Climate Risk Disclosure and Financial Performance of High Carbon Emission Companies in China

(Pendedahan Risiko Iklim dan Prestasi Kewangan Syarikat Pelepasan Karbon Tinggi di China)

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ABSTRACT

Unlike past studies that focus on environment, social and governance disclosure, this study aims to examine the association between climate risk disclosure (CRD) and corporate financial performance (FP). Climate-related risks are fundamentally intertwined with a company's risks, amplifying the drive for companies to communicate these risks to stakeholders openly. This study used a sample of 1,241 annual reports of China's high carbon emission A-share listed companies from 2013 to 2022 as samples and used the climate-related risk keywords developed by prior literature to quantitatively measure the level of the company's disclosure of climate risk information. The empirical results indicate that CRD, which is directly related to the overall business risks, is positively associated with the three FP measurement indicators, i.e., return on assets, return on equity and Tobin's Q. The results also passed the robustness tests. Theoretically, the results underscore the importance of stakeholder legitimacy actions in the form of CRD because it informs stakeholders' decisions and empowers them to support sustainable business practices that could enhance company performance.

Keywords: Climate risk disclosure; financial performance; high carbon emission industries; stakeholder-legitimacy; content analysis.

ABSTRAK

Berbeza daripada kajian lepas yang memberi tumpuan kepada pendedahan Alam Sekitar, Sosial dan Tadbir Urus (ESG), kajian ini bertujuan untuk mengkaji hubungan antara pendedahan risiko iklim (CRD) dan prestasi kewangan korporat (FP). Risiko berkaitan iklim pada asasnya saling berkaitan dengan risiko syarikat, menguatkan dorongan bagi syarikat untuk mengkomunikasikan risiko ini secara terbuka kepada pihak berkepentingan. Kajian ini menggunakan sampel 1,241 laporan tahunan syarikat pelepasan karbon tinggi China yang tersenarai "A-share", dari 2013 hingga 2022 sebagai sampel dan menggunakan kata kunci risiko berkaitan iklim yang dibangunkan oleh kajian terdahulu untuk mengukur tahap pendedahan syarikat mengenai maklumat risiko iklim. Keputusan empirikal menunjukkan bahawa pendedahan risiko iklim, yang berkaitan secara langsung dengan risiko perniagaan keseluruhan, secara positif berkaitan dengan tiga petunjuk pengukuran prestasi kewangan, iaitu, Pulangan atas Aset (ROA), Pulangan atas Ekuiti (ROE), dan Tobins Q. Keputusan ini juga tekal dengan ujian keteguhan. Secara teorinya, dapatan kajian menekankan kepentingan tindakan legitimasi pihak berkepentingan dalam bentuk pendedahan risiko iklim, kerana ia dapat membantu pembuatan keputusan pihak berkepentingan, dan memberi kuasa kepada pihak berkepentingan untuk menyokong amalan perniagaan mampan yang dapat meningkatkan prestasi syarikat.

Kata kunci: Pendedahan risiko iklim; prestasi kewangan; industri pelepasan karbon tinggi; legitimasi-pihak berkepentingan; analisis kandungan

INTRODUCTION

Climate change poses threats, such as supply chain disruptions and sharp rises in production costs due to frequent extreme weather events, to high carbon emission industries,[1] resulting in billions of dollars in yearly losses. In addition, many companies with non-conforming carbon emissions risk customer boycotts and major investors' divestment. Companies that disclose climate risk information and how they manage the risks have the potential to reduce financing costs and increase financial performance (FP). To date, studies have concentrated on the effects of environmental, social and governance (ESG) practices or disclosure on company performance (Chen & Xie 2022; Lee & Raschke 2023; Wong & Zhang 2022; Wong et al. 2021). However, little is understood about the relationship between climate information disclosure and company performance. Analysing climate-related risk information provides an advantage for this study to examine the mixed results found in the ESG disclosure–

performance relationship (Annachiara & Raffaella 2018; Ebru 2022; Lucy & Martin 2018) because different from ESG disclosure, climate-related risks primarily are directly related to a company's risks. This fact increases the motivation for companies to disclose climate-related risk information to stakeholders. This study therefore aims to test the relationship between climate risk disclosure (CRD) and FP by taking China's high carbon emission industry as the sample.

