

Article

Environmental Disclosure Versus Environmental Performance: Implications for Corporate Financial Performance and Risk

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Abstract

Environmental considerations shape corporate strategy, risk management, and firm valuation. Yet, empirical evidence on the links between environmental performance, environmental disclosures and corporate financial performance is mixed and often omits risk implications. We develop a holistic framework to examine the endogenous interrelations among corporate environmental performance (CEP), environmental disclosure (CED), financial performance, and risk. Employing 3SLS, we analyse the simultaneous links between CEP, CED, and market-based measures of performance and risk for a large panel (7877 firm-year observations) of US-listed firms over 2005–2020. The findings reveal that environmental performance and environmental disclosure have distinct economic implications. Environmental performance is associated with lower market valuation and lower market risk. These findings suggest that while substantive environmental initiatives may enhance organisational resilience, investors are not appropriately factoring the associated benefits in firm valuation. In contrast, environmental disclosure is associated with higher market valuation and higher market risk. Thus, environmental communication may enhance corporate legitimacy and strengthen stakeholder relations while simultaneously increasing investor awareness of environmental exposures and sustainability-related uncertainties. We also find a strong positive association between environmental performance and environmental disclosure, suggesting that environmental reporting increasingly reflects underlying environmental actions rather than symbolic signalling alone. Overall, the results highlight the importance of distinguishing between environmental actions and environmental communication when evaluating corporate environmental strategy, firm value, and risk. Overall, the results carry implications for managers, investors, regulators, and researchers seeking to evaluate the role of corporate environmental strategy in corporate resilience, transparency, and value creation.



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1. Introduction

As concerns over climate change, environmental degradation, biodiversity loss, and resource scarcity intensify, corporate environmental responsibility has become a central issue

for firms, investors, regulators, and policymakers worldwide. Environmental considerations increasingly shape corporate strategy, investment decisions, regulatory frameworks (e.g., ISSB S1 and S2), and enterprise risk-management practices. Consequently, understanding how corporate environmental performance (CEP) and corporate environmental disclosure (CED) influence firm performance and risk has become an important research priority within the broader ESG and sustainable finance literature.

Existing research has examined the relationships among CEP, CED, and corporate financial performance (CFP) from multiple theoretical perspectives, producing mixed and often conflicting empirical findings. Studies grounded in the resource-based view (RBV) argue that superior environmental performance can enhance competitiveness, innovation, legitimacy, and firm value (Hart 1995; Russo and Fouts 1997). In contrast, agency-theoretic shareholder value perspectives suggest that environmental initiatives may impose costs that reduce profitability and shareholder wealth (Barnea and Rubin 2010; Friedman 1970). Similarly, research on environmental disclosure yields conflicting conclusions. While some studies drawing on the voluntary disclosure theory (VDT) suggest that environmental disclosure improves transparency, reduces information asymmetry, and strengthens stakeholder relationships (Clarkson et al. 2008; Clarkson et al. 2011; Qiu et al. 2016), others argue that disclosure may primarily serve symbolic legitimacy objectives rather than reflect substantive environmental performance (Cho and Patten 2007; Patten 2002).

Recent developments in the ESG and sustainable finance literature further highlight the complexity of these relationships. Emerging evidence suggests that the financial consequences of environmental actions and disclosures vary considerably across institutional settings, reporting regimes, and market conditions. Studies report inconsistent associations between ESG activities, disclosure practices, firm value, stock returns, and risk exposure (Escobar-Saldívar et al. 2026; Kaspard et al. 2026; Khandelwal et al. 2023). Similarly, recent evidence indicates that environmental disclosures may not always translate into superior market outcomes, particularly where disclosure credibility and comparability remain uncertain (Munir and Pratama 2025; Nassirzadeh et al. 2026). Collectively, this literature suggests that the economic implications of environmental performance and environmental disclosure remain far from settled.

Despite extensive research on the environmental–financial performance nexus, two important limitations remain. First, most studies examine only selected pair-wise relationships between environmental performance, environmental disclosure, financial performance, and risk. Relatively few studies simultaneously examine these variables while explicitly accounting for their endogenous inter-relations (e.g., Al-Tuwaijri et al. 2004; Clarkson et al. 2011). Second, and more importantly, corporate financial risk (CFR) has largely remained peripheral to environmental–financial accountability research despite being central to contemporary ESG debates. This omission is surprising given that environmental initiatives are increasingly justified not only as value-creation mechanisms but also as tools for managing operational, regulatory, reputational, and market risks (Benlemlih et al. 2018; Boutin-Dufresne and Savaria 2004; Hockerts 2015; Jo and Na 2012; Kaspard et al. 2026; McGuire et al. 1988; Oikonomou et al. 2012; Qiu et al. 2016; Sharfman and Fernando 2008; Spicer 1978). Accordingly, this study develops a holistic framework for simultaneously examining the inter-relations among corporate environmental performance, environmental disclosure, firm value, and firm risk.

The study makes three principal contributions. First, we explicitly distinguish between environmental performance and environmental disclosure, two concepts that are frequently conflated within the broader CSR and ESG literature (Hockerts 2015; Margolis and Walsh 2003; Orlitzky et al. 2003). This distinction is increasingly important because environmental actions and environmental communication may generate distinct stakeholder responses

and economic outcomes. Recent evidence suggests that investors increasingly differentiate between substantive environmental performance and disclosure-based ESG signals (Khandelwal et al. 2023; Munir and Pratama 2025; Nassirzadeh et al. 2026).

Second, we extend the environmental–financial accountability literature by explicitly incorporating risk into the analysis. While most prior studies focus on firm value (e.g., Al-Tuwaijri et al. 2004; Clarkson et al. 2011; Nassirzadeh et al. 2026), contemporary ESG debates increasingly emphasise resilience, volatility, downside protection, and exposure to transition-related uncertainty. Hence, by examining risk alongside firm value, the study provides a more complete assessment of the economic consequences of environmental strategies.

