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CLIMATE RISK TRANSPARENCY AND FIRMS' INTEREST COVERAGE RATIO IN EMERGING MARKETS

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ABSTRACT

This study investigates whether financial markets in emerging economies impose a cost on firms that disclose climate change risks. By leveraging a novel firm-level dataset of climate risk disclosures from Thomson Reuters/LSEG Eikon, we analyze the relationship between voluntary disclosures of asset exposure to climate transition risk and physical risk and a firm's interest coverage ratio. Using a System Generalized Method of Moments (System GMM) estimator, we address potential endogeneity and dynamic effects in the relationship between disclosure behavior and financing costs. Our results indicate that firms that disclose climate risk exposure face a higher cost of debt compared to their non-disclosing peers. This suggests that in the institutional context of emerging markets, creditors may interpret transparency as a sign of unmitigated vulnerability rather than a marker of sound governance. The study highlights a critical unintended consequence of climate disclosure, suggesting that regulatory efforts must be coupled with mechanisms that build market confidence in firms' adaptive capacities to prevent transparency from inadvertently restricting access to capital.

Keywords: Climate risk disclosure, cost of debt, emerging economies, sustainable finance, disclosure penalty.

INTRODUCTION

Governments and related organizations are being asked to make a net-zero transition a priority, given the growing awareness of the impact of climate change (Choi et al., 2020; Stern & Valero, 2021). There are two categories of climate change risk: physical risk and transition risk (Attenborough, 2022; Pinner et al., 2020; Thomas et al., 2019). Physical risk can be defined as climate phenomena and environmental changes, such as natural disasters and rising temperatures, that can incur economic costs (Aven, 2020; Swart, 2019). On the other hand, transition risk includes the financial risks that come with moving to a low-carbon economy, such as changes in rules, technology and market dynamics (Di Febo & Angelini, 2025; Park & Kim, 2020; Sheren et al., 2015). We can already see the real effects of climate change risk. Natural disasters and environmental degradation, fueled by global warming, can affect health, savings, productivity and businesses because they create systemic financial risks, increase operational costs and force companies to reallocate capital to disaster recovery (Dell et al., 2009; Rao et al., 2022).

The impact of climate risks varies greatly, especially in emerging markets and across sectors. In agriculture, productivity and revenue are diminished by unpredictable rainfall and extreme temperatures (IPCC, 2023). The energy sector encounters dual pressure. Physical risk due to extreme weather that damages infrastructure and transition risk due to the shift in regulations towards renewable energy, which can affect the value of fossil fuel assets (IEA, 2023). Manufacturing companies, particularly those in the water industry, encountered operational disruptions due to drought and flooding. Additionally, they confronted transition risks stemming from carbon pricing mechanisms and stringent environmental regulations (UNEP, 2021). These vulnerabilities, which are specific to a given sector, are especially pronounced in emerging markets. In these markets, the combination of aging infrastructure and limited adaptive capacity results in exacerbated financial consequences for climate-related events.

Companies play an important role in managing climate change risks and disclosing information about environmental and carbon performance (Meng et al., 2014; Tang & Luo, 2014). One way in which they can adapt is by disclosing climate change information (Attenborough, 2022). As part of their risk management strategies, companies have begun to disclose climate risks. Such disclosure has two sides. On the one hand, this can signal good management, transparency, and a willingness to address climate uncertainty. On the other hand, this transparency provides an overview of the climate change risks faced by the company. This is important for creditors because climate change risk affects cash flow stability and the company's ability to repay debt. For example, natural disasters or strict regulations related to energy transition can reduce revenue. They can also increase operating costs; they can even reduce asset values (Trinh et al., 2024). This ultimately narrows the company's ability to meet its interest and principal obligations (Kling et al., 2021). In this context, climate risk disclosure can influence creditors' assessment of default risk (Qiu et al., 2025; Sautner et al., 2023). If it is considered to increase the potential for disruption to cash flow, the cost of debt tends to increase. Conversely, if it is seen as proof of how well the company is managing risk and keeping its finances stable, then creditors will believe that the company can repay its obligations effectively.

Climate risk disclosure takes various forms in corporate reporting. For instance, the company can disclose asset locations that correlate with areas prone to flooding, revenue from activities with high carbon emissions, or estimates of this performance in the carbon pricing mechanism. A mining company reported that 30% of its operations are in areas expected to experience water stress by 2030, and an agricultural company can disclose its plants' exposure to extreme heat. Energy companies can disclose fossil fuel reserves and the potential for assets to become stranded under climate policy scenarios. This

type of disclosure will provide stakeholders with information about climate vulnerabilities, but it will also reveal the scale of risk for companies to mitigate.

Research on the relationship between climate risk disclosure and a firm's debt repayment capacity remains particularly limited, especially in emerging markets. Examining the impact of environmental performance on financing costs reveals a lack of research on the effects of voluntary disclosure (Chava, 2014; Kling et al., 2021). Huang et al. (2022) examine research on climate vulnerability and capital structure, which focuses more on geography than on disclosure practices. This research gap is important because creditors' assessment of climate change disclosure risk can differ significantly from that of equity investors, particularly regarding default risk and repayment ability.

Climate risk affects the ability of debtors to repay their debts. Several mechanisms can explain this phenomenon. First, physical risk directly erodes cash flow stability: extreme weather can damage productive assets, disrupt supply chains and reduce cost efficiency, which can make revenue and capital expenditures for repairs or adaptation unpredictable (Kahn et al., 2021). Second, transition risks impose regulatory and market-driven costs: carbon taxes, emissions limits, and shifts in consumer preferences can increase operating expenses, reduce demand for carbon-intensive products, and necessitate costly investment (Bolton & Kacperczyk, 2021). Third, climate risk can affect asset value. Property in areas prone to flooding may depreciate. However, fossil fuel reserves can become stranded assets with strict policies (Caldecott et al., 2016). These effects collectively reduce EBIT (Earnings Before Interest and Taxes) and increase financing costs, thereby lowering the debt coverage ratio and indicating a higher default risk for creditors. When the company discloses this information, creditors can measure the cash flow disruption that may prompt them to demand a higher risk.

Climate change risk affects financial performance. Physical risk vulnerabilities such as heat waves, floods, storms, and droughts are becoming more frequent due to climate change. These incidents can damage physical assets and production infrastructure, disrupt supply chains, halt or reduce operating capacity and increase operating costs. Consequently, the cash flow of businesses become increasingly volatile. To compensate for the increased risk, banks and investors demand greater interest spreads because this higher profit volatility raises the possibility of insolvency. Empirical literature also shows that exposure to climate risk is associated with increased ROA volatility and bankruptcy risk, which ultimately drives up the cost of debt. Using global loan data, Kempa (2026) demonstrates that businesses with high levels of physical risk pay higher loan interest rates, must offer more collateral, and have lower long-term credit ratings.