Stakeholder-legitimacy theory can provide solid theoretical support for the relationship between sustainability practices, CRD and FP in this study (Lee & Raschke 2023). If an enterprise wants good FP, it should not only focus on the needs of stakeholders but also ensure that its operation follows the value system of the society in which it is located and form the expected contractual relationship with all parts of the society. Companies need proper strategies to take legitimate actions and demonstrate their ability to balance their objectives with shareholders' demands in the form of disclosure. As a legal information transmission medium, the disclosure of climate information of companies in annual reports proves that companies are pragmatically fulfilling their social responsibilities for environmental protection through open and transparent climate-related information. This disclosure can become a strategy that enhances the positive image of companies, potentially subsequently strengthening market competitiveness. The motivation for this paper stems from the increasing attention that investors are now paying to climate risks because they can threaten the FP of investees, i.e., their investment portfolios (Vestrelli et al. 2024). In response to these significant and growing demands, efforts have been made to enhance the transparency of corporate reporting concerning climate. The Task Force on Climate-related Financial Disclosures (TCFD) was introduced in 2015 to address climate-related financial disclosure. Considering all the previous requirements, including those from the TCFD, the International Sustainability Standards Board (ISSB) issued the International Financial Reporting Standard (IFRS) S2 in late 2023. The latter standard outlines specific minimum disclosure requirements related to climate that will be mandated for all companies globally. This development marks a new era in corporate reporting.

This paper selects 1,241 annual reports of all high carbon emission companies listed as A shares in China from 2013 to 2022 as samples to determine the relationship between CRD and corporate FP. As a typical developing country and the world's second-largest economy, China's economic and industrial development significantly impacts the global environment. Using China as the research background will help provide practical strategies for the international response to climate change. China is also one of the countries with the most significant carbon emissions globally. With the release of the reform and opening-up policy, China has experienced rapid urbanisation and industrialisation, and its carbon emissions have also continued to grow yearly. Therefore, government departments have issued a series of measures, such as carbon emissions trading, setting carbon reduction targets and promoting green and clean energy. Such a policy environment is conducive to the research related to CRD. At the same time, China is currently facing a critical period of green economy transformation and economic restructuring, and this study will help to explore the risks and opportunities in this transition period. Likewise, the rationale behind selecting industries with high carbon emissions is apparent. By their pronounced carbon output, these sectors represent a primary driver behind the marked escalation in carbon emissions. Investigation into these industries elucidates the carbon footprint and emission mitigation prospects inherent in the broader economic boundaries.

In contrast to other sectors, the CRD of companies in high carbon emission industries is confronted with heightened economic and technological hurdles during the implementation phase. Moreover, given the constraints imposed by China's environmental protection policies and the growing trend of green consumption, the FP of companies in high-carbon emission industries is more vulnerable to climate change. This study helps to explore the impact of business strategies in addressing climate change risk (in the form of disclosure strategy) and the FP of these companies. Finally, overall, the high carbon emission industry has attracted more regulatory and public attention from the environmental protection authorities than other industries. Therefore, the information disclosed on climate risk is expected to be sufficient and reliable. Based on a series of empirical analyses, this study concludes that a positive relationship exists between CRD at the company level and FP. Specifically, CRD is significantly positively related to return on assets (ROA), return on equity (ROE) and Tobin's Q, the three standard performance measures selected in this study. The research results are robust to several alternative tests. The results imply that the emphasis of high carbon emission companies on CRD could positively affect their performance.

The contributions of this paper are twofold. Firstly, very few scholars have systematically studied the relationship between climate disclosure and performance as presented herein (for example, Vestrelli et al. 2024). This paper offers evidence of the economic consequences of CRD within the context of China's high carbon emissions industry. The significance of this context in an emerging economy, as described, could enhance the robustness of the analysis. Secondly, this paper has adopted the three most common performance measurement indicators in the literature as the explained variables, thereby greatly enriching the results instead of selecting only one or two, as in Vestrelli et al. (2024) or other studies.

LITERATURE REVIEW

With the changing times, investors' evaluation of investment objectives is no longer confined to traditional financial statements. To ensure the stability and sustainability of the investee companies, an increasing number of investors are paying attention to the disclosure levels of companies in ESG. Most scholars cite stakeholder or legitimacy theory and conclude that the ESG disclosure level is positively associated with the company's FP (Wan & Shaista 2021; Chen & Xie 2022; Albitar et al. 2020).

