VILNIUS TECH
Vilnius Gediminas
Technical University

JOURNAL of BUSINESS ECONOMICS & MANAGEMENT

CORPORATE ENVIRONMENTAL RESPONSIBILITY IN CHINA'S HIGH-POLLUTION INDUSTRY: THE POWER OF INVESTOR

Shuangyan LI [ID], Dan WANG [ID] ✉

The School of Economics and Finance, Xi'an Jiaotong University, Xi'an, China

Abstract. We use Chinese A-share listed firms in the high-pollution industry from 2013 to 2021 as the research sample to explore the impact of investor attention on corporate environmental responsibility. We find that investor attention positively affects corporate environmental responsibility. The primary mechanisms involve increasing executive environmental awareness and strengthening government environmental regulations. Further, we find that financing constraints weaken this positive relationship, while political connections and institutional shareholders strengthen it. The conclusions remain consistent after adopting an alternative measure of the core variable, changing the regression model, and utilizing the 2SLS method. We also provide suggestions for corporate environmental responsibility from both governmental and firm perspectives.

1. Introduction

Since the implementation of the reform and opening-up in 1978, China has experienced rapid industrial development. By 2010, its industrial scale had ranked first globally. China has also gradually developed into a secondary global economy. However, the extensive long-term development of China's industries has severely damaged its natural environment and ecological balance (Sun et al., 2024). In particular, thermal power, steel, mining, and other high-pollution industries have had serious negative impacts on China's natural ecology (Wang et al., 2019). As the primary agents of environmental protection, the willingness and ability of firms to fulfill their environmental responsibilities are associated with sustainable ecological development, green transformation, and industrial upgrading (Prasad et al., 2019). Therefore, against the background of China's economy shifting from rapid to high-quality development (Zhang et al., 2019, 2022b), improving corporate environmental responsibility has become an important issue.

An abundance of research has focused on identifying factors that promote corporate environmental responsibility, including internal corporate characteristics and external regulations. Regarding intra-firm characteristics, Lin and Zhang (2023) argued that digital transformation

positively impacts corporate environmental responsibility. Business executives can strengthen environmental performance through an organizational digital orientation (Bendig et al., 2023). Internal controls (Liu et al., 2024) and green institutional shareholdings (Shi et al., 2024) also contribute to corporate environmental responsibility. Additionally, the CEO's characteristics affect corporate environmental responsibility, such as ethical leadership (Hameed et al., 2023), CEO power (Francoeur et al., 2021), and the CEO's early experiences, including sent-down movements (Li et al., 2023b), military service (Gao et al., 2021), and childhood poverty (Xu & Ma, 2022). Regarding external regulations, the issuance of government regulations, such as cleaner production standards (Hu et al., 2022), ambient air quality standards (Zhang et al., 2022c), and urban environmental legislation (Zhang et al., 2023), has a positive effect on corporate environmental responsibility. Punitive actions such as administrative penalties (Marquis & Bird, 2018) and enforcement intensity (Pan et al., 2024) also have an impact. These studies highlight the power of mandatory external formal institutions in driving corporate environmental responsibility. With investors expressing a strong awareness of environmental protection, as informal institutions, they can potentially influence corporate environmental behavior. However, to our knowledge, no studies have examined the relationship between investor attention and corporate environmental responsibility from an informal institutional perspective.

We examine the impact of investor attention on corporate environmental responsibility using a research sample of A-share listed firms in China's high-pollution industry. The rationale for selecting high-pollution firms as the research sample are as follows. First, these firms are the primary contributors to environmental problems, discharging large amounts of environmental pollutants and even causing extreme weather conditions, such as sandstorms and haze (Wang et al., 2019). Research by the Environmental Statistics Group of the Statistical Science Center of Peking University (2018) shows that regions with a high concentration of polluting experience haze more frequently. Second, high-pollution firms are environmentally sensitive, and investors pay more attention to their environmental activities. The results reveal that investor attention promotes environmental responsibility among high-polluting firms. This effect operates through three primary mechanisms: improving executive environmental awareness, strengthening environmental administrative penalties, and increasing government environmental subsidies. However, financing constraints weaken this positive relationship, while political connections and institutional shareholders enhance the promotional effects. The conclusions remain consistent after adopting an alternative measure of the core variable, changing the regression model, and utilizing the 2SLS method. Heterogeneity analysis shows that the environmental contribution effect of investor attention is more pronounced in state-owned enterprises and regions with high marketization levels.

The contributions of this study are as follows: First, it provides additional insights into promoting corporate environmental responsibility. Unlike previous research which focuses on the impact of firms' internal characteristics (Lin & Zhang, 2023; Bendig et al., 2023; Liu et al., 2024; Shi et al., 2024), CEO features (Hameed et al., 2023; Francoeur et al., 2021; Li et al., 2023b; Gao et al., 2021; Xu & Ma, 2022), and external legal regulations (Hu et al., 2022; Zhang et al., 2022c, 2023; Marquis & Bird, 2018; Pan et al., 2024), we explore the role of retail investor behavior on corporate environmental responsibility through online platforms from an informal institutional perspective at the micro level. We conclude that the informal power developed by investor attention contributes to corporate governance effects and promotes green corporate development. Second, this study contributes to the literature on the

economic consequences of investor attention. Most existing research focuses on investor attention's effects on the stock market, including stock returns (Jang & Jun, 2025), stock liquidity (Ding & Hou, 2015; Cheng et al., 2021), and anomaly risk (Wen et al., 2024; Tian et al., 2024). Others argue that investor attention enhances firm innovation performance (Hao, 2023; He et al., 2022), but few studies consider its role in corporate environmental governance. Our research on corporate environmental responsibility extends the scope of investor attention's micro-level impacts. Finally, regarding research content, we explore the impact of investor attention on corporate environmental responsibility. Furthermore, we investigate the factors that influence the effects of financing constraints and institutional investor shareholdings. This study further extends the research chain between investor attention and corporate environmental responsibility.

The remainder of this paper is structured as follows. Section 2 reviews the literature and develops the hypotheses. Section 3 presents the data and methodology. Section 4 presents the empirical results. Section 5 presents the robustness tests. Finally, Section 6 concludes the study.

2. Literature review and hypothesis development

2.1. Investor attention and corporate environmental responsibility

According to the theory of organizational legality, a contractual relationship exists between corporations and society. Society allows firms to survive and grants them rights, while firms must conform to social norms that are widely accepted by the public to gain legitimacy (Suchman, 1995). China's history and culture are characterized by Confucianism, which creates a foundation for the role of informal institutions. As a result, informal institutions constrain firms' micro-decisions more than formal institutions.