Third, we address endogeneity using a simultaneous equations framework. Environmental performance, disclosure, profitability, market valuation, and risk are likely to be jointly determined through complex feedback mechanisms. CEP and CED may influence how investors assess a firm's market value and risk exposure, while market valuation and risk may themselves shape firms' incentives to undertake environmental initiatives and communicate them to the market. For example, consistent with the RBV arguments (Hart 1995), more resilient firms (firms facing lower market uncertainty) may be strategically better positioned to strengthen their environmental performance. Alternatively, more highly valued firms may be incentivised to disclose their environmental activities as a signalling mechanism (Clarkson et al. 2008; Clarkson et al. 2011). Our empirical framework explicitly accounts for these simultaneous and potentially bi-directional relationships, allowing us to distinguish the market implications of substantive environmental performance from those of environmental communication.

We also extend prior empirical work by Al-Tuwaijri et al. (2004), Clarkson et al. (2008), and Clarkson et al. (2011). Unlike earlier studies that focus primarily on highly polluting sectors (e.g., Clarkson et al. 2011) or cross-sectional samples (e.g., Al-Tuwaijri et al. 2004), our analysis employs longitudinal sample and covers a broad array of industries over a number of years (2005–2020). We also capture environmental performance and disclosure using comprehensive measures widely employed in contemporary ESG research. Environmental performance is measured using LSEG Asset4 environmental performance scores (Ioannou and Serafeim 2015; Shaukat et al. 2016), while environmental disclosure is measured using Bloomberg environmental disclosure scores (Benlemlih et al. 2018; Qiu et al. 2016).

Our findings provide strong evidence that environmental performance, environmental disclosure, firm value, and risk are jointly determined. More importantly, the results reveal that environmental performance and environmental disclosure have distinct implications for firm value and risk management. Environmental performance is associated with lower market valuation and lower market risk. These findings suggest that investors view CEP commitments primarily as mechanisms for reducing environmental risks (incl. physical and transition-related risks) and providing organisational resilience. Yet, investors take a dim view of the expected payoffs of such actions and accordingly discount firm value, consistent with agency-theoretic arguments. We also find that both of these relations are self-reinforcing.

In contrast, environmental disclosure is associated with higher market valuation and higher market risk (with the former relation being self-reinforcing as well). Disclosure appears to enhance firm value, possibly due to improvements to corporate legitimacy and strengthened stakeholder relations. At the same time, extensive disclosure appears to draw investor attention to firm environmental exposures (e.g., regulatory and transition risks) and therefore increase firm-perceived riskiness. Finally, we find a strong positive association between environmental performance and environmental disclosure, suggesting

that environmental reporting increasingly reflects underlying environmental actions rather than symbolic signalling alone.

Overall, the study contributes to the growing ESG and business risk literature by demonstrating that environmental performance and environmental disclosure represent distinct dimensions of corporate environmental strategy with different implications for firm value and risk. The findings underscore the importance of jointly modelling environmental actions, environmental communication, financial performance, and risk within an integrated endogenous framework. They also carry important implications for managers, investors, regulators, and policymakers seeking to evaluate the role of ESG in corporate resilience, transparency, risk management, and value creation.

2. Literature Review and Hypothesis Development

2.1. Corporate Environmental Performance, Environmental Disclosure, Financial Performance, and Risk

The relationship between corporate environmental performance (CEP) and corporate financial performance (CFP) has attracted substantial scholarly attention across management, accounting, finance, and economics. Drawing on the resource-based view (RBV) and/or competitive strategy approach of the firm (Hart 1995; Porter and van der Linde 1995), scholars argue that superior environmental performance can constitute a strategic capability that enhances competitiveness through product, process or resource input efficiency and innovations. Investors may therefore reward firms with strong environmental performance through higher market valuations. There is also an alternative argument grounded in traditional agency theory-based (Jensen and Meckling 1976) shareholder value considerations, suggesting that environmental initiatives may impose costly constraints on firms and reduce financial competitiveness (Barnea and Rubin 2010; Bushee 1998; Friedman 1970). Environmental investments such as pollution-control systems, green resource choices, emissions reduction technologies, or sustainable supply-chain restructuring may involve substantial costs and uncertain payoffs. Consequently, financial markets may discount firms pursuing aggressive environmental strategies. Finally, both Al-Tuwaijri et al. (2004) and Clarkson et al. (2011) argue that environmental and financial performance may ultimately be jointly determined by unobservable firm characteristics such as superior managerial quality, organisational capabilities, or strategic orientation. Consequently, the relationship between CEP and financial performance may be characterised by reverse causality or simultaneity.

Consistent with these competing theoretical perspectives, empirical evidence on the relationship between CEP and market performance remains mixed. Some studies document a positive association between CEP and market valuation measures such as Tobin's Q (Al-Tuwaijri et al. 2004; Clarkson et al. 2011; Dowell et al. 2000), while others report negative associations (Barth and McNichols 1994; Brammer et al. 2006; Hughes 2000). Recent international evidence similarly documents heterogeneous and often negative relationships between ESG indicators and stock returns, with results varying across institutional settings, ESG dimensions, and firm characteristics (Escobar-Saldívar et al. 2026; Munir and Pratama 2025). Thus, whether capital markets perceive substantive environmental performance primarily as a value-enhancing strategic capability or as a costly commitment with uncertain payoffs remains theoretically and empirically unresolved.

As with CEP, environmental disclosure may also have important capital market consequences. There are, however, two dominant views on the determinants and consequences of voluntary disclosures such as those related to the environment. Proponents of voluntary disclosure theory (VDT) such as Clarkson et al. (2008) and Clarkson et al. (2011) argue and find that firms with superior environmental performance make higher environmental dis-

closures to reduce information asymmetry and signal their higher quality to investors, thus leading to higher market valuations. Proponents of legitimacy theory (Patten 2002; Cho and Patten 2007), on the other hand, argue and empirically show that poor environmental performers tend to make higher environmental disclosures as a means to legitimise their operations and improve their corporate image and reputation.