However, the evidence is mixed. Annachiara and Raffaella (2018) contend that a higher level of environmental disclosure in green supply chain management leads to better FP for companies. Conversely, Ebru (2022) has concluded that environmental disclosure harms a company's FP. Lucy and Martin (2018) discovered a reverse relationship, indicating that companies with better financial conditions pay less attention to environmental protection. In addition to environmental performance, Mohammad et al. (2020) found a positive relationship between sustainability disclosure and performance. While these studies have conducted some in-depth research based on ESG or sustainability, they lack specificity on climate-risk disclosure. In contrast to the general public's ESG issues, these climate-related risks are evident threats that directly impact the company and can result in significant financial consequences. Disclosures related to climate risks therefore offer a valuable framework for testing stakeholder legitimacy theory. Addressing climate risks is increasingly seen as a strategy to simultaneously legitimise critical stakeholders' perceptions, such as shareholders and the community.

With global warming and increasingly frequent extreme weather events, the issue of climate change has sparked heated discussions across various sectors. Governments worldwide are continuously implementing stricter regulations on greenhouse gas emissions. Corresponding measures taken by companies to comply with these regulations, such as purchasing carbon emission quotas and investing in clean technologies, will increase operating expenses, subsequently impacting operating efficiency negatively. Simultaneously, damage caused by extreme weather to enterprise facilities and equipment and the stability of energy supply can directly affect company performance (Sun et al. 2020). A growing number of individuals, including investors, are advocating for low-carbon and environmentally friendly practices, leading to reduced investment in high-carbon emission companies. Given that climate change significantly affects operations in high-carbon emission industries, companies increasingly emphasise sustainable development, mainly focusing on climate-related aspects.

To demonstrate their consideration of the environment in operations to stakeholders, many companies have disclosed climate-related information through sustainability reports (SRS) (Kouloukoui et al. 2019). Accountants need to establish relevant environmental performance indicators, specifically climate-related ones, to measure and monitor investment costs in environmental protection and report the results to appropriate managers and other stakeholders on time. CRD is rapidly expanding in developed countries. The disclosure of climate risk requires companies to conduct climate accounting, collecting and sorting out climate risks related to their operations and social environment. Some scholars believe that considering CRD can help companies gain financial and market competitive advantages (Ilhan et al. 2023). This consideration is supported by studies showing that the groups paying the most attention to climate and environmental issues are millennials and Generation Z, who are increasingly becoming the primary consumers in the market (Tyson et al. 2021). Therefore, the more a company prioritises CRD, the better its performance can be expected. In the current field of financial accounting research, much of the focus on CRD has been on factors influencing it (Hussein et al. 2022; Isabel et al. 2022), as well as research on the TCFD (Thanh Ngo et al. 2022; AI Moreno & Caminero 2022). However, insufficient attention has been given to the consequences of climate-related risks (Sun et al. 2020; Sun et al. 2023) and climate-related risk disclosure (Vestrelli et al. 2024).

This study utilises the stakeholder-legitimacy framework, which posits that stakeholders must be considered legitimate entities with valid claims and aligned behaviour (Santana 2012). Legitimacy involves societal acceptance, valid claims indicate recognised entitlements, and legitimate behaviour entails adherence to societal norms (Santana 2012). Thus, the legitimacy of companies disclosing CRD is evidenced by meeting these three criteria, potentially boosting stakeholder acceptance and FP.

According to stakeholder theory, a company's market value primarily depends on its ability to cater to diverse stakeholder needs (Pedrini & Ferri 2019). Stakeholders encompass various groups with interests ranging from financial returns to environmental concerns like low-carbon products. Companies must balance these interests, ensuring that disclosing climate risk information does not compromise profits or market value. Adequate disclosure addresses shareholder and employee concerns, shaping the company's reputation and affirming its legitimacy.

A reputable stance on CRD offers numerous advantages. First, companies with solid disclosure practices attract socially responsible investors, reducing capital costs and expanding the investor base (Ilhan et al. 2023). These companies are perceived as better equipped to handle climate and market risks, facing fewer regulatory challenges, which fosters long-term value creation. High-quality disclosure also meets rising demands from business-to-business customers, consumers and other buyers (Arian & Sands 2024), enhancing market access and contract opportunities.