With the increasing severity of environmental problems in recent years, investors have developed a strong sense of environmental responsibility (Chiou et al., 2011). As the primary contributors to environmental pollution, high-pollution firms are especially under the scrutiny of investors. If these firms are penalized for environmental violations, they risk harming retail investors' interests (Yao et al., 2023). Therefore, whether motivated by public welfare or self-interest, investors tend to monitor firms' environmental practices, urging them to take greater corporate environmental responsibility. Specifically, investors question the environmental problems of high-pollution firms through interactive platforms such as "Interactive Easy" (https://irm.cninfo.com.cn/) and "SSE Interactive" (https://sns.sseinfo.com/). The dissemination of information on interactive platforms likely contributed to the evolution of corporate environmental issues, transforming them from episodic concerns to focal points. The negative social press triggered by investors' environmental attention challenges firms' legitimacy. In response, firms are compelled to prioritize investors' environmental aspirations. By assuming environmental responsibility, they signal their commitment to green market development. Additionally, investors monitor the environmental activities of high-pollution firms through "voting with money," forcing these companies to take proactive measures to improve environmental performance.

Based on the above analysis, we propose the following hypothesis:

H1: Investor attention promotes the environmental responsibility of high-pollution firms.

2.2. The mechanism analysis of firms' internal and external factors

The expression of investor interest directly drives firms to allocate resources toward environmental governance activities, promoting corporate environmental responsibility. It also exerts indirect pressure on firm executives and local governments. Corporate environmental responsibility is enhanced by improving executive environmental awareness and strengthening governmental environmental regulations.

On one hand, investor attention obliges executives to adopt a business philosophy that prioritizes environmental responsibility. Specifically, firms' pollution behaviors indicate that investors' demands for environmental protection are not satisfied, and investors' expectations of environmental activities are unmet (Zeng et al., 2024). This can seriously damage a firm's social reputation and financial performance (Lin et al., 2016). In response to this challenge, executives prefer to raise awareness of environmental protection to maintain firm value. Additionally, investor attention leads to demand for green products in the market. Executives recognize that low-pollution production models are profitable and are encouraged to develop environmental awareness. Drawing on upper echelons theory, as the core drivers of a firm, executives' perceptions impact a firm's growth strategy (Tan & Zhu, 2022). As executives integrate a sense of environmental responsibility into firm culture, firms tend to practice sustainable green behaviors (Wang, 2024). When faced with conflicts between economic benefits and environmental responsibility, the internal motivation resulting from executive environmental awareness leads them to prioritize environmental behaviors. Based on this, we propose H2a as follows:

H2a: Investor attention promotes corporate environmental responsibility through executive environmental awareness.

However, informal institutions supplement and extend formal institutions, reinforcing their consequences and creating incentives to satisfy formal regulations (Helmke & Levitsky, 2004). Research suggests that the social influence of informal institutions is essential for monitoring the implementation of government environmental policies (Chen et al., 2022). As an informal institution, investor attention can strengthen government environmental regulations and promote corporate environmental responsibility. Confronted with pressure from investor scrutiny, the government should first increase administrative penalties for firms' polluting behaviors. To avoid higher penalties for environmental violations, firms are motivated to upgrade their environmental responsibilities (Li et al., 2024). Research argues that environmental penalties create a deterrent effect on firms that ignore environmental regulations (Blundell et al., 2020). The fear of environmental compliance penalties motivates firms to adopt substantial environmental behaviors to improve their environmental responsibilities (Li & Ramanathan, 2024). Second, the government compensates for firms' lost benefits due to environmental governance through market-incentivized regulations such as environmental subsidies (Liao et al., 2023). Providing funds to firms reduces resistance to participating in environmental activities (Li et al., 2024). Accordingly, environmental subsidies encourage firms to align their production with environmental responsibilities. Within the scope of environmental tolerance, a green cycle of firm development and environmental responsibility is realized. Based on the above analysis, we propose the following Hypotheses:

H2b: Investor attention promotes corporate environmental responsibility through government environmental penalties.

H2c: Investor attention promotes corporate environmental responsibility through government environmental subsidies.

2.3. The moderating effect analysis

Financing constraints are critical factors impacting firms' environmental activities (He et al., 2021). Compared to green firms, firms that do not satisfy environmental standards face higher financing constraints. Limited funding leads managers to prioritize performance-related issues, often at the expense of environmental concerns (Vargas-Santander et al., 2024). Activities to fulfill environmental responsibilities, such as green innovation and environmental investments, depend on financial support. Firms in financial distress often ignore stakeholder pressures regarding environmental responsibility. Instead, they prioritize basic operations over environmental activities. Worse, they may sacrifice environmental concerns for profit. Thus, we propose H3a as follows:

H3a: The impact of investor attention on corporate environmental responsibility is more significant for firms with low financing constraints.

Political connections are essential relational resources for firms and exert a significant effect on their environmental behavior (Zhang et al., 2022a; Zhang, 2017). Compared to firms without political connections, firms with political ties are more likely to align with the government. In particular, when local governments face strong pressure from investors' environmental demands, politically connected firms are more likely to take on the responsibility of environmental governance, even at the expense of short-term profits. It is beneficial for these firms to be positively evaluated and recognized by local governments to obtain scarce resources such as environmental subsidies, policy support, and information bias. Therefore, we propose H3b as follows:

H3b: The impact of investor attention on corporate environmental responsibility is more significant for firms with political connections.

Institutional shareholders play an external monitoring role while providing capital to firms (Borochin & Yang, 2017). Unlike a firm's centralized shareholders, institutional shareholders serve as "universal owners." Their portfolios typically cover the entire capital market from a long-term investment perspective. Consequently, they are inevitably affected by the negative externalities generated by businesses (Tao et al., 2020). Sustainability compliance has emerged as a risk-control device for institutional shareholders. Specifically, pushing firms to make positive commitments to environmental protection is a strategy that maximizes the interests of institutional shareholders. Under the pressure of institutional shareholders, firm executives are more likely to invest in green production projects and fulfill environmental responsibilities. Therefore, we propose H3c as follows:

H3c: The impact of investor attention on corporate environmental responsibility is more significant for firms with more institutional shareholders.

The analytical framework diagram of our research is displayed in Figure 1.

3. Data and methodology

3.1. Sample collection

We select Chinese A-share listed firms in the high-pollution industry from 2013 to 2021 as our research sample. The reason for choosing firms in heavily polluting industries is that these industries are a key focus of China's environmental protection departments, and the
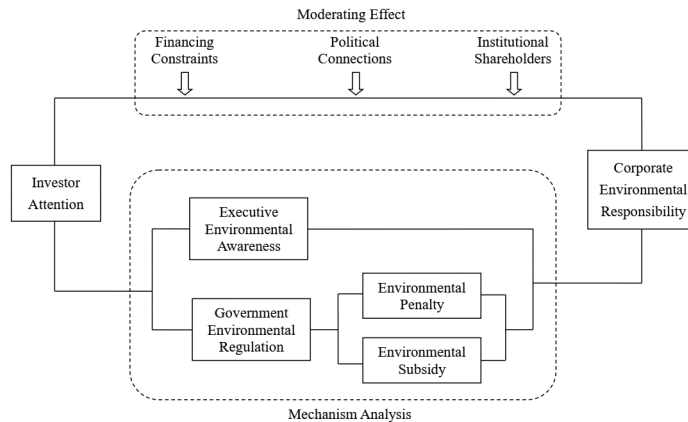
Figure 1. Analytical framework diagram

performance of corporate environmental responsibility is critical to the long-term develop-ment of firms in this sector. According to the List of Classified Management of Environmental Protection Verification Industries of Listed Companies issued by the Ministry of Environmental Protection in 2008, industries such as thermal power, iron and steel, cement, and 16 other sectors are identified as high-pollution industries. The data used in this study are collected from the CSMAR (n.d.) and CNRDS (n.d.) databases. To ensure data accuracy, we exclude samples of ST and *ST-listed firms, firms that had an IPO in the current year, and firms with missing financial data. To avoid errors in the results caused by extreme values, we winsorize the variables at the 1% and 99% levels.