According to recent research, a company's financial performance can be greatly impacted by both physical climate risk and transition risk. Physical climate vulnerabilities such as heat waves, floods, and storms generally disrupt operations, diminish asset values and earnings volatility, therefore increasing borrowing costs and credit risk (Addoum et al., 2020; Ginglinger & Moreau, 2023; Pankratz et al., 2023). Kempa (2026) uses a global loan dataset and shows that businesses with high physical climate risk pay higher loans, must provide more collateral and get lower long-term credit ratings. Then, corporate finance conditions are also impacted by transition risks driven by environmental regulation, carbon price, and technological substitution. Companies in the EU that are more exposed to climate transition risks (as determined by narrative disclosure) pay more for debt, especially in developed financial markets (Jung et al., 2018; Kleimeier & Viehs, 2016). These results are in line with scenario-based data that suggests an abrupt low-carbon transition through a sharp rise in carbon prices or large decarbonization capital expenditures could erode corporate profits and weaken debt repayment capacity (Battiston et al., 2017).

This study is motivated by the unique challenges facing firms in emerging economies at the intersection of climate vulnerability and financial constraints. Emerging markets are disproportionately exposed to physical climate risks due to geographic location, with many concentrated in tropical regions experiencing more frequent extreme weather events (IPCC, 2022). Simultaneously, these economies face severe transition risks as they balance economic development with international pressure to decarbonize (Volz et al., 2020). Emerging market firms operate within institutional environments characterized by weaker regulatory oversight, less developed financial markets, and limited access to adaptation finance (Battiston et al., 2021). In this context, climate risk disclosure presents a paradox: while transparency is globally promoted as a best governance practice, emerging market creditors may lack the institutional capacity or market incentives to reward such openness. Instead, disclosure may function primarily as a risk signal in environments where firms have limited demonstrated capacity for climate adaptation. If disclosure increases debt costs without corresponding access to green finance or technical support, firms in emerging economies face disincentives for transparency, potentially undermining global climate risk management efforts. This study examines whether voluntary climate risk disclosure affects firms' debt servicing capacity in emerging markets by analyzing the relationships between climate transition and physical risk disclosures and interest coverage ratios and whether these relationships are systematically related to firms' ESG performance and carbon intensity. By analyzing these dynamics, we aim to assess how climate transparency influences firms' financing conditions and creditors' risk assessment in emerging markets.

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Climate change generates two primary categories of risks, each of which has a different effect on how well a business does financially. Physical risk encompasses the immediate impacts of climate phenomena and environmental transformations. Studies have demonstrated that extreme temperatures can negatively impact efficiency and have negative effects on productivity and income (Dell et al. 2009; Kruttli et al., 2025). Rao et al. (2022) show that precipitation volatility affects firm investments and asset values, while Huang et al. (2018) find that firms in disaster-prone regions exhibit greater earnings volatility and maintain higher cash reserves as a precautionary measure.

Transition risk is the risk that comes with moving to a low-carbon economy by changing the rules, technology, and market preferences. Companies with high carbon emissions face declining market valuations as investors adjust to the future cost of regulations (Bolton & Kacperczyk, 2021). Seltzer et al. (2020) show that companies with elevated carbon emissions experience heightened stock price volatility in response to climate policy announcements. In contrast, institutional investors require more returns for maintaining carbon-intensive assets. The financial significance of transition risks has significantly increased due to the expansion of carbon pricing schemes and renewable energy (Andersson et al., 2016).

Literature offers conflicting perspectives on climate risk disclosure. Signaling theory shows that voluntary disclosure indicates good risk management and quality corporations can reduce asymmetric information and reduce the cost of capital (Connelly et al., 2011; Spence, 1973). Based on this theory, companies that disclose climate change risks show transparency and preparedness, which should reassure creditors and investors. Previous studies have shown that enhanced environmental disclosure improves access to finance (Cheng et al., 2014; Dhaliwal et al., 2011).

Conversely, disclosure can be viewed as a double-edged sword that reveals a firm's underlying vulnerabilities. By disclosing its significant climate exposure, a company alerts the market to potential future costs and operational risks. From an agency theory perspective, this information prompts creditors to hike risk premiums to offset the heightened probability of default (Jensen & Meckling, 1976; Smith & Warner, 1979). Supporting this view (Chava, 2014), finds that negative environmental externalities face higher loan spreads and shorter maturities, as creditors price in environmental risks.

Recent empirical evidence on climate disclosures' financial effects presents mixed findings. Studies in developed markets generally find positive effects: Jung et al. (2018) document that firms with credible carbon reduction strategies secure favorable debt terms, while (Kleimeier & Viehs, 2016) shows that better carbon performance reduces loan costs. However, research in emerging markets remains limited and suggests different dynamics. Kling et al. (2021) find that national climate vulnerability increases sovereign and corporate borrowing costs in developing countries, indicating that climate risk information may be penalized rather than rewarded.

The majority of climate disclosure research examines equity market and reputation effects rather than credit market implications. Matsumura et al. (2014) find that carbon emissions disclosure is associated with lower firm valuations in carbon-intensive industries, suggesting investors price emissions as liabilities. Krueger et al. (2019) demonstrate through survey evidence that institutional investors increasingly incorporate climate risk into valuation models, with physical risks considered more financially material than transition risks. Vestrelli et al. (2024) show that media attention to climate change amplifies the market value impact of climate disclosures, indicating that disclosure effects depend on broader stakeholder awareness.

From a reputation perspective, disclosure serves as a means of establishing corporate legitimacy and trust (Depoers et al., 2016). Clarkson et al. (2008) distinguish between substantive disclosure of concrete climate actions and symbolic disclosure of general commitments, finding that only substantive disclosure improves environmental performance. More recently, Hewa et al. (2025) found that the quality of climate disclosures impacts investor behaviour, with detailed quantitative disclosures receiving more favourable responses than vague qualitative statements.

According to Khanna & Palepu (1997), emerging economies are confronted with elevated physical and transition risk exposure, in conjunction with institutional deficiencies marked by inadequate regulatory enforcement, underdeveloped capital markets, and constrained climate adaptation resources. In these settings, creditors will lack the expertise to evaluate the quality of a firms' climate risk management and also lack confidence in the firms' adaptive capacity.

Recent findings indicate that emerging market creditors respond conservatively to climate-related information. Hasan et al. (2025) found that climate disclosure by emerging market lenders resulted in credit rationing rather than improved access to green finance. Liu et al. (2025) found that Chinese firms disclosing higher climate risks face increased debt costs, which are only partially mitigated by low carbon intensity. These findings suggest that, in contexts of institutional weakness and adaptation constraints, climate disclosure primarily signals vulnerability rather than governance quality.

Based on theoretical and empirical evidence, we hypothesize that the ability of enterprises in emerging economies to service debt is adversely impacted by climate risk disclosure, which is seen by creditors as an indication of potential future cash flow issues and repayment difficulties. As a result, creditors

demand greater risk premiums. Reduced coverage ratios clearly indicate this effect, as rising debt expenses diminish the operating interest margin.

