporate culture to better understand how organisational values influence firms' responses to financially relevant ESG issues. Finally, while firm performance is a central dimension of financial outcomes, it represents only one aspect of firms' overall financial health. Future research could therefore investigate the implications of ESG relevance for firms' financing decisions, including borrowing behaviour and access to capital. Examining the relationship between ESG relevance and the cost of debt, including loan spreads and bond yield spreads, would provide further insights into how ESG relevance is reflected in the assessments of creditors and capital markets.

Author Contributions

Alper Kara: supervision, conceptualization, investigation, writing – original draft, writing – review and editing, resources. **Ngoc Sao Ly Nguyen:** conceptualization, investigation, methodology, formal analysis, data curation, writing – original draft. **Yilmaz Yildiz:**

conceptualization, investigation, methodology, data curation, formal analysis, supervision, writing – review and editing.

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Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data used in this paper are available upon request.

Endnotes

¹ See, for example, the European Union's 2023 Sustainable Finance Disclosures Regulation (SFDR) and the US Securities and Exchange Commission's (SEC's) ESG disclosure proposal for Investment Advisers available from <https://www.sec.gov/rules-regulations/2024/03/s7-10-22>.

² See Gillan et al. (2021) for an extensive review of ESG and CSR research in corporate finance.

³ Relatedly, rating divergence has been shown to influence green innovation outputs and is contingent on firm-level governance and external scrutiny (Zhou et al. 2024).

⁴ Fitch Ratings is a well-known credit-rating agency and financial data provider. In addition to conventional credit ratings, Fitch Ratings provides ESG Relevance Scores that assess how ESG issues influence individual credit-rating decisions, making its data particularly relevant for examining the financial relevance of ESG issues from a credit perspective.

⁵ ESG relevance scores were introduced in response to growing interest in ESG issues and the increasing integration of ESG issues into credit-rating decisions. Importantly, investors began to demand greater transparency and clarity regarding how ESG characteristics are reflected in credit ratings (Fitch Ratings 2020).

⁶ The report can be accessed via <https://www.spglobal.com/en/research-insights/articles/esg-industry-report-card-health-care>.

⁷ All regression analyses are conducted using Stata 18.

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Appendix A

Variance inflation factors (VIFs) are widely employed to diagnose multicollinearity. We conduct VIF test computed from Pooled OLS including all explanatory variables and fixed effects and present results in Table A1—VIF examination. All VIF values are below the conventional threshold of 10, suggesting that multicollinearity is very unlikely to affect our estimates.

TABLE A1 | Variance inflation factors (VIFs).

	VIF	1/VIF
<i>ENV_RS</i>	1.580	0.632
<i>ENV</i>	1.890	0.528
<i>CASH</i>	1.430	0.698
<i>LEV</i>	1.300	0.770
<i>RND</i>	1.700	0.590
<i>SIZE</i>	5.060	0.198
<i>DIV</i>	1.320	0.757
<i>BSIZE</i>	2.150	0.464
<i>BIND</i>	3.120	0.321
<i>GENDER</i>	2.510	0.399
<i>DUALITY</i>	2.530	0.395
<i>TENURE</i>	1.450	0.690

Note: This table presents the VIFs for the variables included in the baseline regression analysis. Definitions of the variables are provided in Table 3.