3.2. Variables

3.2.1. Corporate environmental responsibility

To provide an integrated and systematic assessment of corporate environmental responsibil-ity, we select 13 indicators from five aspects – legal awareness, social evaluation, eco-friendly production, low-carbon technology, and green management – to create a CER rating system following Li et al. (2020).

The first aspect, legal awareness, primarily evaluates whether a corporation obeys laws and regulations throughout its business operations and strengthens its legal awareness. We assess legal awareness through three indicators: whether the corporation complies with the GRI Sustainability Reporting Guidelines, whether it reports on environmental and sustaina-ble development, and whether it has been subject to environmental penalties. Referring to the GRI indicates a company's shift toward green production. Disclosing environmental and sustainability information and the absence of environmental penalties reflect a corporation's supports environmental policies.

The second aspect, social evaluation, measures whether a corporation has a strong social reputation in environmental protection. A good social reputation helps firms gain market recognition and increases consumers' willingness to buy, which is beneficial for the long-term growth of corporations. We assess social evaluation through two indicators: whether the corporation has received environmental recognition and whether it holds a competitive advantage in this area.

The third aspect, eco-friendly production, focuses on whether a corporation has caused damage to the environment during the production process. We assess eco-friendly outputs through three indicators: circular economy, pollutant emissions, and environmentally beneficial products. Using sustainable energy or adopting economic recycling measures in production indicates that a firm is highly aware of environmental protection. The development or use of innovative products, machines, or technologies that benefit the environment is an essential indicator of green production.

The fourth aspect, low-carbon technology, primarily focuses on whether a corporation uses green production technologies. We assess this through energy conservation and efforts to reduce the three types of waste. The energy-saving and low-carbon technologies adopted by a firm to minimize exhaust gas, wastewater, waste residue, and greenhouse gas emissions reflect its commitment to sustainability in fulfilling environmental responsibilities.

The fifth aspect, green management, primarily measures whether a corporation integrates green management into its corporate culture. We assess green management through three indicators: environmental certification, green office policies, and third-party verification of a firm. Firms with ISO14001-certified environmental management systems and green office policies or measures are more likely to fulfill their environmental responsibilities. Verification by third-party institutions ensures the objectivity and credibility of corporate environmental information disclosures, helping to regulate and constrain corporate business activities.

To ensure consistent scoring, firms that are penalized for environmental violations or discharge pollutants are assigned 0 points; otherwise, they receive 1 point. Other indicators are positive; if the behavior is present in the corporation, 1 point is assigned; otherwise, 0 points are assigned. To avoid subjectivity in assigning weights, we give equal weight to all indicators, and the corporate environmental responsibility score is based on a total of 13 indicators.

3.2.2. Investor attention

The Internet has gradually become an essential tool for people to access the information they seek. Internet searches have documented the browsing history of all Internet users across China. Therefore, the Web Search Index from the CNRDS (n.d.) database effectively indicates investor attention toward a corporation. Additionally, Da et al. (2011) confirmed that the Internet search index is a reliable indicator of investor attention. To measure investor attention, we use the stock code, firm abbreviations, and full name of a single firm as keywords, summing the daily search value. We then calculate the natural logarithm of the median of the total search plus one for each year.

3.2.3. Control variables

We control for several variables that may affect corporate environmental responsibilities, which are obtained from the CSMAR (n.d.) database. These include: leverage (*Lev*), cash flow (*CF*), market value to book value (*MTB*), tangible assets (*Tangibility*), shareholding ratio of the top ten shareholders (*Top10*), Return on Equity (*ROE*), growth rate of operating income (*Growth*), dividends (*Dividends*), and firm age (*Age*). Table 1 presents the definitions of these control variables.

Table 1. Variable definitions

Variable	Definition
CER	The scores of corporate environment responsibility range from zero to thirteen.
Attention	The natural logarithm of the median of the search value plus one each year
Lev	Total debt divided by total assets.
CF	Cash flow from operating activities divided by total assets.
MTB	The market value of the firm divided by the book value of the firm.
Tangibility	Total tangible assets divided by total assets.
Top10	Some of the shareholding ratios of top ten shareholders.
ROE	Net profit divided by average equity of shareholders.
Growth	Operating income growth rate year-over-year.
Dividends	Dummy variable: If the firm's dividend in the current year is 0, the value equals 0, and 1 otherwise.
Age	The number of years since the IPO.
Lnepc	Natural logarithm of terms frequency capturing executives environmental awareness in annual reports plus one.
Penalty	Number of environmental administrative penalties in the city where the firm is located divided by 100.
Lnsubsidy	Natural logarithm of environmental subsidy.
PC	Dummy variable: If the firm chairman or general manager works or has worked as a government official is 1, and 0 otherwise.
Insshr	The proportion of floating stock held by institutional shareholders.

3.3. Regression model

We use ordinary least squares (OLS), following Wang et al. (2024), and construct the following model to test the relationship between investor attention and corporate environmental responsibility:

$$CER_{i,t} = \beta_0 + \beta_1 Attention_{i,t} + \beta Control_{i,t} + Industry + Year + \varepsilon_{i,t}. \tag{1}$$

For the mechanism analysis, we construct the following model:

$$Q_{i,t} = \beta_0 + \beta_1 Attention_{i,t} + \beta Control_{i,t} + Industry + Year + \varepsilon_{i,t}; \tag{2}$$

$$CER_{i,t} = \beta_0 + \beta_1 Attention_{i,t} + \beta_2 Q_{i,t} + \beta Control_{i,t} + Industry + Year + \varepsilon_{i,t}. \tag{3}$$

For the moderating effect, we construct the following model:

$$CER_{i,t} = \beta_0 + \beta_1 Attention_{i,t} + \beta_2 Lnwsvi_{i,t} \times M_{i,t} + \beta_3 M_{i,t} + \beta Control_{i,t} + Industry + Year + \varepsilon_{i,t}, \tag{4}$$

where ε is the error term, $Q_{i,t}$ represents the mechanism variable, and $M_{i,t}$ denotes the moderating variable. We control for industry and firm fixed effects and cluster at the company level.