H1: Corporate climate change risk disclosure negatively affects the firm's ability to repay debt.

METHODOLOGY

Data

Our research encompasses the years 2015-2022, encompassing the post-Paris Agreement period during which climate risk disclosure procedures intensified in emerging markets and extending to the current phase of increased climate awareness and regulatory examination. Climate risk disclosure data are sourced from Thomson Reuters/LSEG Eikon. After imposing these filters and winsorizing continuous variables at the 1st and 99th percentiles to mitigate the influence of outliers, the final dataset comprises 3,170 firm-year observations from 12 emerging economies.

Dependent Variable

The study uses the interest coverage ratio (ICR) to measure the ability to repay debt based on prior literature. First, the ICR reflects the relationship between operational performance (EBIT) and financing obligations (interest expense), providing an indicator of risk. Unlike the debt service coverage ratio (DSCR), which includes principal repayments, ICR focuses specifically on the recurring burden most sensitive to creditor perceptions and covenant structures. Prior research validates ICR as a key determinant of credit risk and financing costs. Iotti et al. (2024) demonstrate the efficacy of ICR in assessing debt sustainability across various sectors. ICR's effectiveness in assessing debt sustainability across various sectors, while credit rating agencies explicitly use ICR in rating methodologies (Altman & Hotchkiss, 2005). A declining ICR is indicative of an increased probability of interest payment default, which is the earliest and most visible form of financial distress. ICR is particularly appropriate for examining disclosure effects because it responds to both numerator and denominator changes: climate disclosure may affect operating earnings (EBIT) through anticipated climate costs, and interest expenses through altered credit spreads. This dual sensitivity allows us to capture the full mechanism through which disclosure influences debt servicing capacity.

Independent Variable

We use two measures of climate risk disclosure on transition risks (CEXT) and climate risk disclosure on physical risks (CEXP) (Doruk, 2025). These variables are measured using a binary indicator that is equal to 1 if a firm discloses assets or business activities exposed to climate change transition risks and equal to 0 otherwise. These indicators reflect the extent to which firms report their exposure and responses to different dimensions of climate-related risks. By distinguishing between transition- and physical-risk disclosure, we investigate whether markets react differently to various types of transparency.

Control Variables

Control variables used include liquidity, profitability, interest tax before margin, capital expenditure, environmental innovation, firm size and GDP Growth.

Table 1

Variables

Variable	Notation	Description	Reference	Expectation Sign
Dependent Variables				
Interest Coverage Ratio	ICR	Interest coverage ratio is defined as a company's capacity to satisfy interest expenses by means of operating income. ICR is determined by dividing earnings before interest and taxes by total interest expenses.	(Iotti et al., 2024)	
Debt Service Coverage Ratio	DSCR	The ratio assesses how effectively a company's operating profits can cover debt commitments. It is calculated by dividing EBIT by the total debt service. From a lending perspective, a higher ratio indicates a healthy for repayment and lower default risk and a lower DSCR indicates weaker financial resilience and higher credit risk.	(Drehmann et al., 2015)	
Independent Variables				
Financial exposure to transition risk	CEXT	Financial exposure to transition risk refers to the extent to which a firm's assets, operations, or business activities are vulnerable to risks associated with the transition to a low-carbon economy, such as regulatory changes, carbon pricing, market shifts, or technological substitution. We measure financial exposure to transition risk (CEXT) using a binary variable. The value of **1** is assigned if the firm discloses assets or business activities that are vulnerable to climate transition risk, and **0** otherwise.	(Doruk, 2025)	Negative
Financial exposure to physical risk	CEXP	Financial exposure to physical risk refers to the extent to which a firm's assets, operations, or business activities are vulnerable to the physical impacts of climate change, such as extreme weather events, rising sea levels, floods, droughts, or temperature increases that may disrupt operations or reduce asset value. We measure financial exposure to physical risk (CEXP) using a binary variable. The value of **1** is assigned if the firm discloses assets or business activities that are vulnerable to physical climate risk, and **0** otherwise.	(Doruk, 2025)	Negative

(continued)

Variable	Notation	Description	Reference	Expectation Sign
Firm Level - Control Variables				
Profitability	Profitability	Profitability is defined as a firm's capacity to demonstrate overall efficiency in the utilization of resources. Profitability is measured using Return on Assets (ROA), calculated as Net Income divided by Total Asset. A higher ROA is indicative of enhanced efficiency in asset utilization and robust financial performance.	(Ferdous et al., 2024)	Negative
Investment	CAP_Exp	Capital expenditure (CAPEX) is a measure of a firm's investment in long term assets, including property, plant, and equipment. Capital expenditure calculated by dividing capital expenditure to total assets.	(Ferdous et al., 2024)	Negative
Firm Size	Size	Firm size is indicative of a company's operational and resource scale, which can influence disclosure practice and financing conditions. Firm size is calculated using of the natural logarithm of the total assets.	(Ferdous et al., 2024)	Negative
Liquidity	Liquidity	Liquidity is defined as a firm's ability to meet its short-term obligations using its current assets. Liquidity is measured using the Current Ratio calculated as Current Assets divided to Current Liabilities.	(Ferdous et al., 2024)	Negative
Env_Inno	Env_Inno	Environmental innovation is defined as a firm's initiatives to develop and implement technologies, processes or practices of energy efficiency. In this study, the concept is represented using Environmental Innovation score.	(Ferdous et al., 2024)	Negative
Country Level Control Variables				
Economic Growth	GDP_Growth	The natural logarithm of a country's Gross Domestic Product per capita (constant 2015 USD) over a specified period.	World Bank	Negative

Method

To rigorously address the specific concerns of endogeneity, along with reverse causality and dynamic endogeneity, whereby a firm's past cost of debt may influence its current disclosure decisions, we employ the two-step System Generalized Method of Moments (GMM) estimator developed by Blundell and Bond (1998). This estimator is specifically tailored for our needs, as it is intended for dynamic panel models in which the dependent variable may exhibit persistence, and the explanatory variables may not be strictly exogenous. The System GMM estimator employs lagged levels of the variables as instruments for the current first-differences equation and lagged first differences as instruments for the levels equation, thereby enhancing efficiency.

We estimate the following dynamic model:

$$ICR\_it = \beta_0 + \rho ICR\_i(t-1) + \beta_1 CEXT\_it + \delta X\_it + \mu\_i + \lambda\_t + \varepsilon\_it \quad (1)$$

$$ICR\_it = \beta_0 + \rho ICR\_i(t-1) + \beta_2 CEXP\_it + \delta X\_it + \mu\_i + \lambda\_t + \varepsilon\_it \quad (2)$$

In this specification**,** ICR_it denotes the interest coverage ratio of firm *i* in year *t*. The lagged dependent variable, ICR_i(t-1)**,** captures the dynamic persistence of firms' debt-servicing capacity. CEXT_it and CEXP_it represents climate transition risk disclosure and physical risk disclosure, respectively, while X_it is a vector of control variables at the firm and country level. The terms μ_i and λ_t denote unobserved firm-specific and time-specific effects, respectively, and ε_it is the error term.