As regulations pertaining to environmental performance and related reporting has tightened over time through standards set by the Environmental Protection Agency (EPA) and the Sustainability Accounting Standards Board (SASB) in the US, it is likely that the link between CEP and CED has also strengthened over time. Regardless of the theoretical stance, producing high-quality corporate environmental disclosure (CED) requires substantial investments in reporting systems, environmental monitoring, governance structures, assurance processes, and stakeholder engagement activities (Brammer and Pavelin 2008; Cormier and Magnan 1999; Qiu et al. 2016). Thus, firms enjoying stronger financial positions, as reflected in their market values, may be better able to provide extensive and objective environmental disclosures. At the same time, environmental disclosure may itself influence firm value by reducing information asymmetry, strengthening legitimacy, enhancing stakeholder trust, and improving corporate reputation (Clarkson et al. 2011; Lev et al. 2010; Qiu et al. 2016). Hence, as with CEP, the relationship between CED and financial performance is also potentially endogenous.

Empirical research examining the relationship between environmental disclosure and market performance has thus far produced inconsistent findings. Earlier studies relying primarily on negative environmental disclosures often report adverse market reactions (Freedman and Patten 2004; Lorraine et al. 2004; Shane and Spicer 1983). In contrast, more recent studies using broader and more objective disclosure measures report positive valuation effects (Clarkson et al. 2011; Nassirzadeh et al. 2026). However, evidence continues to highlight substantial ambiguity in this relationship. For example, Khandelwal et al. (2023) report a negative ESG disclosure premium, suggesting that firms with higher disclosure may earn lower stock returns, potentially reflecting disclosure costs or risk-pricing effects. Environmental disclosures may therefore be viewed more cautiously if investors perceive them as symbolic, costly, or indicative of heightened environmental exposure. In line with these arguments, Munir and Pratama (2025) document that environmental disclosure does not have a significantly positive effect on firm value in emerging markets where disclosure comparability and credibility remain uneven.

The potentially different market implications of CEP and CED are particularly important. Environmental performance represents substantive corporate actions and outcomes, whereas environmental disclosure represents the communication of environmental information to market participants and other stakeholders. Investors may therefore respond differently to what firms 'do' environmentally and what they 'disclose' about those activities. Superior CEP may signal strategic capabilities, resource efficiency, regulatory preparedness, and long-term resilience, while extensive CED may reduce information asymmetry, enhance transparency and legitimacy. Conversely, environmental initiatives may involve costly investments with uncertain payoffs, while greater disclosure may reveal environmental liabilities, transition challenges, or other risk exposures that investors subsequently incorporate into firm valuation. These competing mechanisms reinforce the importance of treating CEP and CED as conceptually and empirically distinct dimensions of corporate environmental strategy.

Importantly, while Al-Tuwaijri et al. (2004) and Clarkson et al. (2011), argue that CEP, CED, and market performance are jointly determined, these studies omit consideration of market risk. This omission is surprising given longstanding theoretical arguments supported by empirical evidence, which show that corporate social responsibility may

function as an effective risk-management strategy often by creating ‘moral capital’ with stakeholders (Chen and Metcalf 1980; Godfrey 2005; Godfrey et al. 2009; McGuire et al. 1988; Spicer 1978). In line with these arguments, studies find that superior environmental performance can reduce implicit stakeholder claims, strengthen corporate legitimacy, and provide insurance-like protection against downside market risk (Oikonomou et al. 2012; Salama et al. 2011). From this perspective, firms with superior environmental performance may be less exposed to environmental controversies, regulatory sanctions, reputational losses, and adverse stakeholder reactions, thereby reducing uncertainty surrounding their future cash flows and consequently their market risk.

There is, however, an alternative argument based on legitimacy theory supported by empirical evidence that firms operating in environmentally sensitive or controversial industries may face higher baseline market risk and therefore engage more actively in environmental initiatives as a reputational or legitimacy-building strategy (Jo and Na 2012; Toms 2002). Firms experiencing greater market uncertainty may similarly have stronger incentives to improve environmental performance in order to signal resilience, strengthen stakeholder support, or mitigate future environmental and regulatory exposures. Consequently, the relationship between CEP and market risk may itself be endogenous due to simultaneity and reverse causality.

Compared with CEP, the relationship between environmental disclosure and market risk remains relatively underexplored. Existing studies generally assume unidirectional causality. For example, Cormier and Magnan (1999) treat market risk as a determinant of disclosure, arguing that riskier firms disclose more information to reduce information asymmetry. In contrast, Benlemlih et al. (2018) suggest that extensive environmental disclosure can itself reduce market risk by improving transparency and investor confidence. More extensive disclosure may allow investors to assess firms’ environmental exposures (such as those related to transition to a low-carbon economy, i.e., climate-related transition and physical risks) more accurately, thereby reducing information uncertainty. However, greater transparency may also reveal environmental liabilities, regulatory exposures, transition challenges, or other proprietary risk-relevant information that increases investors’ assessment of firm risk (Dye 1986). Environmental disclosure may therefore have either a risk-reducing or risk-revealing role in capital markets. Without explicitly accounting for endogeneity, it remains difficult to establish the nature and direction of causality between CED and market risk. This is an open empirical question tested in this study.

The consideration of market risk alongside market valuation is particularly important because the two represent related but distinct dimensions of investors’ assessment of the firm. Tobin’s Q captures the market’s valuation of the firm relative to its asset base and incorporates expectations about future growth and value creation, whereas stock return volatility captures uncertainty surrounding those expectations. Environmental strategies may therefore affect firm value and risk through different channels. A corporate environmental action or disclosure could, for example, enhance expected long-term value while simultaneously altering the uncertainty investors attach to those future benefits. Examining valuation without risk—or risk without valuation—may consequently provide an incomplete picture of the capital market implications of corporate environmental behaviour.

Overall, prior evidence concerning the relationships among CEP, CED, market performance, and market risk remains theoretically and empirically inconclusive. Existing research has largely examined selected pair-wise relationships, and relatively few studies consider environmental performance, environmental disclosure, market valuation, and market risk simultaneously while explicitly recognising their potentially bi-directional relationships. Following Al-Tuwaijri et al. (2004) and Clarkson et al. (2011), but extending their framework by explicitly incorporating market risk, we treat CEP, CED, market per-

formance, and market risk as jointly endogenous. Our approach therefore enables us to examine simultaneously whether substantive environmental actions and environmental communication have distinct implications for firm valuation and market risk, while also recognising that firms' environmental strategies may themselves respond to their market valuation and risk exposure. Given the competing theoretical arguments and mixed empirical findings in prior research, we refrain from making directional predictions.