4. Empirical research

4.1. Summary statistics

Table 2 reports the results of the descriptive statistics for the main variables used in this study. The average value of *CER* is 2.626, suggesting that high-pollution firms, on average, have poor environmental responsibility. Investor attention has an average of 6.781, with a standard deviation of 0.715, indicating that the level of investor interest in these firms is relatively stable, though still high. Regarding the control variables, the *ROE* ranges from a minimum to –0.776 to a maximum of 0.422. This reflects the fact that some corporations experience negative operating cash flow, indicating significant variations in profitability. The difference between *Growth* among sample firms is also significant, implying that some corporations face challenges in development potential and growth opportunities.

Table 2. Summary statistics

Variable	Observation	Mean	Std. Dev.	Min	Median	Max
CER	4915	2.626	2.772	0	1	12
Attention	4915	6.781	0.715	0	6.735	9.715
Attention$_{t-1}$	4915	6.723	0.859	0	6.714	9.715
Lev	4915	0.462	0.197	0.069	0.465	0.929
CF	4915	0.060	0.064	–0.115	0.058	0.241
MTB	4915	0.697	0.258	0.131	0.703	1.226
Tangibility	4915	0.337	0.172	0.027	0.317	0.782
Top10	4915	0.578	0.156	0.221	0.578	0.923
ROE	4915	0.057	0.146	–0.776	0.062	0.422
Growth	4915	0.154	0.396	–0.487	0.081	2.592
Dividends	4915	0.378	0.485	0	0	1
Age	4915	13.044	7.071	1	13	29

Note: Table 2 provides a descriptive statistical analysis of the variables involved in the principal regression in the paper.

4.2. Baseline regression

We use Model (1) to examine the relationship between investor attention and corporate environmental responsibility, with the results reported in Table 3. Column (1) shows the univariate test results, where the coefficient is 1.175, which is significantly positive at the 1% level. The control variables affecting corporate environmental responsibility are added to Column (2). The coefficient of *Attention* reduces to 1.029, but remains significant at the 1% level. To address potential endogeneity, we introduce lagged investor attention in Columns (3) and (4), which results in a further decrease in the coefficient. We speculate that since all the sample firms operate in high-pollution industries, creating a green corporate image for the market and investors is an urgent priority. Therefore, the impact of investor attention is more pronounced in the current period. These results support H1, indicating that investor attention encourages high-pollution firms to fulfill their environmental responsibilities.

Table 3. Baseline regression

	(1)	(2)	(3)	(4)
Attention	1.175***	1.029***		
	(7.68)	(6.72)		
Attention$_{t-1}$			0.807***	0.691***
			(8.12)	(7.22)
Lev		0.923**		1.033**
		(2.20)		(2.43)
CF		3.711***		4.008***
		(4.41)		(4.81)
MTB		1.521***		1.553***
		(4.56)		(4.62)
Tangibility		0.173		0.250
		(0.31)		(0.45)
Top10		2.638***		2.527***
		(4.30)		(4.09)
ROE		1.000***		1.215***
		(2.94)		(3.50)
Growth		−0.321***		−0.271***
		(−3.23)		(−2.70)
Dividends		−0.172		−0.127
		(−1.07)		(−0.79)
Age		0.036***		0.034**
		(2.73)		(2.52)
Industry	YES	YES	YES	YES
Year	YES	YES	YES	YES
cons	−4.417***	−7.943***	−1.813**	−5.627***
	(−3.71)	(−6.02)	(−2.05)	(−5.42)
N	4915	4915	4915	4915
R^2	0.165	0.222	0.150	0.210

Note: Table 3 reports the results of baseline regression. T-statistics are reported in parentheses. ***, ** and * represent significance at the 1%, 5% and 10% levels, respectively.

4.3. The mechanism analysis of firms' internal and external factors

As the theoretical analysis shows, investor attention affects the environmental responsibility of high-pollution firms through three mechanisms: improving executive environmental awareness, strengthening environmental administrative penalties, and increasing government environmental subsidies. We use Models (2) and (3) to test the feasibility of these mechanisms. Specifically, executive environmental awareness (*Lnepc*) is measured by the natural logarithm of the frequency of environmental terms captured in executives' annual reports (plus one),

following Li et al. (2023c). Environmental administrative penalties (*Penalty*) are measured by the number of environmental penalties in the city where the firm is located, divided by 100. Government environmental subsidies (*Lnsubsidy*) are expressed as the natural logarithm of the environmental subsidy, following Han et al. (2024).

Table 4 reports the results of the mechanism analysis. The findings for the executive environmental awareness mechanism are reported in Columns (1) and (2). Not surprisingly, the coefficient of *Lnepc* is 0.131, which is significant at the 1% level. This implies that investor attention enhances the environmental awareness of executives in high-pollution firms, thereby contributing to corporate environmental responsibility. The results for the environmental administrative penalty mechanism are shown in Columns (3) and (4). The coefficient of *Penalty* is significantly positive, suggesting that investor attention promotes environmental responsibility by imposing heavier administrative penalties for firms' pollution behavior. The results for the environmental subsidy mechanism are displayed in Columns (5) and (6). It is evident that investor attention positively affects the increase in corporate environmental responsibility through environmental subsidies.

Table 4. The mechanism analysis

	Lnepc	CER	Penalty	CER	Lnsubsidy	CER
	(1)	(2)	(3)	(4)	(5)	(6)
Attention	0.131***	1.005***	1.197***	1.000***	1.003***	0.904***
	(3.30)	(6.65)	(2.68)	(6.71)	(6.66)	(6.13)
X		0.187***		0.025***		0.125***
		(2.79)		(2.99)		(6.33)
Lev	0.382***	0.852**	0.146	0.920**	1.428***	0.745*
	(2.61)	(2.04)	(0.11)	(2.21)	(2.97)	(1.82)
CF	0.674**	3.585***	−0.113	3.713***	1.930*	3.469***
	(2.22)	(4.28)	(−0.04)	(4.41)	(1.87)	(4.23)
MTB	0.642***	1.401***	1.324	1.489***	2.991***	1.147***
	(6.10)	(4.26)	(1.25)	(4.54)	(8.00)	(3.47)
Tangibility	0.431***	0.093	−5.387***	0.307	0.362	0.128
	(2.59)	(0.17)	(−3.33)	(0.55)	(0.58)	(0.23)
Top10	0.824***	2.484***	7.646***	2.449***	2.513***	2.323***
	(4.94)	(4.05)	(4.16)	(4.07)	(5.02)	(3.85)
ROE	0.375***	0.930***	−1.799*	1.044***	0.754	0.905***
	(3.20)	(2.75)	(−1.72)	(3.06)	(1.30)	(2.75)
Growth	−0.048	−0.312***	−0.767**	−0.302***	−0.199	−0.296***
	(−1.48)	(−3.15)	(−2.51)	(−3.08)	(−1.57)	(−3.03)
Dividends	0.015	−0.174	0.705	−0.189	0.189	−0.195
	(0.31)	(−1.10)	(1.40)	(−1.19)	(1.39)	(−1.23)
Age	−0.001	0.037***	0.028	0.036***	−0.034***	0.041***
	(−0.26)	(2.75)	(0.59)	(2.70)	(−3.04)	(3.06)

	Lnepc	*CER*	*Penalty*	*CER*	*Lnsubsidy*	*CER*
	(1)	(2)	(3)	(4)	(5)	(6)
Industry	YES	YES	YES	YES	YES	YES
Year	YES	YES	YES	YES	YES	YES
cons	1.488***	−8.221***	−12.659***	−7.629***	3.833***	−8.423***
	(4.71)	(−6.28)	(−3.21)	(−5.95)	(2.90)	(−6.59)
N	4915	4915	4915	4915	4915	4915
R^2	0.409	0.225	0.139	0.228	0.226	0.234

Note: Table 4 reports the mechanism analysis of executive environmental awareness, administrative penalty, and government subsidy. T-statistics are reported in brackets, and statistical significance at the 1%, 5%, and 10% levels is marked with ***, **, and *, respectively.