RESULTS AND DISCUSSION

Descriptive Statistics

Table 2

Descriptive Statistics

Variable	Obs	Mean	Std. dev.	Min	Max
ICR	3,170	1.773302	1.434036	-4.419521	6.25074
DSCR	3,170	1.842948	2.340448	0	9.488679
CEXT	3,170	0.0776025	0.2675873	0	1
CEXP	3,170	0.0804416	0.2720186	0	1
Liquidity	3,170	1.693622	1.219354	0.08243	7.915
Profitability	3,170	0.0482997	0.0748459	-0.6801	0.7307
CAP_Exp	3,117	-2.362994	2.143077	-13.07493	8.947742
Env_Inno	3,170	23.72739	30.20359	0	99.8062
Size	3,149	22.13661	1.385071	17.73133	26.61699
GDP_Growth	3,170	2.327426	3.440867	-9.518295	12.00059

Table 2 presents the descriptive statistics for the variables, based on an unbalanced panel of 3,170 firm-year observations. The dependent variable, the winsorized Interest Coverage Ratio (ICR_win) has a mean of 1.77. This means that the average firm in our sample generates earnings sufficient to cover its interest expenses 1.77 times. The substantial standard deviation (1.43) and range (from -4.42 to 6.25) show that there is a lot of variation in how profitable firms are and their ability to pay back debt over time. The key independent variables of interest, CEXT and CEXP, which indicate disclosure of transition and physical climate risks, have low means of 0.078 and 0.080, respectively. This means that only about 7.7%-8.0% of the firm-year observations in our sample involve voluntary climate risk disclosure, which shows that this practice is not yet common among firms in these emerging economies. Regarding firm-level controls, the average firm exhibits healthy liquidity (Mean Current Ratio = 1.69) and modest profitability (Mean ROA = 0.048). The wide variation in firm size (Size), with a mean of 22.14 and a standard deviation of 1.39, confirms that our sample encompasses a diverse mix of small and large entities. Finally, the country-level control for economic growth (GDP_Growth) shows a positive average rate of 2.33%, albeit with considerable variation across the sample period.

Table 3 shows the final sample's firm-year observations by country and industry. The sample is dominated by firms from the largest emerging economies, with South Africa (820 observations), Brazil (580), and Malaysia (380) constituting the most represented nations. Conversely, smaller or more specialized economies such as Bahrain (20), Qatar (60), and the United Arab Emirates (50) contribute minimally to the overall sample. The sample is well diversified across sectors, which is indicative of the industrial composition of these economies. The largest group consists of businesses in the Consumer Non-Cyclicals sector (910 observations), Basic Materials (530 observations) and Technology (410 observations). Importantly, industries that are often linked to significant exposure to climate risk, such as Utilities (250 observations) and energy (310 observations), are also well- represented, which is essential for examining climate disclosure procedures.

The industrial emphasis of these economies, often centered on the manufacture of vital goods and resource exploitation, is highlighted by the predominance of Consumer Non-Cyclicals and Basic Materials. The significant involvement of companies from high climate risk sectors such as Energy and Utilities is particularly noteworthy, as these industries are both disproportionately impacted by climate-related physical and transition hazards and are essential to the low-carbon transition. This sectoral balance facilitates a sophisticated study across industries with varying exposures to climate-related financial hazards.

Furthermore, Table 4 shows the pairwise correlation between the independent variables used. The results show no correlations greater than 0.7, indicating that the independent variables are sufficiently independent of each other to be included together in the regression model.

Table 3

Descriptive Statistics by Countries and Sector

Country of headquarters	Basic material	Consumer cyclicals	Consumer non-cyclicals	Energy	Health care	Real estate	Technology	Utilities	Total
Bahrain	0	20	0	0	0	0	0	0	20
Brazil	100	100	150	40	30	10	40	110	580
Indonesia	40	10	80	50	10	30	70	10	300
Malaysia	20	40	130	50	10	30	60	40	380
Philippines	0	10	100	0	0	40	20	30	200
Qatar	0	0	10	10	0	20	20	0	60
Russia	90	0	10	90	0	10	30	40	270
Saudi Arabia	30	0	0	0	0	0	20	10	60
South Africa	190	150	270	10	40	90	70	0	820
Thailand	30	20	70	50	20	10	30	10	240
Turkey	30	30	90	10	0	10	20	0	190
United Arab Emirates	0	0	0	0	0	20	30	0	50
Total	530	380	910	310	110	270	410	250	3,170

Table 4

Correlation Matrix

	ICR	CEXT	CEXP	Profitability	CAP_Exp	Size	Liquidity	Env_Inno	GDPGrowth
ICR	1								
CEXT	-0.0392	1							
CEXP	-0.0427	0.8413	1						
Profitability	0.2659	0.0161	0.0307	1					
CAP_Exp	-0.1087	0.0435	0.0462	-0.0425	1				
Size	-0.139	0.1498	0.1506	0.0063	0.3221	1			
Liquidity	0.3244	-0.0629	-0.0669	0.1501	-0.1628	-0.0938	1		
Env_Inno	-0.0452	0.1552	0.1388	0.0435	0.0602	0.2059	-0.0854	1	
GDPGrowth	0.0467	0.0893	0.094	0.1386	-0.137	0.1099	0.0223	0.0374	1

Table 5

Result GMM

	(1) ICR	(2) ICR	(3) DSCR	(4) DSCR
L.ICR	0.567***	0.567***	0.528***	0.530***
	(0.0886)	(0.0886)	(0.0593)	(0.0591)
CEXT	-0.134**		-0.0878*	
	(0.0647)		(0.0642)	
CEXP		-0.158**		-0.0678*
		(0.0750)		(0.0607)
Profitability	4.785***	4.791***	2.305***	2.306***
	(0.980)	(0.974)	(0.474)	(0.475)
CAP_Exp	-0.0205	-0.0202	0.0175	0.0175
	(0.0196)	(0.0191)	(0.0147)	(0.0149)
Size	0.102*	0.0969*	-0.0128	-0.0119
	(0.0573)	(0.0559)	(0.0538)	(0.0555)
Liquidity	0.247***	0.245***	0.0948***	0.0952***
	(0.0544)	(0.0538)	(0.0331)	(0.0334)
Env_Inno	-0.00180*	-0.00177*	-0.000842	-0.000883
	(0.00109)	(0.00107)	(0.000741)	(0.000747)
GDP Growth	0.0194***	0.0197***	0.181*	0.173*
	(0.00650)	(0.00642)	(0.334)	(0.350)
Constant	17.41***	16.59**	4.267*	4.055*
	(6.742)	(6.603)	(8.008)	(8.409)
AR (1)	0.000	0.000	0.000	0.000
AR (2)	0.365	0.372	0.173	0.176