Second, positive buyer behaviour, driven by trust in the company's environmental commitment, increases customer loyalty and repeat business (Kumar 2020). This loyalty translates into higher sales volumes and values, giving the company a competitive edge. A strong reputation also elevates market value and facilitates partnerships within supply chains (Bilro et al. 2023; Dzhengiz 2020), fostering growth and collaboration.

Third, company reputation influences talent attraction and retention (Rodrigues et al. 2021). Job seekers are drawn to purpose-driven organisations offering fulfilment beyond financial compensation. Trust in the company's mission enhances productivity and reduces turnover rates, further bolstering performance.

In summary, climate risk management efforts, including disclosure practices, enhance company reputation, thus improving access to resources, market opportunities, profitability and brand value, ultimately enhancing FP. On this basis, this paper puts forward the following hypothesis:

H_1 A positive relationship exists between CRD and company performance.

METHODOLOGY

SAMPLE SELECTION AND DATA SOURCES

Since 2013, the State Council of China has issued an action plan to prevent and control air pollution for Chinese A-share listed companies. Therefore, this paper selects explicitly the annual reports of A-share listed companies in China's high carbon emission industry from 2013 to 2022 as the research sample for reasons stated in the introduction section. The initial sample was 1,831 company years. This study excluded 590 company-years because of variations in the timing of annual report releases across different companies and extreme values falling within the top and bottom 1% of the sorted data. As a result, the final sample comprised 1,241 company-years. Climate risk data is obtained from the annual report, and other financial data is from the China Stock Market & Accounting Research database (CSMAR).

VARIABLES MEASUREMENT

This paper draws on the current literature on climate risk studies that use text analysis of CRD (Li et al. 2024). Their study constructed a 'climate risk' dictionary from the earnings conference call records of listed companies in the United States. This measure differs from climate-related financial disclosure, as TCFD or IFRS S2 suggested, because this study focuses solely on climate risks. By contrast, those guidelines place a financial emphasis and encompass a broader scope of climate issues, including governance, strategy, risk management, metrics and targets.

However, the annual reports of Chinese-listed companies are generally written in Chinese. The terms (expressions) in Chinese have been acknowledged to be much greater (richer) than those in English (Li et al. 2024). Errors could therefore occur in mechanically translating and retrieving from the English dictionary constructed by Li et al. (2024) to measure climate risk. For example, when analysing the annual report, the following similar situations may occur: 'flooding' can simply refer to 'flood', that is, abnormal high precipitation caused by extreme weather, and 'the flood' may refer to a specific flood event, 'the floods' refers to multiple types of floods, and 'a flood of' can be used to describe many people and objects. Therefore, to ensure the validity of the extracted vocabulary in representing climate risk, this paper translated the dictionary developed by Li et al. (2024) into Chinese and manually analysed the keywords using the knowledge of Chinese grammar. The instructions of the China Meteorological Disaster Yearbook are also used as a source to judge and delete irrelevant or invalid text content. Therefore, the final keywords used are presented in Appendix A. Careful checking of the keywords and adaptation to the Chinese language increases the measure's validity.

Using automated computer procedures for information retrieval and analysis enhances the consistency and reliability of the results. The count of CRDs calculated using a computer was compared with manual calculations for several companies to ensure consistency and reliability. Adjustments were then made to the program to reflect the actual disclosure of climate risks accurately. This study calculated the ratio of 'climate risk' words to the total number of words in the annual report to obtain the level of CRD (Li et al. 2020). The larger the index value, the more attention companies pay to climate risk literally.

Companies generally measure FP through financial indicators like ROE, ROA and Tobin's Q value (Chen & Xie 2022; Liu et al. 2021). ROE reflects the return received by owners' equity by measuring the net profit ratio to average net assets. ROA measures the net profit per unit of assets by calculating the ratio of after-tax net profit to total assets. Tobin Q measures a company's growth by calculating the ratio of its market value to its net assets.

Based on the research results of Li et al. (2024) and Qi Yudong (2021), this paper controls the impact of variables such as company size (Size), asset–liability ratio (Lev), company listing age (Age), company growth (Growth), The largest shareholder's shareholding (top 1), liquidity (La), free cash flow (cash), independent director ratio (board), audit quality (big 4), The proportion of female executives (female) on corporate FP. The specific

variables are defined in Table 1.