2.2. The Relationship Between Corporate Environmental Performance and Environmental Disclosure

The relationship between environmental performance and environmental disclosure represents a central issue in the environmental responsibility literature. As mentioned earlier, competing theoretical perspectives offer conflicting predictions regarding the direction of this relationship. Drawing on legitimacy theory and socio-political perspectives, some scholars argue and find that firms with weaker environmental performance may engage in greater environmental disclosure as a form of impression management designed to preserve legitimacy and deflect stakeholder scrutiny (Cho and Patten 2007; Patten 1991, 2002). Under this view, environmental disclosure may function symbolically rather than substantively.

In contrast, scholars adopting the RBV and voluntary disclosure theory (VDT) perspectives suggest and find that firms with stronger environmental performance are more likely to provide extensive environmental disclosure (Al-Tuwaijri et al. 2004; Clarkson et al. 2008; Qiu et al. 2016). Superior environmental performers may have stronger incentives to voluntarily disclose environmental information in order to differentiate themselves from competitors, enhance reputation, attract investors, and strengthen stakeholder relations. Consistent with this perspective, recent evidence documents a strong positive relationship between emission performance and environmental disclosure, suggesting that firms increasingly use disclosure to communicate credible environmental commitment and reduce investor uncertainty (Munir and Pratama 2025). Despite disagreement regarding the nature of the CEP–CED association, scholars generally agree that environmental performance and environmental disclosure are closely interrelated and should therefore be examined jointly within environmental–financial accountability analyses (Al-Tuwaijri et al. 2004). Accordingly, we include both CEP and CED as endogenous variables in our framework.

Overall, the preceding discussion highlights substantial theoretical ambiguity and mixed empirical evidence concerning the relationships among environmental performance, environmental disclosure, financial performance, and firm risk. Nevertheless, the literature reinforces the view that environmental disclosure, environmental performance, firm valuation, and financial risk are deeply interconnected. Yet existing studies continue to examine these dimensions largely in isolation, particularly with limited attention to simultaneity and risk integration. Our study addresses this gap by jointly modelling CEP, CED, financial performance, and risk within a unified endogenous framework. In doing so, it contributes to the emerging ESG and business risk literature by explicitly examining whether environmental actions and environmental communication have distinct implications for firm performance and risk. This distinction has become increasingly important as investors, regulators, and other stakeholders seek to differentiate between substantive environmental outcomes and environmental transparency.

3. Data and Methodology

3.1. Sample

Our sample covers US firms listed on NYSE, AMEX or NASDAQ over the period 2005–2020. The dataset is developed via merging of several databases. Financial variables

are obtained from Compustat/CRSP (CCM), environmental disclosures scores are obtained from Bloomberg and environmental performance scores from LSEG (formerly Asset4 and Refinitiv). Institutional ownership data is obtained from ThomsonReuters Stock Ownership database. To be consistent with prior studies, we drop observations corresponding to firms belonging to financial sector. This then leads us to a final usable sample of 7877 firm-year observations covering a wide cross section of industries.

3.2. Endogenous Variables

The environmental performance score (CEP) as defined by LSEG “*measures a company’s impact on living and non-living natural systems, including the air, land and water, as well as complete ecosystems. It reflects how well a company uses best management practices to avoid environmental risks and capitalize on environmental opportunities*”. It covers ‘hard’ performance indicators (as classified by Clarkson et al. 2008) such as information on energy used, CO₂ emissions, other pollution, water and waste recycled, etc. Hence, the score provides a largely objective measure of a firm’s overall environmental performance. It has been used by prior related literature (e.g., Ioannou and Serafeim 2015; Shaukat et al. 2016).

The environmental disclosure score (CED), developed by Bloomberg, is based on data points collected from multiple sources including annual reports, standalone sustainability reports and company websites. These data points follow the GRI framework and capture standardised cross-sector and industry-specific metrics. The weighted score is normalised to range from zero, for companies disclosing no environmental data, to 100 for those disclosing every data point collected, and is expressed as a percentage to make it comparable across companies. The score is also industry-relevant: each company is evaluated only on data relevant to its industry sector. The Bloomberg E disclosure score captures both the quantity (the number of E items reported) and the quality (objective, industry-relevant data) of environmental disclosures. Approximately 80% of the environmental disclosure items covered are objective, while only 20% are ‘soft’, i.e., subjective, data points. These scores therefore largely capture what Clarkson et al. (2008) would call a firm’s ‘hard’ environmental disclosure. A number of recent studies have used Bloomberg disclosure scores (e.g., Benlemlih et al. 2018; Qiu et al. 2016; Utz and Wimmer 2014).

We employ a stock-based performance measure of financial performance (Tobin’s *Q*), widely used in prior related literature (e.g., Dowell et al. 2000; Munir and Pratama 2025). We employ stock Volatility, measured by the standard deviation of the firm’s daily stock’s return, as the measure of firm risk (Jo and Na 2012; McGuire et al. 1988).

As discussed above, we expect to find the following endogenous links (visualised by Figure 1). First, we expect a unidirectional link running from CEP to CED. Second, we expect a bi-directional link of both CEP and CED with firm financial performance. Third, we expect a bi-directional link between CEP and firm risk. Fourth, we postulate a bi-directional link between CED and firm risk. Finally, we expect a link from firm riskiness to its valuation.

3.3. Exogenous Regressors and Control Variables

The decisions to include/exclude particular variables are driven by theoretical considerations and the identification requirements for the system of equations. Specifically, we control for firm size (Size) as measured by the natural logarithm of total assets in all the regressions. Larger firms face greater public scrutiny as well as stakeholder responsibility pressures and thus are more likely to engage in broader social responsibility, including environmental activities and disclosures (Brammer and Pavelin 2006, 2008; Cho and Patten 2007; Qiu et al. 2016). We also expect a negative relationship between size and firm’s risk:

prior studies suggest that larger firms are less exposed to risk, as they are more able to manage risk especially in times of high volatility (e.g., Jo and Na 2012).