4.4. The moderating effect analysis

4.4.1. The moderating effect of financing constraints

Table 5 presents the moderating effects of financing constraints. In Column (1), we include the *FC* in the baseline regression, and the coefficient of *FC* is −2.634. This is significantly negative at the 1% level, indicating that financing constraints weaken the corporate environmental responsibility of high-pollution firms. To verify whether financing constraints reduce the relationship between investor attention and corporate environmental responsibility, we introduce an interaction term, with the results shown in Column (2). The coefficient of the interactive term (*Attention*FC*) is significantly negative, implying that the greater the financing constraints faced by firms, the weaker the role of investor attention in promoting corporate environmental responsibility. These conclusions remain consistent even when investor attention is lagged, thus validating H3a.

Table 5. The moderating effect of financing constraints

	(1)	(2)	(3)	(4)
Attention	0.697***	0.688***		
	(4.76)	(5.07)		
FC	−2.634***	−2.779***	−2.955***	−2.913***
	(−6.41)	(−6.93)	(−7.63)	(−7.59)
Attention×FC		−1.320***		
		(−4.63)		
$Attention_{t-1}$			0.463***	0.618***
			(5.40)	(6.22)
$Attention_{t-1}$×FC				−1.374***
				(−5.91)
Lev	−0.664	−0.760	−0.798	−0.789
	(−1.32)	(−1.54)	(−1.60)	(−1.62)

End of Table 5

	(1)	(2)	(3)	(4)
CF	2.664***	2.607***	2.711***	2.575***
	(3.37)	(3.31)	(3.45)	(3.29)
MTB	0.684**	0.629*	0.594*	0.502
	(2.02)	(1.88)	(1.75)	(1.51)
Tangibility	−0.043	−0.059	−0.022	0.016
	(−0.08)	(−0.11)	(−0.04)	(0.03)
Top10	1.812***	1.614***	1.657***	1.581***
	(2.93)	(2.65)	(2.71)	(2.64)
ROE	0.992***	1.049***	1.118***	1.062***
	(3.04)	(3.25)	(3.42)	(3.30)
Growth	−0.303***	−0.276***	−0.267***	−0.222**
	(−3.11)	(−2.88)	(−2.73)	(−2.33)
Dividends	−0.215	−0.243	−0.194	−0.226
	(−1.36)	(−1.54)	(−1.23)	(−1.43)
Age	0.025*	0.028**	0.021	0.023*
	(1.88)	(2.16)	(1.61)	(1.76)
Industry	YES	YES	YES	YES
Year	YES	YES	YES	YES
cons	−2.674*	−2.431*	−0.691	−1.733
	(−1.81)	(−1.76)	(−0.62)	(−1.51)
N	4915	4915	4915	4915
R²	0.244	0.253	0.240	0.256

Note: Table 5 reports the moderating effect of financing constraints. T-statistics are reported in brackets, and statistical significance at the 1%, 5%, and 10% levels is marked with ***, **, and *, respectively.

4.4.2. The moderating effect of political connections

Table 6 presents the moderating effects of political connections. We define political connections (*PC*) as a dummy variable following Zhang et al. (2022a). *PC* equals 1 if the firm's chairman or general manager works or has worked as a government official, and 0 otherwise. In Column (1), we adopt *PC* as a control variable in the baseline regression. *PC* is significantly positive, indicating that political connections contribute to improving firms' environmental performance. We further introduce the interaction term *Attention*PC* to explore whether political connections play a moderating role. Column (2) shows the results, where the coefficient of the interaction term is significantly positive. This reveals that political connections are a factor to consider when high-pollution firms adjust their environmental responsibilities under the supervision of investors. This conclusion supports H3b.

Table 6. The moderating effect of political connections

	(1)	(2)	(3)	(4)
Attention	1.017***	1.032***		
	(6.68)	(7.15)		
PC	0.303*	0.299*	0.300*	0.290*
	(1.87)	(1.85)	(1.83)	(1.80)
Attention×PC		0.379**		
		(1.97)		
Attention$_{t-1}$			0.679***	0.722***
			(7.13)	(7.51)
Attention$_{t-1}$×PC				0.458**
				(2.40)
Lev	0.935**	0.917**	1.044**	1.011**
	(2.24)	(2.20)	(2.47)	(2.40)
CF	3.742***	3.676***	4.038***	3.917***
	(4.46)	(4.41)	(4.86)	(4.75)
MTB	1.485***	1.491***	1.518***	1.503***
	(4.43)	(4.47)	(4.49)	(4.46)
Tangibility	0.219	0.224	0.294	0.309
	(0.39)	(0.40)	(0.53)	(0.56)
Top10	2.686***	2.710***	2.574***	2.601***
	(4.38)	(4.43)	(4.17)	(4.23)
ROE	0.975***	0.953***	1.190***	1.167***
	(2.88)	(2.82)	(3.44)	(3.39)
Growth	−0.326***	−0.328***	−0.277***	−0.268***
	(−3.28)	(−3.29)	(−2.76)	(−2.68)
Dividends	−0.155	−0.150	−0.112	−0.109
	(−0.98)	(−0.95)	(−0.70)	(−0.69)
Age	0.039***	0.039***	0.037***	0.036***
	(2.94)	(2.89)	(2.72)	(2.66)
Industry	YES	YES	YES	YES
Year	YES	YES	YES	YES
cons	−7.986***	−8.096***	−5.674***	−5.920***
	(−6.06)	(−6.36)	(−5.47)	(−5.74)
N	4915	4915	4915	4915
R^2	0.224	0.225	0.212	0.215

Note: Table 6 reports the moderating effect of political connections. T-statistics are reported in brackets, and statistical significance at the 1%, 5%, and 10% levels is marked with ***, **, and *, respectively.