(continued)

	(1) ICR	(2) ICR	(3) DSCR	(4) DSCR
Hansen	0.652	0.657	0.651	0.631
Number of Instrument	11	11	11	11
Number Group	307	307	316	316
Sector Dummy	Yes	Yes	Yes	Yes
Country Dummy	Yes	Yes	Yes	Yes
Observations	2454	2454	2496	2496

Notes. Standard errors in parentheses.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 5 presents the findings of the System GMM estimation and provides robust empirical support for the central hypothesis of this study: the existence of a "disclosure penalty" in emerging markets. The coefficients for both climate risk disclosure variables, CEXT and CEXP, are negative and statistically significant at the 5% and 1% levels, respectively. Specifically, CEXT is associated with a decrease in the ICR by approximately 0.134 units, while CEXP corresponds to a larger decrease of 0.158 units. This indicates that firms voluntarily reporting exposure to climate risks are perceived by creditors as riskier borrowers, resulting in a higher implicit cost of debt and reduced ability to service existing obligations.

Climate risk disclosure may indicate that companies are engaging in activities that are increasingly seen as risky or not in line with changing environmental standards. In developing markets, where rules are often unpredictable, disclosing climate-related financial risks may lead to unexpected regulatory scrutiny, operational restrictions, or negative reactions from stakeholders. For example, a manufacturing firm that discloses significant water-intensive operations in drought-prone regions may face production curtailments as water regulations tighten. Also, if companies are open about activities that use a lot of carbon, this could lead to higher taxes on carbon or costs for emissions trading in places that adopt climate policies. These anticipated costs reduce future EBIT (the numerator of ICR), which decreases debt repayment capacity. Unlike developed markets where firms typically disclose alongside mitigation strategies, emerging market firms may lack resources for credible adaptation plans, causing disclosure to signal vulnerability without offsetting resilience measures (Duan et al., 2025; Mehedi et al., 2024). Firms disclosing substantial climate risks may be compelled to divert resources from productive investments toward climate adaptation or compliance activities yielding lower returns. For instance, coastal property exposure disclosure may necessitate expensive flood defenses, while transition risk disclosure may force premature asset retirement or technology shifts. These climate-driven capital allocations generate opportunity costs, reducing profitability and cash flow generation relative to non-disclosure peers who can defer or avoid such expenditures. Moreover, in competitive emerging markets, disclosure may disadvantage firms relative to non-disclosing competitors who avoid climate-related scrutiny and associated costs (Arya & Mittendorf, 2007). The cumulative effect weakens firms' financial performance and debt servicing capacity. These mechanisms support our hypothesis by demonstrating how disclosure creates firm-level financial burdens that manifest as reduced ICR. The effect operates through both increased financing costs (higher interest expense) and constrained operational performance (pressure on EBIT). Importantly, this is distinct from the actual underlying climate risk our measure captures disclosure effects conditional on firm characteristics, suggesting that the act of transparency itself imposes costs in emerging market institutional environments. The negative coefficients of -0.134 for CEXT and -0.158 for CEXP indicate that disclosing firms experience ICR reductions of approximately 7-9% relative to their non-disclosing counterparts, holding other factors constant.

Table 6

Statistic Split Based on ESG and Carbon

	High ESG ICR	Low ESG ICR	High Carbon ICR	Low Carbon ICR
L.ICR	0.442***	0.686***	0.373***	0.867***
	(0.162)	(0.0924)	(0.123)	(0.106)
CEXT	-0.180**	-0.0758	-0.255**	-0.0701
	(0.0920)	(0.140)	(0.115)	(0.195)
Profitability	6.183***	2.616**	6.541***	1.876**
	(1.626)	(1.034)	(1.294)	(0.941)
CAP_Exp	-0.00919	-0.0146	-0.0194	-0.0302
	(0.0395)	(0.0185)	(0.0347)	(0.0390)
Size	0.194*	-0.0227	0.105*	0.0397
	(0.105)	(0.0612)	(0.0558)	(0.102)
Liquidity	0.401***	0.166***	0.252***	0.141***
	(0.126)	(0.0440)	(0.0759)	(0.0538)
Env_Inno	-1.281**	-0.0294	-0.552*	-0.471
	(0.534)	(0.328)	(0.335)	(0.525)
GDP Growth	30.58**	1.334	13.17	11.65
	(12.54)	(7.755)	(8.404)	(11.95)
Constant	0.442***	0.686***	0.373***	0.867***
	(0.162)	(0.0924)	(0.123)	(0.106)
AR (1)	0.000	0.000	0.000	0.004
AR (2)	0.185	0.929	0.199	0.666
Hansen	0.454	0.570	0.896	0.779
Number of Instrument	11	11	11	11
Number Group	238	207	297	240
Sector Dummy	Yes	Yes	Yes	Yes
Country Dummy	Yes	Yes	Yes	Yes
Observations	1407	1047	1342	1112

Notes. Standard errors in parentheses.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 6 shows the subsample analysis. The result shows that the impact of climate risk disclosure (CEXT) on debt costs (ICR) is only significant for companies with high ESG (Environment, Social and Governance) scores, while the relationship is statistically insignificant for companies with low ESG scores. This indicates that creditors do not respond to climate risk disclosure uniformly but is heavily influenced by corporate governance and sustainability reputation (You et al., 2025). For companies with high ESG scores, climate risk disclosure is perceived negatively by creditors. This is because creditors have higher expectations from companies with good ESG performance, as they are considered already

to have strong climate risk management systems in place. When companies openly reveal considerable climate risks, this information is viewed as a sign of weakness and potential vulnerability. Consequently, creditors assess that the risk exposure is more serious than initially anticipated, thus increasing the risk premium and pushing up borrowing costs. On the contrary, for companies with lower ESG scores, creditors do not hold high expectations for their climate risk management quality from the outset. Therefore, additional information through disclosure does not appreciably affect risk perception, as it is considered neither credible nor relevant enough to change market assessments (Liu et al., 2025). This explains why the relationship between climate risk disclosure and borrowing costs is not significant for companies with low ESG scores.

The results show that companies with high emissions are negatively impacted by the disclosure of climate change risk, especially the disclosure of transition risk (Jin & Wang, 2025). These findings show that the more information that is shared, the less a company can handle its interest expenses, which means more debt costs. In other words, creditors do not see this information as a good sign of responsibility. Instead, they see it as proof that the company is very exposed to risks related to change in the economy, such as the introduction of carbon taxes, strict rules on emissions, and the transition to a low-carbon economy. The new information makes creditors want higher risk premiums. However, for a company that emits low levels of greenhouse gases, disclosing this information has no big impact. Investors already see these companies as relatively safe from the change to a low-carbon economy. Thus, voluntary climate risk disclosure does not function as a uniform signal of transparency but instead confirms risk, substantially affecting only companies with high carbon footprints (Ehlers et al., 2022; Owolabi et al., 2024).