TABLE 1. Variables measurement

Variable type	Variable indicator	Variable symbol	Calculation formula
Independent variable	Climate risk disclosure	*CRD*	Proportion of the number of "climate risk" keywords from the total number of words in the annual report x 100%
Dependent variable	Return on equity	*ROE*	The ratio of a company's net profit to average shareholders' equity x 100%
	Return on assets	*ROA*	(after tax net profit ÷ average total assets) × 100%
	Tobin's Q	*Tobin*	(Market capitalization/book value of assets) x 100%
Control variable	Company listing age	*age*	Current year - year of listing
	Asset capability ratio	*lev*	(Total liabilities at the end of the period / total assets at the end of the period) x 100%
	Company size	*size*	Natural logarithm of total assets at the end of the period
	Operating income growth rate	*Growth*	(The ratio of the increase in the company's operating revenue this year to the total operating revenue of the previous year) x 100%
	The largest equity shareholding	*top1*	The percentage of the largest shareholder ownership at the end of the period.
	Liquidity	*La*	(current assets/total assets) x 100%
	Free cash flow	*Cash*	(net operating profit after tax + depreciation and amortization) - (capital expenditure + increase in working capital)
	Independent director ratio	*Board*	The proportion of independent directors on the board x 100%
	Audit quality	*big4*	Valued 1 if the four major accounting companies audit the enterprise, and 0 otherwise.
	The proportion of female executives	*Female*	(The number of female executives divided by the total number of executives) x 100%

Model Settings

Based on the previous content, this study proposes the following model:

$$Perform_{it} = \alpha_0 + \alpha_1 CRD_{it} + \alpha_2 age_{it} + \alpha_3 lev_{it} + \alpha_4 size_{it} + \alpha_5 growth_{it} + \alpha_6 top1_{it} + \alpha_7 la_{it} + \alpha_8 cash_{it} + \alpha_9 board_{it} + \alpha_{10} big4_{it} + \alpha_{11} female_{it} + e_{it}$$

where *Perform* denotes company performance represented by *ROE*, *ROA* and *Tobin* and other variables are as defined in Table 1.

RESULTS

TABLE 2. Descriptive statistics

variable	mean	s.d.	median	min	max
Tobin	1.535	0.777	1.287	0.767	8.744
ROE	0.059	0.186	0.069	-3.826	0.432
ROA	0.058	0.053	0.053	-0.473	0.286
CRD	0.336	0.224	0.282	0.026	1.280
age	3.020	0.288	3.045	1.792	3.664
lev	0.486	0.175	0.494	0.048	0.972
size	23.050	1.423	22.930	20.140	26.940
growth	0.203	1.541	0.064	-1.854	49.810
top1	0.359	0.154	0.351	0.036	0.877
la	0.392	0.216	0.375	0.019	0.902
cash	0.068	0.058	0.066	-0.260	0.288
board	0.365	0.047	0.333	0.231	0.600
big4	0.106	0.307	0.000	0.000	1.000
female	0.139	0.149	0.125	0.000	0.875

Note: N=1,241 company-years

According to the descriptive results in Table 2, no severe outliers occur when the mean and median values are generally similar. The average value of CRD is 0.336% of the total words in the annual report. Compared with previous studies, the CRD level within China's high carbon emission industry is lower than the level reported by

Liu et al. (2021). This gap could arise from deliberate concealment or underestimation of the climate risks faced by high carbon emission companies, especially under high-intensity environmental regulation, in efforts to uphold the industry's reputation. Conversely, the gap may also indicate a lack of sufficient awareness and capability within the company's management to enhance transparency in the company's annual reports. The standard deviation of CRD is 0.224, with a minimum value of 0.0256 and a maximum value of 1.280, highlighting a substantial disparity in the extent of CRD. As indicated in the table above, among the three methods of measuring corporate FP, the average value of Tobin's Q is 1.535, with a standard deviation of 0.777. The average value of ROE is 0.0586, with a standard deviation of 0.186, while the average value of ROA is 0.0575, with a standard deviation of 0.0533. These descriptive statistical results suggest a significant disparity in ROE across different companies.