4.4.3. The moderating effect of institutional shareholders

Table 7 shows the moderating effects of institutional shareholders. In Column (1), we introduce *Insshr* into the regression. The coefficient of *Insshr* is 1.371, which is significantly positive at the 1% level, suggesting that supervision by institutional shareholders contributes to improving environmental performance. We further introduce the interactive term *Attention*Insshr*, and the results are displayed in Column (2). The coefficient of *Attention*Insshr* is significantly positive at the 1% level, indicating that the higher the number of institutional shareholders, the more significant the contribution of investor attention to corporate environmental responsibility, thus verifying H3c.

Table 7. The moderating effect institutional shareholders

	(1)	(2)	(3)	(4)
Attention	0.983***	1.001***		
	(6.41)	(7.20)		
Insshr	1.371***	1.718***	1.535***	1.889***
	(3.30)	(3.95)	(3.71)	(4.33)
Attention×Insshr		1.245***		
		(3.43)		
$Attention_{t-1}$			0.661***	0.678***
			(6.94)	(7.23)
$Attention_{t-1}$×Insshr				0.956***
				(4.06)
Lev	0.777*	0.768*	0.861**	0.866**
	(1.87)	(1.88)	(2.04)	(2.08)
CF	3.682***	3.538***	3.958***	3.817***
	(4.44)	(4.26)	(4.82)	(4.65)
MTB	1.549***	1.476***	1.581***	1.518***
	(4.67)	(4.45)	(4.73)	(4.57)
Tangibility	−0.041	−0.053	0.006	0.020
	(−0.07)	(−0.10)	(0.01)	(0.04)
Top10	1.253*	0.729	0.986	0.518
	(1.74)	(1.00)	(1.37)	(0.72)
ROE	0.926***	0.962***	1.119***	1.114***
	(2.74)	(2.86)	(3.24)	(3.22)
Growth	−0.312***	−0.292***	−0.263***	−0.245**
	(−3.17)	(−2.98)	(−2.65)	(−2.49)
Dividends	−0.202	−0.223	−0.164	−0.180
	(−1.26)	(−1.39)	(−1.02)	(−1.12)
Age	0.020	0.019	0.016	0.013
	(1.41)	(1.36)	(1.11)	(0.91)

End of Table 7

	(1)	(2)	(3)	(4)
Industry	YES	YES	YES	YES
Year	YES	YES	YES	YES
cons	−7.271***	−7.218***	−5.018***	−5.008***
	(−5.47)	(−5.92)	(−4.84)	(−4.97)
N	4915	4915	4915	4915
R^2	0.227	0.234	0.217	0.224

Note: Table 7 reports the moderating effect of institutional shareholders. T-statistics are reported in parentheses. ***, ** and * represent significance at the 1%, 5% and 10% levels, respectively.

5. Robustness tests

5.1. Change in indicator measurement method

To avoid biased conclusions due to the measurement of significant variables, we change the measurement methods of investor attention and corporate environmental responsibility.

With the gradual popularization of Internet technology, online forums, such as GUBA, have become an indispensable part of the financial market. Investors are increasingly willing to share their views and expectations about stocks in forums, and online investor opinions affect corporate decisions. For investor attention, we use the online stock forum DongFang GUBA – which has a vast user base and the greatest influence on China's stock market – as the data source, drawing on Huang et al. (2016). As an alternative, we adopt the natural logarithm of a firm's annual postings plus one (*post*) and the natural logarithm of a firm's annual reading of relevant posts plus one (*read*). For corporate environmental responsibility, we use the environmental responsibility scores (*Hexun*) of listed companies provided by Hexun.com as an alternative measure (Chen et al., 2020).

The results are displayed in Table 8. Even when we change the measures of the main variables, investor attention still contributes to corporate environmental responsibility, showing that the conclusion is robust.

Table 8. Change the indicator measurement method

	CER	CER	Hexun	Hexun
	(1)	(2)	(3)	(4)
Attention			0.469***	
			(3.21)	
$Attention_{t-1}$				0.387***
				(4.05)
post	0.387***			
	(4.06)			
read		0.457***		
		(4.66)		

	CER	CER	Hexun	Hexun
	(1)	(2)	(3)	(4)
Lev	1.216***	1.165***	0.042	0.057
	(2.76)	(2.66)	(0.08)	(0.11)
CF	4.250***	4.150***	2.838*	2.902**
	(4.97)	(4.86)	(1.94)	(1.99)
MTB	1.731***	1.756***	1.737***	1.724***
	(5.03)	(5.13)	(4.49)	(4.45)
Tangibility	0.221	0.218	0.622	0.629
	(0.39)	(0.38)	(0.89)	(0.90)
Top10	2.455***	2.582***	0.929	0.911
	(3.81)	(4.00)	(1.31)	(1.28)
ROE	1.432***	1.353***	0.626	0.683
	(3.91)	(3.73)	(1.01)	(1.10)
Growth	−0.360***	−0.381***	−0.194	−0.173
	(−3.45)	(−3.68)	(−1.08)	(−0.96)
Dividends	−0.112	−0.123	−0.208	−0.200
	(−0.69)	(−0.75)	(−1.03)	(−0.99)
Age	0.048***	0.045***	0.026*	0.023
	(3.46)	(3.26)	(1.71)	(1.54)
Industry	YES	YES	YES	YES
Year	YES	YES	YES	YES
cons	−4.562***	−8.507***	−0.261	0.359
	(−3.72)	(−4.60)	(−0.19)	(0.32)
N	4915	4915	4349	4349
R^2	0.186	0.190	0.165	0.165

Note: Table 8 reports the regression results after changing the measurement method of core explanatory variables. Column (1) uses the natural logarithm of firm's annual postings in the GUBA plus one for regression, and column (2) uses the natural logarithm of firm's annual reading of relevant posts in the GUBA plus one for regression. Columns (3) and (4) use the score of Hexun for regression. T-statistics are reported in parentheses. ***, ** and * represent significance at the 1%, 5% and 10% levels, respectively.

5.2. Changing regression model

Considering that corporate environmental responsibility is a bounded variable, we adopt the Tobit model for the regression. The results are shown in Table 9. It is observed that the regression coefficient for investor attention remains significantly positive at the 1% level, indicating that our conclusions are robust.

Table 9. Changing regression model

	(1)	(2)
Attention	1.298***	
	(7.98)	
Attention$_{t-1}$		0.829***
		(7.15)
Lev	0.980**	1.133**
	(2.13)	(2.42)
CF	3.974***	4.398***
	(4.22)	(4.71)
MTB	1.626***	1.664***
	(4.46)	(4.51)
Tangibility	0.225	0.318
	(0.38)	(0.53)
Top10	2.782***	2.621***
	(4.24)	(3.95)
ROE	0.951**	1.231***
	(2.51)	(3.16)
Growth	−0.337***	−0.279**
	(−3.06)	(−2.49)
Dividends	−0.223	−0.163
	(−1.27)	(−0.93)
Age	0.048***	0.046***
	(3.30)	(3.07)
Industry	YES	YES
Year	YES	YES
cons	−10.244***	−7.037***
	(−7.36)	(−6.10)
sigma_e	7.406***	7.552***
	(23.08)	(24.11)
N	4915	4915
Wald chi2	13.51	12.42
Log–likelihood	−10 958.366	−11 002.639

Note: Table 9 reports the results of the Tobit model. The t-statistics are reported in brackets, and ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels.