Table 7

Statistic Split Based on ESG and Carbon

	High ESG ICR	Low ESG ICR	High Carbon ICR	Low Carbon ICR
L.ICR	0.485***	0.688***	0.367***	0.860***
	(0.123)	(0.0918)	(0.126)	(0.104)
CEXP	-0.109*	-0.0446	-0.263**	0.0314
	(0.0619)	(0.140)	(0.109)	(0.188)
Profitability	5.367***	2.615**	6.642***	1.905**
	(1.257)	(1.018)	(1.316)	(0.933)
CAP_Exp	-0.0194	-0.0148	-0.0195	-0.0272
	(0.0227)	(0.0184)	(0.0354)	(0.0385)
Size	-0.0403	-0.0217	0.106*	0.0317
	(0.137)	(0.0592)	(0.0578)	(0.101)
Liquidity	0.287***	0.165***	0.254***	0.142***
	(0.107)	(0.0436)	(0.0776)	(0.0533)
Env_Inno	0.0576	-0.0358	-0.559	-0.432
	(0.782)	(0.316)	(0.353)	(0.520)

(continued)

	High ESG ICR	Low ESG ICR	High Carbon ICR	Low Carbon ICR
GDP Growth	-0.526	1.482	13.32	10.78
	(18.26)	(7.462)	(8.829)	(11.87)
Constant	0.485***	0.688***	0.367***	0.860***
	(0.123)	(0.0918)	(0.126)	(0.104)
AR (1)	0.000	0.001	0.000	0.001
AR (2)	0.326	0.926	0.187	0.678
Hansen	0.157	0.456	0.922	0.801
Number of Ins	11	11	11	11
Number Group	238	207	297	240
Sector Dummy	Yes	Yes	Yes	Yes
Country Dummy	Yes	Yes	Yes	Yes
Observations	1407	1047	1342	1112

Notes. Standard errors in parentheses.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 7 shows that the effect of climate change exposure disclosure (CEXP) on a company's ability to cover interest expenses (ICR) varies depending on the company's ESG characteristics and carbon intensity. In companies with high ESG ratings, CEXP has a negative and significant effect on ICR. This finding indicates that even though companies have relatively good ESG performance, creditors still respond pessimistically when physical climate change risks are disclosed. Creditors interpret the disclosure of information about the threat of floods, storms, or extreme temperature rises as confirmation that the company still faces operational vulnerabilities and may face potential cash flow disruptions in the future. Thus, even though companies with high ESG profiles are considered to have better sustainability practices, the disclosure of physical risks increases creditors' concerns and drives up borrowing costs (Kempa, 2026).

In contrast, for companies with low ESG ratings, the effect of CEXP on ICR is insignificant. This suggests that creditors are likely to ignore the physical risk disclosures of these companies, either because of low disclosure levels or because the information is considered less credible. For companies with low ESG ratings, creditors may already have a high-risk perception, and therefore, additional disclosures do not significantly change their assessment.

The pattern resembles that observed when the study is predicated on carbon classifications. For industries with elevated emissions, CEXP adversely affects ICR significantly. Physical risk disclosure is viewed as an affirmation of the company's significant vulnerability to climate change effects, so enhancing creditors' risk perceptions and increasing risk premiums. In contrast, for enterprises with minimal emissions (low carbon), the effect of CEXP is negligible. Creditors perceive low-emission enterprises as comparatively insulated from the physical risks posed by climate change; hence, further information regarding physical risk does not significantly alter the credit risk evaluation (Carbone et al., 2021; Curcio et al., 2023).

CONCLUSION

The research findings indicate that climate risk disclosure, both transition risk (CEXT) and physical risk (CEXP), has a significant negative impact on a company's ability to meet its interest payment obligations, as measured by the Interest Coverage Ratio (ICR) and Debt Service Coverage Ratio (DSCR). This means that the higher the level of climate risk disclosure, the lower the company's ability to cover its interest expenses from its operating income. These findings confirm the existence of a disclosure penalty phenomenon in emerging markets, where creditor perceived information openness as a sign of vulnerability, rather than good governance. Creditors assess that companies voluntarily disclosing climate risks potentially face additional future costs, whether in the form of adaptation investments, regulatory compliance, or potential operational losses. Consequently, they demand a higher risk premium, thereby increasing the company's cost of debt and reducing its repayment capacity.

The analytical results indicate that the adverse consequences of climate risk disclosures are consistently observed across companies, with significantly greater impacts in firms exhibiting high ESG scores and substantial carbon emissions. This situation arises from creditors' elevated expectations of enterprises deemed dedicated to sustainability. Consequently, when these organisations reveal substantial climate concerns, the information is frequently interpreted as indicative of inadequate risk management, thereby exacerbating lenders' sense of risk. Conversely, for companies with high ESG scores or minimal carbon emissions, these disclosures exert diminished influence as they are perceived as less pertinent or less credible in altering market valuations.

The study advises policymakers in developing nations to establish a more standardized and incentivized framework for climate risk disclosure, ensuring that transparency does not result in financial penalties for corporations. Governments and financial authorities must enhance market comprehension by improving financial literacy for institutions and investors, ensuring that climate risk disclosure is perceived as a measure of adaptation readiness rather than a sign of weakness. Furthermore, corporations are encouraged to equilibrate risk disclosures with details on specific mitigation and adaptation plans to ensure that the market perceives a more solution-focused message. At a macro level, international cooperation and investment for green transitions are essential for enhancing market confidence in enterprises dedicated to climate transparency and long-term sustainability.

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REFERENCES

Addoum, J. M., Ng, D. T., & Ortiz-Bobea, A. (2020). Temperature shocks and establishment Sales. *The Review of Financial Studies*, *33*(3), 1331–1366. https://doi.org/10.1093/rfs/hhz126

Altman, E. I., & Hotchkiss, E. (2005). *Corporate financial distress and bankruptcy*. Wiley. https://doi.org/10.1002/9781118267806

Andersson, M., Bolton, P., & Samama, F. (2016). Hedging climate risk. *Financial Analysts Journal*, *72*(3), 13–32. https://doi.org/10.2469/faj.v72.n3.4

Arya, A., & Mittendorf, B. (2007). The interaction among disclosure, competition between firms, and analyst following. *Journal of Accounting and Economics*, *43*(2–3), 321–339. https://doi.org/10.1016/j.jacceco.2006.11.001

Attenborough, D. (2022). Corporate disclosures on climate change: An empirical analysis of FTSE all-share British fossil fuel producers. *European Business Organization Law Review, 2*3, 313–346. https://doi.org/10.1007/s40804-022-00246-2

Aven, T. (2020). Climate change risk–what is it and how should it be expressed? *Journal of Risk Research*, *23*(11), 1387–1404. https://doi.org/10.1080/13669877.2019.1687578

Battiston, S., Mandel, A., Monasterolo, I., Schütze, F., & Visentin, G. (2017). A climate stress-test of the financial system. *Nature Climate Change*, *7*(4), 283–288. https://doi.org/10.1038/nclimate3255

Bolton, P., & Kacperczyk, M. (2021). Do investors care about carbon risk? *Journal of Financial Economics*, *142*(2), 517–549. https://doi.org/10.1016/j.jfineco.2021.05.008

Caldecott, B., Harnett, E., Cojoianu, T., Kok, I., Pfeiffer, A., & Rios, A. R. (2016). *Stranded assets: A climate risk challenge*.