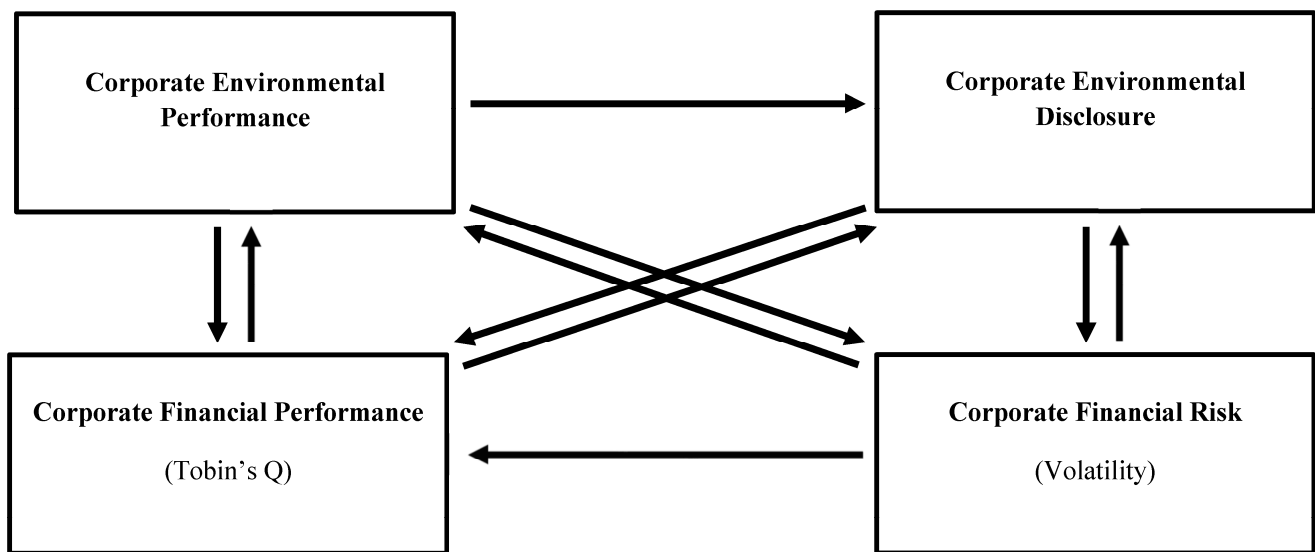


Figure 1. Predicted relations between the endogenous variables.

Leverage is measured by total debt to total assets ratio. Prior evidence suggests higher leverage to be associated with higher firm risk (Elmoatasem Abdelghany 2005). Thus, a positive association is expected between firm's leverage and risk.

Following prior studies, we control for capital expenditure scaled by total assets (CapEx) while modelling firm environmental performance (Shaukat et al. 2016). Improving CEP is likely to require substantial investment outlays associated with process redesign, greener technology adoption, emissions reduction, etc. However, investments in physical capital are unlikely to be required to improve environmental disclosures, justifying exclusion of CapEx from the CED equation below.

We also control for asset growth (Asst_Grwth), as measured by total assets in year t minus total assets in year $t - 1$ divided by total assets in year $t - 1$, in the equations explaining environmental disclosures and firm risk (Jo and Na 2012; Qiu et al. 2016). Moreover, given that Tobin's Q is employed as a measure of financial performance, we expect a positive link between asset growth and Q (which is likely to reflect firm growth opportunities as well).

Arora and Dharwadkar (2011) and Clarkson et al. (2011) argue and find empirical support for the claim that firms pursuing a proactive environmental strategy are the ones with greater financial resources. We therefore control for financial slack (Fin_Slack, measured as the ratio of the sum of cash and short-term investments and total receivables to the book value of total assets; Arora and Dharwadkar 2011; Qiu et al. 2016; Shaukat et al. 2016) while modelling both environmental performance and disclosures.

Many financial institutions are likely to focus on financial performance of their investee firms (in particular, short-term returns) and therefore might be reluctant for their investee firms to make CSR investments, the financial benefits of which may require longer time horizons to materialise. Accordingly, we expect a negative relation between institutional shareholdings (Inst_Hold, measured as shareholdings of financial institutions disclosed in 13F statements) and measures of environmental performance (Qiu et al. 2016).

Finally, asset tangibility as a reverse proxy for firm's investments in R&D (Asst_Tangibility, measured as the ratio of tangible assets to total assets) is likely to relate to both firm financial performance and risk (Jo and Na 2012).

3.4. Model Specification

The discussion above leads us to formulate the following system of equations (with expected links between the endogenous variables visualised by Figure 1):

$$\text{Tobin's_Q}_{it} = \alpha_0 + \alpha_1 \times \text{CEP}_{it} + \alpha_2 \times \text{CED}_{it} + \alpha_3 \times \text{Volatility}_{it} + \alpha_4 \times \text{Size}_{it} + \alpha_5 \times \text{Asst_Grwth}_{it} + \alpha_6 \times \text{Asst_Tangibility}_{it} + \text{Industry fixed effects} + \text{Year fixed effects} + \varepsilon_{1it} \quad (1)$$

$$\text{Volatility}_{it} = \beta_0 + \beta_1 \times \text{CEP}_{it} + \beta_2 \times \text{CED}_{it} + \beta_3 \times \text{Size}_{it} + \beta_4 \times \text{Leverage}_{it} + \beta_5 \times \text{Asst_Grwth}_{it} + \beta_6 \times \text{Asst_Tangibility}_{it} + \text{Industry fixed effects} + \text{Year fixed effects} + \varepsilon_{2it} \quad (2)$$

$$\text{CEP}_{it} = \gamma_0 + \gamma_1 \times \text{Tobin's_Q}_{it} + \gamma_2 \times \text{Volatility}_{it} + \gamma_3 \times \text{Size}_{it} + \gamma_4 \times \text{CapEx}_{it} + \gamma_5 \times \text{Fin_Slack}_{it} + \gamma_6 \times \text{Inst_Hold}_{it} + \text{Industry fixed effects} + \text{Year fixed effects} + \varepsilon_{3it} \quad (3)$$

$$\text{CED}_{it} = \delta_0 + \delta_1 \times \text{CEP}_{it} + \delta_2 \times \text{Tobin's_Q}_{it} + \delta_3 \times \text{Volatility}_{it} + \delta_4 \times \text{Size}_{it} + \delta_5 \times \text{Asst_Grwth}_{it} + \delta_6 \times \text{Fin_Slack}_{it} + \text{Industry fixed effects} + \text{Year fixed effects} + \varepsilon_{4it} \quad (4)$$