TABLE 3. Correlation analysis

	Tobin	ROE	ROA	CRD	age	lev	size	growth	top1	la	cash	board	big4	female
Tobin	1.00													
ROE	-0.06**	1.00												
ROA	0.05*	0.60***	1.00											
CRD	0.23***	0.03***	0.01***	1.00										
age	-0.09***	-0.06**	-0.03	0.11***	1.00									
lev	-0.36***	-0.20***	-0.26***	0.24***	0.21***	1.00								
size	-0.50***	0.11***	0.18***	0.40***	0.29***	0.48***	1.00							
growth	-0.00	0.01	0.01	0.03	-0.01	-0.02	-0.05*	1.00						
top1	-0.11***	0.13***	0.19***	0.18***	-0.03	0.10***	0.35***	0.00	1.00					
la	0.35***	-0.05*	-0.09***	-0.42***	-0.27***	-0.36***	-0.55***	0.07**	-0.23***	1.00				
cash	-0.00	0.36***	0.57***	0.09***	0.01	-0.07***	0.17***	-0.03	0.16***	-0.27***	1.00			
board	0.02	-0.05*	-0.08***	0.02	0.01	-0.09***	-0.06**	0.07**	0.04	0.05	-0.09***	1.00		
big4	-0.08***	0.09***	0.17***	0.13***	0.16***	0.10***	0.36***	-0.02	0.14***	-0.07**	0.17***	-0.06**	1.00	
female	0.16***	-0.04	-0.03	-0.03	0.02	-0.19***	-0.19***	-0.03	-0.00	0.17***	-0.12***	0.05*	-0.11***	1.00

Note: *, * *, * * * respectively represent significance tests passed at the 10%, 5% and 1% levels

Before conducting empirical analysis, this study first conducts correlation analysis on the selected variables. The Pearson correlation coefficients are shown in Table 3. The table shows that correlation coefficients among all independent variables are below 0.5, indicating that the correlations between the variables are not high. Multicollinearity tests conducted using VIF confirm our initial finding when the highest value is only 2.30 (Table 4), indicating that multicollinearity is unlikely to be a problem and the regression results are reliable.

TABLE 4. Multicollinearity test

Variable	VIF	1/VIF
CRD	1.31	0.762
Age	1.18	0.845
lev	1.63	0.614
size	2.30	0.435
growth	1.02	0.981
ROA	2.25	0.444
top1	1.21	0.830
la	1.83	0.548
cash	1.65	0.608
board	1.04	0.961
big4	1.24	0.809
female	1.10	0.908
Mean VIF	1.49	

TABLE 5. Baseline analysis

VARIABLES	(1) Tobin	(2) ROE	(3) ROA
CRD	0.083**	0.025**	0.007**
	(2.11)	(2.01)	(2.51)
age	-0.685*	0.234**	0.059**
	(-1.96)	(2.25)	(2.46)
lev	-0.062	-0.390***	-0.129***
	(-0.33)	(-6.65)	(-10.02)
size	-0.282***	0.083***	0.021***
	(-4.62)	(4.36)	(5.12)
growth	-0.003	0.027**	0.001
	(-0.28)	(2.11)	(0.83)
top1	0.213	0.038	0.022
	(0.74)	(0.43)	(1.13)
la	0.220	0.032	0.051***
	(0.94)	(0.45)	(3.18)
cash	0.782**	0.945***	0.343***
	(2.22)	(8.50)	(14.27)
board	-0.340	-0.061	-0.072**

	(-0.72)	(-0.42)	(-2.22)
big4	0.237	0.016	0.020**
	(1.57)	(0.35)	(2.00)
female	0.230	0.018	0.018
	(1.23)	(0.32)	(1.42)
Constant	9.426***	-2.368***	-0.552***
	(5.84)	(-4.76)	(-5.02)
Observations	1,241	1,241	1,241
R-squared	0.252	0.168	0.305

Note: *, * *, * * respectively represent significance tests passed at the 10%, 5% and 1% levels, with t-values in parentheses

The results of the Hausmann test show that $chi^2 = 45.46$, the p-value is 0.0000, indicating that the original assumption of panel random effect should be rejected. Hence, this model uses a panel fixed effect model. The fixed effect includes company- and year-fixed effects. The baseline results presented in Table 5 prove that CRD is related positively to the company's performance, represented by Tobin's Q, ROE and ROA, indicating the research result is expected and consistent with most of the related literature in ESG/sustainability (Annachiara & Raffaella 2018; Mohammad et al. 2020), confirming the acceptance of the hypothesis. Companies that prioritise robust CRD practices may benefit from attracting socially responsible investors, lowering capital costs and broadening their investor base (Ilhan et al. 2023). Such companies are seen as better prepared to manage climate and market risks, encountering fewer regulatory obstacles, thus promoting long-term value creation.