5.3. Instrument variable

Although we control for factors that may affect corporate environmental responsibility, the endogenous problems caused by reverse causality between investor attention and corporate environmental responsibility have not been tested. Specifically, when a firm has environ-

mental awareness, fosters a green culture, and signals to the public that it is fulfilling its environmental responsibilities, investor attention will naturally increase. This can create a false correlation between investor attention and corporate environmental responsibility. To eliminate the endogeneity problem, we adopt instrumental variables for a two-stage least squares (2SLS) analysis to conduct robustness tests.

The first instrumental variable is the average investor attention in the same industry (*Ind_Average*), following Hao (2023). Drake et al. (2017) argued that investor attention shifts between companies within the same industry, suggesting that the investor attention of peer firms in the same industry is correlated. However, there is no evidence that peer industry investor attention influences firms' environmental responsibilities. Therefore, *Ind_Average* satisfies the conditions of relevance and exclusivity. The second instrumental variable is the average investor attention in the same province (*Pro_Average*), following Li et al. (2023). This correlates with investors' online searches without impacting a specific company's environmental responsibility. According to Hao (2023), the third instrumental variable is whether the stock is included in the CSI 300 Index (*ifHS300*) and its market value (*value*). Psychological theory argues that people provide stronger feedback to objects with salient features in the same situation (Fiske & Taylor, 2016). Compared with companies excluded from the CSI 300 Index, stocks in the CSI 300 Index have outstanding characteristics. Therefore, firms with varying market capitalizations in the primary stock index potentially attract retail investors due to the salient effect. However, this has no effect on corporate environmental responsibility.

Table 10 presents the results of the 2SLS model. The first-stage results show that the coefficients of the instrumental variables are significant at the 1% level. Additionally, the F-value exceeds the empirical limit of 10, thus passing the weak instrument test. In the second stage, the coefficient of *Attention* is significantly positive, indicating that our conclusions are robust. In other words, investor attention promotes corporate environmental responsibility, rather than the reverse.

Table 10. Endogeneity: Instrument variable

	Attention	CER	Attention	CER	Attention	CER
	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage
	(1)	(2)	(3)	(4)	(5)	(6)
Attention*		1.033**		1.410***		3.048***
		(2.10)		(5.70)		(15.91)
Ind_Average	0.955***					
	(9.92)					
Pro_Average			0.686***			
			(16.70)			
ifHS300					0.721***	
					(26.40)	
value					0.009***	
					(7.83)	
Lev	0.406***	0.922***	0.344***	0.767***	0.295***	0.092
	(8.43)	(3.28)	(7.32)	(3.48)	(6.78)	(0.41)

End of Table 10

	Attention	CER	Attention	CER	Attention	CER
	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage
	(1)	(2)	(3)	(4)	(5)	(6)
CF	0.737***	3.707***	0.721***	3.429***	0.520***	2.215***
	(4.96)	(5.35)	(4.91)	(5.47)	(3.81)	(3.24)
MTB	0.272***	1.520***	0.205***	1.424***	0.204***	1.007***
	(6.47)	(7.08)	(5.08)	(7.93)	(5.29)	(5.15)
Tangibility	0.137**	0.173	0.076	0.121	0.167***	−0.107
	(2.25)	(0.65)	(1.26)	(0.46)	(2.98)	(−0.37)
Top10	−0.580***	2.640***	−0.617***	2.865***	−1.025***	3.843***
	(−9.67)	(6.59)	(−10.55)	(8.96)	(−17.93)	(11.82)
ROE	0.522***	0.998***	0.505***	0.791***	0 .389***	−0.106
	(8.10)	(2.73)	(7.94)	(2.75)	(6.57)	(−0.36)
Growth	−0.003	−0.321***	−0.006	−0.320***	0.036*	−0.316***
	(−0.15)	(−3.48)	(−0.28)	(−3.47)	(1.74)	(−3.14)
Dividends	0.096***	−0.172**	0.062***	−0.208**	0.049***	−0.363***
	(5.86)	(−1.88)	(3.96)	(−2.54)	(3.35)	(−4.25)
Age	0.015***	0.036***	0.013***	0.031***	0.013***	0.006
	(10.14)	(3.82)	(8.83)	(4.38)	(9.20)	(0.79)
Industry	YES	YES	YES	YES	YES	YES
Year	YES	YES	YES	YES	YES	YES
cons	−0.133	−7.971**	1.932***	−10.420***	6.710***	−21.084***
	(0.844)	(−2.48)	(6.74)	(−6.28)	(101.53)	(−16.28)
1st Stage F	98.49		279.04		582.25	
N	4915	4915	4915	4915	4915	4915
R^2	0.393	0.222	0.4247	0.216	0.487	0.054

Note: Table 10 reports the regression results of 2SLS. The values in brackets are *t* and *z*. The first stage reports t-statistics and the second stage reports z-statistics. ***, ** and * represent significance at the 1%, 5% and 10% levels, respectively.

5.4. Heterogeneity of firm ownership and marketization level

Due to the unique characteristics of China's current system, the property rights relationship between state-owned enterprises (SOEs) and the government allows SOEs to receive greater policy support, such as low-cost access to funds and tax relief. However, while benefiting from resources, SOEs must also bear more environmental responsibilities. In contrast, investors pay more attention to SOEs and have higher expectations regarding environmental protection. Therefore, compared to private enterprises (NSOEs), SOEs in the high-pollution industry are expected to fulfill environmental responsibilities at a higher level. We divide the sample into SOEs and NSOEs based on firm ownership, and the sub-sample results are presented in Table 11. The coefficient of SOEs is higher than that of NSOEs, aligning with our logical inference.

The level of marketization is a comprehensive indicator used to measure the process of regional marketization and degree of economic growth. The supervision of laws and public opinion in different regions is also important. When a region has a high level of marketization, its legal regulatory system is better, information transparency is higher, and the role of investor attention in monitoring corporate governance is more pronounced. Therefore, investor attention contributes more to corporate environmental responsibility in areas with high marketization. We adopt the annual NERI index to measure the regional marketization level. We divide the sample into two subsamples – high and low marketization – based on whether a province's NERI index is higher than the median NERI index for each year. The results are reported in Table 11, as previously inferred.

The results of the sub-sample analysis show that investor attention promotes corporate environmental responsibility, supporting the robustness of our conclusions.