We include industry and year fixed effects in all the equations to account for the panel structure of the dataset. Industry fixed effects are based on 17-industry classification by Fama and French (1997). The models are estimated via the three-stage least square method (3SLS). In order to account for within-firm dependence of observations, the estimation employs firm-level bootstrapping with 100 replications. Finally, we perform a series of diagnostic tests to verify that our model is well identified and does not suffer from weak instrument problems. The model passes these tests, as reflected by acceptably low values of Sargan (1958) test statistics and high values of conditional F statistics (Sanderson and Windmeijer 2016).

3.5. Descriptive Statistics

Table 1 provides descriptive statistics for the variables used in this study. The average scores for environmental performance and disclosures are 20.185 and 16.053 (out of 100), respectively. Tobin's Q of the average firm is 2.267. The average firm size measured as natural log of total assets is 7.861, which correspond to approx. \$2.6 bn. The average firm is moderately leveraged (at 23%), spends about 3.6% of total assets on capital expenditures p.a., has an annual asset growth of −0.138, financial slack corresponding to 20% of total assets, and institutional investors hold on average 72.1% of the firm's outstanding equity. Finally, tangible assets represent on average about 20% of the total asset base. For several variables, the median and mean values are reasonably close to each other indicating lack of skewness in the corresponding distributions.

Table 1. Descriptive statistics.

	Variable	Mean	Median	S.D.	Min	Max	Pair-Wise Correlation Coefficients									
							(1)	(2)	(4)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1)	CEP	20.185	8.960	24.948	0.000	98.550	1.000									
(2)	CED	16.053	8.264	17.235	0.775	84.298	0.767	1.000								
(3)	Tobin's_Q	2.267	1.619	1.764	0.795	10.585	0.044	0.046	1.000							
(4)	Volatility	0.111	0.093	0.061	0.039	0.356	−0.196	−0.191	0.053	1.000						
(5)	Size	7.861	7.840	1.901	3.319	12.501	0.584	0.520	−0.192	−0.377	1.000					
(6)	Leverage	0.235	0.191	0.213	0.000	0.977	0.145	0.136	−0.006	0.099	0.054	1.000				
(7)	CapEx	0.036	0.022	0.045	0.000	0.246	0.058	0.074	0.054	0.129	−0.039	0.167	1.000			
(8)	Asst_Grwth	−0.138	−0.061	0.326	−1.956	0.388	0.120	0.101	−0.148	−0.102	0.079	−0.001	0.019	1.000		
(9)	Fin_Slack	0.200	0.099	0.236	0.001	0.959	0.004	0.015	0.451	0.274	−0.199	−0.207	−0.144	−0.103	1.000	
(10)	Inst_Hold	0.721	0.787	0.240	0.069	1.000	0.112	0.065	0.038	−0.005	0.103	0.128	0.069	0.010	0.061	1.000
(11)	Asst_Tangibility	0.200	0.103	0.232	0.001	0.874	0.133	0.151	−0.096	0.084	0.035	0.310	0.766	0.056	−0.281	0.026

Note: All the variables are defined in Section 3.

Table 1 illustrates that most pair-wise correlations among the variables (in particular, those among exogenous regressors in our model) are relatively weak, with some notable exceptions. In particular, CEP and CED indicators are strongly and positively correlated, indicating that strong environmental performance is usually accompanied by extensive environmental disclosures. Both indicators are also positively correlated with firm size. As expected, the measure of firm risk, i.e., Volatility, is negatively correlated with firm size. Finally, firms with more financial slack tend to attract higher valuation (as reflected by Tobin's Q), while asset tangibility and CapEx are also positively correlated, as expected.

4. Results and Discussion

Table 2 presents the main results of the paper.

Table 2. Simultaneous equation model employing market-based measures of financial performance and risk.

Dependent Variable	Tobin's Q			Volatility			CEP			CED		
Regressors	Coeff.	z-Stat	p-Value	Coeff.	z-Stat	p-Value	Coeff.	z-Stat	p-Value	Coeff.	z-Stat	p-Value
CEP	−0.652	−4.44 **	0.000	−0.006	−4.81 **	0.000				0.724	21.26 **	0.000
CED	0.910	4.59 **	0.000	0.011	7.86 **	0.000						
Tobin's Q							−20.328	−11.45 **	0.000	1.179	4.25 **	0.000
Volatility	−12.184	−1.06	0.291	−0.022	−4.07 **	0.000	−133.032	−5.37 **	0.000	15.237	1.51	0.131
Size	0.800	2.03 *	0.042	−0.022	−4.07 **	0.000	9.257	27.99 **	0.000	−0.950	−2.35 *	0.019
Leverage				0.050	7.99 **	0.000						
CapEx							84.033	8.78 **	0.000			
Asst_Grwth	0.623	1.30	0.194	−0.014	−2.15 *	0.032				−0.717	−1.46	0.144
Fin_Slack							89.630	12.37 **	0.000	−0.558	−1.01	0.312
Inst_Hold							−17.507	−10.38 **	0.000			
Asst_Tangibility	−0.233	−1.17	0.243	0.007	2.00 *	0.045						
Intercept, Year and Industry FE	Yes			Yes			Yes			Yes		
Wald test statistics and p-values	$\chi^2(34) = 260.25$ ** p-value 0.000			$\chi^2(34) = 493.75$ ** p-value 0.000			$\chi^2(34) = 3194.72$ ** p-value 0.000			$\chi^2(34) = 6556.58$ ** p-value 0.000		

Note: The system is estimated by the 3SLS method employing firm-level bootstrapping with 100 repetitions. All the variables are defined in Section 3. ** and * denote statistical significance at 1% and 5% levels, respectively.