Additionally, high-quality disclosure meets increasing expectations from business-to-business customers, consumers and other purchasers (Arian & Sands 2024), consequently improving market access and contract prospects. It also enables collaboration within supply chains (Bilro et al. 2023; Dzhengiz 2020). It may lead to positive consumer behaviour influenced by confidence in the company's environmental dedication, resulting in enhanced customer loyalty and repeat purchases (Kumar 2020). This loyalty translates into heightened sales volumes and values, providing the company a competitive advantage. Additionally, a company's environmental reputation significantly impacts talent attraction and retention because job seekers are drawn to purpose-driven organisations offering fulfilment beyond financial compensation. Trust in the company's mission enhances productivity and reduces turnover rates, ultimately bolstering overall performance (Rodrigues et al. 2021). However, these results contrast with those of Ebru (2022) and Lucy and Martin (2018) regarding environmental disclosure and environmental protection. This discrepancy arises from the distinct nature of CRD, which, unlike unrelated environmental issues, is imperative for companies to address to mitigate business risks.

To sum up, the empirical results suggest that regardless of the type of corporate FP indicator used, CRD has a positive impact on corporate FP. The results imply that CRD is beneficial for improving corporate performance. Notably, slight differences arise in the significance and signs of the coefficients for control variables when Tobin's Q is used as the dependent variable compared with ROE and ROA, indicating variations in the relationships from the market versus accounting performance perspectives.

TABLE 6. Robustness test

VARIABLES	Tobin	ROE	ROA
CRD^2	0.323**	0.055**	0.025**
	(2.15)	(2.01)	(2.34)
age	-0.729**	0.141**	0.062**
	(-2.08)	(2.31)	(2.56)
lev	-0.079	-0.299***	-0.131***
	(-0.42)	(-8.92)	(-10.17)
size	-0.278***	0.065***	0.020***
	(-4.45)	(5.98)	(4.63)
growth	-0.003	0.020***	0.001
	(-0.24)	(3.01)	(1.20)
top1	0.213	0.084*	0.025
	(0.74)	(1.71)	(1.29)
la	0.250	0.071*	0.047***
	(1.07)	(1.73)	(2.92)
cash	0.782**	0.673***	0.346***
	(2.22)	(10.86)	(14.27)
board	-0.486	-0.079	-0.080**
	(-1.02)	(-0.94)	(-2.44)
big4	0.247	0.034	0.021**
	(1.64)	(1.28)	(2.08)
female	0.253	0.034	0.020
	(1.34)	(1.02)	(1.53)
Constant	9.482***	-1.744***	-0.527***
	(5.80)	(-6.05)	(-4.67)
Observations	1,241	1,241	1,241
R-squared	0.252	0.219	0.301

Note: *, * *, * * respectively represent significance tests passed at the 10%, 5% and 1% levels, with t-values in parentheses

To further validate the reliability of the findings, this study employs an alternative measurement for CRD. Hu Nan (2021) opted for a different text corpus in their analysis, followed by Qi Yudong (2021). The study extracted text from the Management Discussion and Analysis (MD&A) section of the annual reports of listed companies. This section typically covers the company's performance analysis over a period, along with future business plans, risks and opportunities. CRD is assessed as the ratio of climate risk keywords in the MD&A section to the total number of words in that section. Contrasted with previous calculations, which focused on the ratio of climate risk keywords in the annual report, this method emphasises measuring management's awareness and active management of corporate climate risk. The test results, presented in Table 6, indicate that even after adjusting the explanatory variable's measurement method, the model coefficients' direction and significance remain unchanged compared to the original model. This consistency underscores the robustness of the model results, suggesting that CRD continues to exert a significant positive impact on corporate FP.