Carbone, S., Giuzio, M., Kapadia, S., Krämer, J. S., Nyholm, K., & Vozian, K. (2021). Working Paper Series the low-carbon transition, climate commitments and firm credit risk. https://doi.org/10.2866/56399

Chava, S. (2014). Environmental externalities and cost of capital. *Management Science*, *60*(9), 2223–2247. https://doi.org/10.1287/mnsc.2013.1863

Cheng, B., Ioannou, I., & Serafeim, G. (2014). Corporate social responsibility and access to finance. *Strategic Management Journal*, *35*(1), 1–23. https://doi.org/10.1002/smj.2131

Choi, D., Gao, Z., & Jiang, W. (2020). Attention to global warming. *Review of Financial Studies*, *33*(3), 1112–1145. https://doi.org/10.1093/rfs/hhz086

Clarkson, P. M., Li, Y., Richardson, G. D., & Vasvari, F. P. (2008). Revisiting the relation between environmental performance and environmental disclosure: An empirical analysis. *Accounting, Organizations and Society*, *33*(4–5), 303–327. https://doi.org/10.1016/j.aos.2007.05.003

Connelly, B. L., Certo, S. T., Ireland, R. D., & Reutzel, C. R. (2011). Signaling theory: A review and assessment. *Journal of Management, 37*(1), 39–67. https://doi.org/10.1177/0149206310388419

Curcio, D., Gianfrancesco, I., & Vioto, D. (2023). Climate change and financial systemic risk: Evidence from US banks and insurers. *Journal of Financial Stability*, *66*, 101132. https://doi.org/10.1016/j.jfs.2023.101132

Dell, M., Jones, B. F., & Olken, B. A. (2009). Temperature and income: Reconciling new cross-sectional and panel estimates. *American Economic Review*, *99*(2), 198–204. https://doi.org/10.1257/AER.99.2.198

Depoers, F., Jeanjean, T., & Jérôme, T. (2016). Voluntary disclosure of greenhouse gas emissions: Contrasting the carbon disclosure project and corporate reports. *Journal of Business Ethics*, *134*(3), 445–461. https://doi.org/10.1007/s10551-014-2432-0

Dhaliwal, D. S., Li, O. Z., Tsang, A., & Yang, Y. G. (2011). Voluntary nonfinancial disclosure and the cost of equity capital: The initiation of corporate social responsibility reporting. *Accounting Review*, *86*(1), 59–100. https://doi.org/10.2308/accr.00000005

Di Febo, E., & Angelini, E. (2025). Transition risk in climate change: A literature review. *Risks*, *13*(4), 66. https://doi.org/10.3390/risks13040066

Doruk, Ö. T. (2025). Climate change exposure and firm value: Evidence from low and middle income economies. *Finance Research Letters*, *85*, 107977. https://doi.org/10.1016/j.frl.2025.107977

Drehmann, M., Illes, A., Juselius, M., & Santos, M. (2015). How much income is used for debt payments? A new database for debt service ratios. In *BIS Quarterly Review*. www.bis.org/statistics/dsr.htm.

Duan, D., Wei, R., Wang, C., & Xia, B. (2025). Opportunity or obstacle? Climate risk disclosure and corporate ESG performance. *International Review of Economics and Finance*, *100*, 104101. https://doi.org/10.1016/j.iref.2025.104101

Ehlers, T., Packer, F., & de Greiff, K. (2022). The pricing of carbon risk in syndicated loans: Which risks are priced and why? *Journal of Banking and Finance*, *136.* https://doi.org/10. 1016/j. jbankfin.2021.106180

Ferdous, L. T., Atawnah, N., Yeboah, R., & Zhou, Y. (2024). Firm-level climate risk and accounting conservatism: International evidence. *International Review of Financial Analysis*, *95*, 103511. https://doi.org/10.1016/j.irfa.2024.103511

Ginglinger, E., & Moreau, Q. (2023). *Climate risk and capital structure*. http://ssrn.com/abstract_id= 3327185www.ecgi.global/content/working-papers

Hasan, I., Lee, H., Qiu, B., & Saunders, A. (2025). Climate-related disclosure commitment of the lenders, credit rationing, and borrower environmental performance. *Review of Accounting Studies*, *31*(1), 1-44. https://doi.org/10.1007/s11142-025-09918-z

Hewa, S., Mala, R., Chen, J., & Dumay, J. (2025). Climate related disclosures and investor behaviour: An Australian study. *Advances in Accounting*, *68*, 100809. https://doi.org/10.1016/j.adiac.2025. 100809

Huang, H. H., Kerstein, J., & Wang, C. (2018). The impact of climate risk on firm performance and financing choices: An international comparison. *Journal of International Business Studies*, *49*(5), 633–656. https://doi.org/10.1057/s41267-017-0125-5

Huang, H. H., Kerstein, J., Wang, C., & Wu, F. (2022). Firm climate risk, risk management, and bank loan financing. *Strategic Management Journal*, *43*(13), 2849–2880. https://doi.org/10.1002/ smj.3437

IEA. (2023). *World energy outlook 2023*. https://www.iea.org/reports/world-energy-outlook-2023

Iotti, M., Manghi, E., & Bonazzi, G. (2024). Debt sustainability assessment in the biogas sector: Application of interest coverage ratios in a sample of agricultural firms in Italy. *Energies*, *17*(6), 1404. https://doi.org/10.3390/en17061404

IPCC. (2023). *Climate change 2022 – Impacts, adaptation and vulnerability*. Cambridge University Press. https://doi.org/10.1017/9781009325844

Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics*, *3*(4), 305–360. https://doi.org/10.1016/ 0304-405X(76)90026-X

Jin, W., & Wang, Y. (2025). If money talks: Climate change-related regulation and firms' cost of debt. *Borsa Istanbul Review*, *25*(2), 275–285. https://doi.org/10.1016/j.bir.2025.01.002

Jung, J., Herbohn, K., & Clarkson, P. (2018). Carbon risk, carbon risk awareness and the cost of debt financing. *Journal of Business Ethics*, *150*(4), 1151–1171. https://doi.org/10.1007/s10551-016-3207-6