Table 2 illustrates that environmental performance (CEP) and environmental disclosure (CED) have distinct and contrasting implications for firm performance and risk. The results also provide strong evidence that environmental performance, environmental disclosure, financial performance, and risk are jointly determined, thereby supporting the importance of analysing these relationships within an integrated endogenous framework rather than through isolated pair-wise associations as was largely prevalent in prior literature.

Table 2 shows that environmental performance is negatively associated with firm financial performance (measured by Tobin's Q), whereas environmental disclosure has a positive effect on financial performance. Consistent with the agency-theoretic arguments (Barnea and Rubin 2010; Bushee 1998; Friedman 1970), the negative coefficient on CEP suggests that firms engaging in more intensive environmental initiatives may incur substantial contemporaneous costs associated with environmental investments, process redesign, greener technology adoption, emissions reduction, compliance activities, and broader sustainability programmes. Such expenditures may negatively impact financial performance even when they are undertaken with the expectation of generating longer-term strategic benefits. This finding is consistent with the view that environmental performance often represents a form of strategic investment whose economic benefits materialise gradually through enhanced operational efficiency, innovation, regulatory preparedness, and reputational capital. Thus, our results suggest that while investors recognise the associated costs, they as yet do not fully recognise the benefits associated with superior environmental performance. In particular, investors do not view responsible environmental performance as a signal of superior

environmental strategy and preparedness for future environmental physical and regulatory uncertainties, as well as stakeholder expectations. This under-appreciation of benefits is similar to the undervaluation of the benefits of strong corporate governance in the 1990s and early 2000s (Gompers et al. 2003; Shaukat and Trojanowski 2018).

In contrast, environmental disclosure exhibits a positive association with firm valuation (Tobin's Q). This finding is consistent with Hart's (1995) natural resource-based view that emphasises the value of effective environmental communication. From the perspective of natural resource-based view and voluntary disclosure theory (Clarkson et al. 2008; Clarkson et al. 2011; Qiu et al. 2016), extensive and objective environmental disclosure can reduce information asymmetry, improve corporate legitimacy and reputation, and strengthen relationships with key stakeholders (e.g., customer and employee loyalty), which in turn are valued by investors. Firms that communicate their environmental commitments effectively may therefore be better positioned to convert environmental initiatives into tangible value-relevant benefits.

The results also reveal important differences in the effects of CEP and CED on firm risk. Table 2 indicates that environmental performance reduces firm's perceived riskiness. This finding is consistent with the resource-based view and risk-management perspectives (Hart 1995; Porter and van der Linde 1995), which argue that effective environmental management can function as a form of strategic risk management. Firms with superior environmental performance may be perceived by investors as being better equipped to manage environmental liabilities, regulatory change, stakeholder pressures, and transition-related risks. Consequently, environmental performance appears to provide a degree of downside protection that reduces market uncertainty and volatility (Godfrey 2005; Godfrey et al. 2009; Husted 2005; Oikonomou et al. 2012; Salama et al. 2011).

Conversely, the positive association between environmental disclosure and stock return volatility suggests that extensive disclosure of proprietary environmental information may increase investor attention to environmental exposures and sustainability-related uncertainties. Environmental disclosures may be perceived by investors as a response to existing environmental concerns, regulatory pressure, or stakeholder scrutiny. Alternatively, extensive disclosure may draw attention to environmental risks and liabilities that would otherwise receive less market attention. For instance, they could reveal information about future compliance costs, environmental liabilities, transition challenges, or strategic risks that become incorporated into market expectations. In this sense, greater transparency may reduce information asymmetry while simultaneously increasing the amount of proprietary risk-relevant information available to investors (Dye 1986). This interpretation is particularly relevant in contemporary ESG markets where investors increasingly scrutinise environmental disclosures as indicators of future sustainability risk exposure.

Table 2 also provides evidence on other relationships among the endogenous variables. First, firms with higher market valuations provide more extensive environmental disclosures but exhibit weaker environmental performance. Interpreting this result in conjunction with our earlier findings on the effects of CED and CEP on Tobin's Q indicates that these links are not only endogenous, but also self-reinforcing. In particular, the findings imply a positive feedback loop between firm value and CED and a negative feedback loop between firm value and CEP. This behaviour appears consistent with firms catering to investor preferences for extensive CED and limited CEP (as reflected in our earlier findings on the effects of CED and CEP on firm value).

Second, riskier firms tend to have lower CEP. Reading it in conjunction with the previous finding on the negative effect of CEP on risk again indicates the presence of endogeneity and a self-reinforcing mechanism. In other words, riskier firms have poorer environmental performance, and poor environmental performance contributes to greater

firm risk, consistent with the arguments and empirical results of Godfrey (2005), Godfrey et al. (2009), Husted (2005), Oikonomou et al. (2012), and Salama et al. (2011).

Third, firm financial performance and riskiness do not appear to be significantly related. Fourth, we do not find a significant relation between stock return volatility and environmental disclosures. This is contrary to prior arguments and findings of Cormier and Magnan (1999) who find that riskier firms tend to disclose more.

Finally, consistent with the resource-based view (RBV) and voluntary disclosure theory (VDT) arguments, we find a strong positive link between CEP and CED: firms with superior environmental performance tend to make higher environmental disclosures. This suggests that environmental reporting increasingly reflects underlying environmental actions rather than symbolic impression management alone. As ESG reporting requirements continue to expand globally, firms may face increasing incentives to ensure consistency between environmental performance and environmental communication.