THEORETICAL IMPLICATIONS

Leveraging stakeholder-legitimacy theory as its primary framework, the study reveals a noteworthy finding regarding corporate disclosure practices. In a larger context, it indicates that when corporate disclosures are tied to business or operational risks, such disclosures notably influence stakeholder legitimisation, consequently enhancing company performance. From a stakeholder legitimisation perspective, this study implies that disclosing climate-related risks may attract socially responsible investors, thereby reducing capital costs, broadening the investor pool, fostering customer trust and loyalty and enhancing talent acquisition and retention, collectively enhancing company reputation and, consequently, performance. However, these explanations are solely offered by the theory to explain the observed findings and empirical tests await exploration in future studies. Within the confines of the current study, these tests could not be conducted because each explanation necessitates a distinct, detailed analysis requiring the identification of an appropriate theory to construct a suitable framework.

MANAGERIAL IMPLICATIONS

This study underscores the practical significance of CRD to stakeholders. The timely release of the recent standard by the ISSB concerning climate-related financial disclosure is crucial in addressing the urgent need to mitigate the climate impact on business operations. Regulators are critical in shaping the regulatory landscape to incentivise and enforce compliance with meaningful CRD. By implementing clear guidelines and standards for climate-related financial reporting, regulators can enhance transparency and comparability across industries, facilitating more informed decision-making by stakeholders and investors.

This initiative could trigger other behavioural changes. For instance, if companies must disclose climate risk information, management would be compelled to confront these issues earnestly. If most companies in the economy adopt this perspective, it could facilitate the government's efforts to attain its zero net carbon emission

target. In addition, revealing climate risks is significant, empowering investors to make informed choices. Offering information on the environmental consequences and hazards linked to a company's activities and disclosing climate risks allows investors to evaluate their investments' sustainability and long-term feasibility. Equipped with this understanding, responsible investors can adjust their investment approaches in line with their environmental beliefs, favouring companies that are dedicated to addressing climate change and lessening its detrimental impacts. Furthermore, transparent disclosure enables investors to accurately assess how climate risks can affect a company's performance, aiding them in making investment decisions considering financial gains and environmental consequences. Thus, CRD is a tool for conscious investors looking to incorporate environmental factors into their investment strategies and encourage positive progress toward a more sustainable future.

CONCLUSION

Climate change presents significant challenges to high carbon emission industries, leading to supply chain disruptions, heightened production costs from extreme weather events and substantial annual financial losses. Additionally, companies risk customer boycotts and investor divestment due to non-compliance with carbon emissions standards. However, companies disclosing climate risk information and mitigation strategies can potentially lower financing costs, increase market value and improve FP. This study aims to investigate the association between CRD and the FP of 1,241 high-carbon emission companies in China from 2013 to 2022. This study employs content analysis of CRD. The findings robustly demonstrate a positive relationship between the extent of CRD and company performance. This paper confines its scope to a single country to ensure that other country-level factors do not influence the results. Consequently, it is essential to interpret the results cautiously because they may not directly apply to settings with differing institutional backgrounds.

By understanding the potential implications of CRD on FP and reputation, other stakeholders can actively engage with companies to advocate for more robust disclosure practices and sustainable business strategies. The findings of this study underscore the critical need for collaboration between stakeholders, regulators and companies. This collective effort is crucial to deepen understanding and promote effective CRD practices. By fostering greater environmental awareness and incentivising sustainable business practices, stakeholders and regulators can significantly contribute to enterprises and society's long-term resilience and prosperity.

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NOTES

1. Generally, refers to non-metallic mineral products, electric heating gas and water, and metal products.
2. CRD (Number of climate risk keywords in the discussion and analysis section of the annual report / total number of words in this section)

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APPENDIX A

Word set of climate risk indicators

Words	
Source	Li et al. (2024), National Meteorological Science Data Center, annual report
Keywords	energy conservation, electric energy, energy, cleaning, fuel, ecology, water conservation, environment, green, evolve, solar energy, upgrading, recycling, transformation, utilization, nuclear power, wind power, natural gas, efficiency, oil, efficiency, recycling, regeneration, high efficiency, photovoltaic, emission reduction, consumption reduction, disasters, earthquakes, typhoons, tsunamis, flooding, droughts, conflagration, height, pouring rain, inclement, waterlogging, strong winds, dust, hail, special, dry damage, hurricane, frost, inundation, storm, debris flow, landslide, flood, dry disaster, blizzard, icy, snow damage, ice and snow, climate, weather, nature, humidity, water temperature, cooling, cold, air temperature, rainfall, temperature, rain, rainy season, rain condition, freezing, precipitation, early frost, low temperature, high temperature, rain and snow