Kahn, M. E., Mohaddes, K., Ng, R. N. C., Pesaran, M.H, Raissi, M., & Yang, J.-C. (2021). *Long-term macroeconomic effects of climate change: A cross-country analysis*. https://doi.org/10. 17632/hytzz

Kempa, K. (2026). Physical climate risk and the pricing of bank loans. *Journal of Environmental Economics and Management*, *137*, 103280. https://doi.org/10.1016/j.jeem.2025.103280

Khanna, T., & Palepu, K.G. (1997). Why focused strategies may be wrong for emerging markets. *Harvard Business Review*. https://hbr.org/1997/07/why-focused-strategies-may-be-wrong-for-emerging-markets

Kleimeier, S., & Viehs. P. M. (2016). Carbon disclosure, emission levels, and the cost of debt. In *Emission levels, and the cost of debt*. https://doi.org/10.26481/umagsb.2016003

Kling, G., Volz, U., Murinde, V., & Ayas, S. (2021). The impact of climate vulnerability on firms' cost of capital and access to finance. *World Development*, *137,* 105131. https://doi.org/10.1016/j.worlddev.2020.105131

Krueger, P., Sautner, Z., & Starks, L. T. (2019). *The importance of climate risks for institutional investors* (ECGI Finance Working Paper No. 610/2019). European Corporate Governance Institute. https://doi.org/10.2139/ssrn.3235190

Kruttli, M. S., Tran, B. R., & Watugala, S. W. (2025). Pricing Poseidon: Extreme weather uncertainty and firm return dynamics. *Journal of Finance*, *80*(2), 783–832. https://doi.org/10.1111/JOFI.13416

Liu, R., Li, J., & Wu, M. (2025). The impact of climate change risk on corporate debt financing capacity: A moderating perspective based on carbon emissions. *Sustainability (Switzerland)*, *17*(14). https://doi.org/10.3390/su17146276

Matsumura, E. M., Prakash, R., & Vera-Muñoz, S. C. (2014). Firm-value effects of carbon emissions and carbon disclosures. *Accounting Review*, *89*(2), 695–724. https://doi.org/10.2308/accr-50629

Mehedi, S., Nahar, S., & Jalaludin, D. (2024). Determinants of corporate climate change disclosure: Is the mediating role of corporate strategic response to environmental governance and policy matter? Evidence from emerging market. *Sustainable Development*, *32*(1), 195–210. https://doi.org/10.1002/sd.2641

Meng, X. H., Zeng, S. X., Shi, J. J., Qi, G. Y., & Zhang, Z. B. (2014). The relationship between corporate environmental performance and environmental disclosure: An empirical study in China. *Journal of Environmental Management*, *145*, 357–367. https://doi.org/10.1016/j.jenvman.2014.07.009

Owolabi, A., Mousavi, M. M., Gozgor, G., & Li, J. (2024). The impact of carbon risk on the cost of debt in the listed firms in G7 economies: The role of the Paris agreement. *Energy Economics*, *139*, 107952. https://doi.org/10.1016/j.eneco.2024.107925

Pankratz, N., Bauer, R., & Derwall, J. (2023). Climate change, firm performance, and investor surprises. *Management Science*, *69*(12), 7352–7398. https://doi.org/10.1287/mnsc.2023.4685

Park, H., & Kim, J. D. (2020). Transition towards green banking: Role of financial regulators and financial institutions. *Asian Journal of Sustainability and Social Responsibility*, *5*(1). https://doi.org/10.1186/s41180-020-00034-3

Pinner, D., Rogers, M., & Samandari, H. (2020). Addressing climate change in a post-pandemic world. *Mckinsey Quarterly*.

Qiu, X., Zhuang, Y., & Liu, X. (2025). Climate risk and corporate debt financing: Evidence from Chinese a-share-listed firms. *Sustainability (Switzerland)*, *17*(9), 3870. https://doi.org/10.3390/su17093870

Rao, S., Koirala, S., Thapa, C., & Neupane, S. (2022). When rain matters! Investments and value relevance. *Journal of Corporate Finance*, *73,* 101827. https://doi.org/10.1016/j.jcorpfin.2020.101827

Sautner, Z., Van Lent, L., Vilkov, G., & Zhang, R. (2023). Firm-Level climate change exposure. *The Journal of Finance*, *78*(3). https://doi.org/10.1111/jofi.13219

Seltzer, L., Starks, L. T., & Zhu, Q. (2020). Climate regulatory risks and corporate bonds. *SSRN Electronic Journal.* https://doi.org/10.2139/ssrn.3563271

Sheren, M., Ashton, C., Scott, M., & Allen, M. (2015). Breaking the tragedy of the horizon - climate change and financial stability. *Speech given at Lloyd's of London*, 220–230.

Smith, C. W., & Warner, J. B. (1979). On financial contracting an analysis of bond covenants. *Journal of Financial Economics, 7*(2), 117-161. https://doi.org/10.1016/0304-405X(79)90011-4

Spence, M. (1973). Job market signaling. *The Quarterly Journal of Economics*, *87*(3), 281–306.

Stern, N., & Valero, A. (2021). *Innovation, growth and the transition to net-zero emissions*. https://doi.org/10.1016/j.respol.2021.104293

Swart, R. (2019). *Assessing physical climate risks for investments: A risky promise*. https://doi.org/ 10.1016/j.cliser.2019.04.001

Tang, Q., & Luo, L. (2014). Carbon management systems and carbon mitigation. *Australian Accounting Review*, *24*(1), 84–98. https://doi.org/10.1111/auar.12010

Thomas, K., Hardy, R. D., Lazrus, H., Mendez, M., Orlove, B., Rivera-Collazo, I., Roberts, J.T., Rockman, M., Warner, B.P., & Winthrop, R. (2019). Explaining differential vulnerability to climate change: A social science review. *Wiley Interdisciplinary Reviews: Climate Change*, *10*(2), e565. https://doi.org/10.1002/ WCC.565

Trinh, V. Q., Trinh, H. H., Li, T., & Vo, X. V. (2024). Climate change exposure, financial development, and the cost of debt: Evidence from EU countries. *Journal of Financial Stability*, *74*. https://doi.org/10.1016/j.jfs.2024.101315

UNEP. (2021). *Creating a financial industry that positively impacts and serves people and planet*. https://www.unepfi.org/industries/banking/annual-overview-2021/

Vestrelli, R., Colladon, A.F., & Pisello, A. L. (2024). When attention to climate change matters: The impact of climate risk disclosure on firm market value. *Energy Policy*, *185*. https://doi.org/10.1016/j.enpol.2023.113938

You, X., Chen, C., Peng, K., & Li, Y. (2025). ESG disclosure quality and cost of debt. *Emerging Markets Review*, *64*. https://doi.org/10.1016/j.ememar.2024.101219