The analyses also document several noteworthy effects of the control variables. Firm size is strongly positively associated with environmental performance but negatively associated with environmental disclosure. Larger firms appear to possess the resources and capabilities necessary to implement substantive environmental initiatives (i.e., higher CEP), while simultaneously adopting more selective disclosure strategies (i.e., lower CED), after controlling for environmental performance. Leverage increases firm riskiness, consistent with conventional finance theory. Capital expenditure is positively associated with environmental performance, suggesting that environmental improvement often requires sustained investment in physical assets, technology, and operational infrastructure. Financial slack positively influences environmental performance, indicating that resource-rich firms may allocate greater resources to environmental initiatives. However, the effect of financial slack on environmental disclosures is not statistically significant, suggesting that enhancing environmental disclosures is relatively less resource-sensitive than real environmental commitments. Institutional ownership is negatively associated with environmental performance, suggesting that institutional investors seem wary of environmental investments with uncertain short-term payoffs. Finally, firms with higher tangibility of asset base are perceived to be riskier.

Overall, the findings demonstrate that environmental performance and environmental disclosure represent distinct dimensions of corporate environmental strategy. Environmental performance appears to function as a mechanism for reducing perceived riskiness of firms, albeit at the cost of lower valuations. Environmental disclosure, by contrast, is associated with higher market valuations and higher perceived riskiness. These contrasting results highlight the importance of distinguishing between environmental actions and environmental communication when evaluating the economic consequences of ESG strategies.

5. Conclusions and Implications

This study develops a holistic framework for examining the inter-relations among corporate environmental performance (CEP), corporate environmental disclosure (CED), corporate financial performance (CFP), and corporate financial risk (CFR), while explicitly accounting for the endogenous nature of these relationships. By simultaneously modelling environmental actions, environmental communication, financial outcomes, and risk, the study provides a more comprehensive understanding of the economic consequences of corporate environmental strategies. In doing so, it extends prior environmental-financial accountability research by incorporating firm risk as an integral component of the analysis and by explicitly distinguishing between environmental performance and environmental disclosure.

Our findings provide strong evidence that CEP, CED, CFP, and CFR are jointly determined and that several of the relationships among these variables are bi-directional and self-reinforcing. The results also demonstrate that environmental performance and environmental disclosure are not interchangeable dimensions of ESG strategy. Rather, they represent distinct corporate activities that generate different financial and risk outcomes and appear to be valued differently by capital markets.

First, we find that environmental performance is associated with lower market valuation and lower risk. These findings suggest that investors view CEP commitments primarily as mechanisms for reducing environmental risks (incl. physical and transition-related risks), providing organisational resilience and downside protection. Yet, investors take a dim view of the expected payoffs of such an environmentally responsible firm behaviour and accordingly discount firm value, consistent with agency-theoretic arguments. We also find that the relationships between CEP and both firm value and risk to be self-reinforcing.

Second, we find that environmental disclosure is positively associated with market valuation and market risk. These findings suggest that the economic consequences of environmental disclosure are distinctly different from those of environmental performance. Disclosure appears to enhance firm value, possibly through reduction in information asymmetry, improvements to corporate legitimacy and reputation, and strengthened customer and employee loyalty, which in turn are valued by investors. There is also a positive feedback loop between firm value and CED, consistent with firms catering to investor preferences for extensive CED.

At the same time, CED is also associated with increased riskiness. One possible explanation is that environmental disclosure conveys information not only about environmental achievements, but also about environmental exposures, future compliance obligations, transition challenges, and sustainability-related uncertainties. Consequently, while greater transparency may strengthen stakeholder relations, it may simultaneously increase investor awareness of firm-specific environmental risks.

Third, we document a strong positive association between environmental performance and environmental disclosure. This finding provides support for the resource-based view (RBV) and voluntary disclosure theory (VDT), suggesting that firms with superior environmental performance are more willing and able to communicate their environmental achievements to stakeholders. Importantly, the result implies that environmental disclosure increasingly reflects underlying environmental actions rather than merely symbolic impression management. In an era of growing ESG scrutiny and reporting regulation, firms appear to face stronger incentives to ensure consistency between what they do and what they disclose.

The findings carry several important implications for managerial practice. For managers, the results highlight the need to distinguish between environmental performance and environmental disclosure when designing ESG strategies. Environmental performance appears to enhance corporate resilience and lower risk, although markets do not yet seem to value these benefits. Environmental disclosure, by contrast, appears to enhance market value but may also increase investor scrutiny and the visibility of environmental risks.

The results also have important implications for investors and financial market participants. Investors increasingly face the challenge of distinguishing between firms that excel at communicating sustainability commitments and those that achieve substantive environmental outcomes. Our findings suggest that these dimensions should be evaluated separately. While environmental disclosure enhances corporate legitimacy, reputation, and is thus valued by investors, effective environmental actions help mitigate environment-related risks (and thus stock return volatility). While investors are cognisant of the value

of extensive environmental disclosures, they are yet not appropriately factoring in the long-term benefits of real environmental actions in firm valuation.

From a policy perspective, the findings contribute to ongoing debates concerning ESG reporting regulation and sustainability disclosure standards. The positive relationship between environmental performance and disclosure suggests that environmental reporting increasingly reflects substantive environmental actions, which supports current efforts to enhance disclosure standardisation, comparability, and assurance. At the same time, the finding that disclosure may increase perceived risk highlights the importance of ensuring that environmental information is decision-useful, balanced, and comparable across firms. Regulators should therefore continue to strengthen reporting frameworks that improve disclosure quality while reducing information overload and inconsistencies in ESG reporting practices.

More broadly, the findings suggest that environmental performance and environmental disclosure play different roles within the corporate risk-management process. Environmental performance appears to reduce market risk through substantive improvements in organisational resilience and stakeholder relations, whereas environmental disclosure primarily affects how firms are valued by investors. Effective ESG strategies therefore require both substantive environmental action and credible communication, but the economic consequences of these activities should not be assumed to be identical.

Finally, our findings have important implications for future research. The results demonstrate that the relationships among environmental performance, environmental disclosure, financial performance, and risk are endogenous and often self-reinforcing. Thus, they cannot be adequately understood through isolated pair-wise analyses. Future studies should continue to employ integrated modelling approaches capable of addressing simultaneity and reverse causality. Moreover, an important limitation of our study is its focus on a specific institutional setting. Further research could also explore whether the relationships documented here vary across institutional environments, regulatory regimes, industries, and different ESG dimensions.

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