Table 11. Heterogeneity of firm ownership and marketization level

	NSOEs		SOEs		Low-level Marketization		High-level Marketization	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Attention	0.638***		1.229***		0.714**		1.136***	
	(3.95)		(4.86)		(2.39)		(6.33)	
Attention$_{t-1}$		0.364***		1.080***		0.575***		0.724***
		(4.22)		(5.37)		(3.18)		(6.65)
Lev	1.315***	1.435***	0.584	0.636	1.733*	1.789*	0.628	0.760
	(2.63)	(2.82)	(0.89)	(0.96)	(1.92)	(1.93)	(1.32)	(1.58)
CF	4.395***	4.631***	3.545***	3.801***	3.317*	3.362*	3.751***	4.165***
	(4.31)	(4.57)	(2.77)	(3.03)	(1.90)	(1.96)	(3.89)	(4.33)
MTB	1.310***	1.331***	1.386***	1.270**	1.706**	1.573**	1.550***	1.636***
	(3.15)	(3.17)	(2.68)	(2.46)	(2.44)	(2.27)	(4.06)	(4.23)
Tangibility	0.628	0.636	−0.479	−0.374	0.212	0.282	0.209	0.316
	(0.90)	(0.91)	(−0.60)	(−0.47)	(0.22)	(0.30)	(0.33)	(0.49)
Top10	0.387	0.157	4.837***	4.954***	1.212	1.200	2.928***	2.819***
	(0.54)	(0.22)	(5.38)	(5.50)	(0.99)	(1.00)	(4.23)	(4.01)
ROE	2.103***	2.373***	0.298	0.311	0.993	1.049	1.100***	1.376***
	(4.17)	(4.55)	(0.65)	(0.68)	(1.39)	(1.49)	(2.82)	(3.41)
Growth	−0.136	−0.112	−0.427***	−0.347**	−0.347**	−0.336**	−0.260**	−0.187
	(−1.11)	(−0.90)	(−2.84)	(−2.28)	(−2.41)	(−2.34)	(−2.05)	(−1.47)
Dividends	−0.238	−0.235	−0.433*	−0.393*	−0.562*	−0.487	−0.011	0.015
	(−1.10)	(−1.09)	(−1.92)	(−1.74)	(−1.80)	(−1.56)	(−0.06)	(0.08)
Age	0.035**	0.035**	0.022	0.012	0.011	0.003	0.041***	0.041**
	(2.11)	(2.04)	(0.89)	(0.48)	(0.40)	(0.10)	(2.64)	(2.57)
Industry	YES	YES	YES	YES	YES	YES	YES	YES
Year	YES	YES	YES	YES	YES	YES	YES	YES

	NSOEs		SOEs		Low-level Marketization		High-level Marketization	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
cons	−6.804***	−4.701***	−9.676***	−8.552***	−5.559**	−4.424**	−8.135***	−5.445***
	(−4.60)	(−4.50)	(−5.02)	(−5.29)	(−2.17)	(−2.37)	(−5.13)	(−4.32)
N	2580	2580	2335	2335	1184	1184	3731	3731
R^2	0.193	0.184	0.261	0.259	0.201	0.200	0.260	0.243

Note: Table 11 reports the regression results by sub-samples. Columns (1)–(4) show the regression results of state-owned firms and non-state-owned firms, and columns (5)–(8) report the regression results of high-low-level marketization. The t-statistics are written in brackets, and ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels.

6. Conclusions

6.1. Main findings

To explore the relationship between investor attention and corporate environmental responsibility, we use Chinese A-share listed firms in high-pollution industry from 2013 to 2021 as the research sample and draw the following conclusions through empirical tests.

Investor attention positively and significantly impacts the environmental responsibility of high-pollution firms, indicating that investor attention has become an external force that cannot be ignored and influences firms' environmental behavior. Investor attention promotes corporate environmental responsibility by increasing executives' environmental awareness and strengthening government environmental regulations. The moderating analysis reveals that financing constraints weaken the positive correlation between these two factors. In contrast, political connections and institutional shareholders strengthen the promotion of investor attention on corporate environmental responsibility. Heterogeneity analysis shows that the environmental contribution effect of investor attention is more pronounced in state-owned enterprises and in regions with high marketization levels.

6.2. Suggestions

From a governmental perspective, first, the cost of fulfilling environmental responsibility is high for corporations, and the benefits are not easily realized in the short term. Therefore, the government should formulate policies to reduce the cost of corporate green production, such as providing subsidies to firms that adopt low-carbon and energy-saving production technologies and offering tax concessions to firms that produce green products. These measures can improve corporate interest in fulfilling environmental responsibilities. Second, the government should strengthen its regulatory role by building a system for information disclosure and public participation. By signaling the importance of environmental protection to investors, it can leverage investor attention to further promote corporate environmental responsibility.

From a firm perspective, on one hand, company management should pay attention to network public opinion, understand public information in a timely manner, shape the corporate image, and maintain relationships with investors. Companies should also actively enhance

their awareness of environmental protection, formulate green development strategies, and assume environmental responsibility.

6.3. Limitations and prospects

Our study has some limitations. We only examine the impact of investor attention on corporate environmental responsibility using Chinese firms in high-pollution industry. To gain a more comprehensive understanding, future research should test these findings using an international sample. In subsequent studies, the sample could be extended to both developed and developing countries. Further refinement of the relationship between investor attention and CER across different institutional and cultural contexts will contribute to sustainable human development.

Author contributions

Shuangyan Li structured the research. Dan Wang was responsible for data collection and analysis. Shuangyan Li and Dan Wang wrote the first draft of the paper and were responsible for the revision.

Disclosure statement

The authors declare that they have no competing financial, professional, or personal interests from other parties.

References

Bendig, D., Schulz, C., Theis, L., & Raff, S. (2023). Digital orientation and environmental performance in times of technological change. *Technological Forecasting and Social Change*, *188*, Article 122272. https://doi.org/10.1016/j.techfore.2022.122272

Blundell, W., Gowrisankaran, G., & Langer, A. (2020). Escalation of scrutiny: The gains from dynamic enforcement of environmental regulations. *American Economic Review*, *110*(8), 2558–2585. https://doi.org/10.1257/aer.20181012

Borochin, P., & Yang, J. (2017). The effects of institutional investor objectives on firm valuation and governance. *Journal of Financial Economics*, *126*(1), 171–199. https://doi.org/10.1016/j.jfineco.2017.06.013

Chen, X., Zhang, J., & Zeng, H. (2020). Is corporate environmental responsibility synergistic with governmental environmental responsibility? Evidence from China. *Business Strategy and the Environment*, *29*(8), 3669–3686. https://doi.org/10.1002/bse.2603

Chen, L., Li, W., Yuan, K., & Zhang, X. (2022). Can informal environmental regulation promote industrial structure upgrading? Evidence from China. *Applied Economics*, *54*(19), 2161–2180. https://doi.org/10.1080/00036846.2021.1985073

Cheng, F., Chiao, C., Wang, C., Fang, Z., & Yao, S. (2021). Does retail investor attention improve stock liquidity? A dynamic perspective. *Economic Modelling*, *94*, 170–183. https://doi.org/10.1016/j.econmod.2020.10.001

Chiou, T., Chan, H. K., Lettice, F., & Chung, S. H. (2011). The influence of greening the suppliers and green innovation on environmental performance and competitive advantage in Taiwan. *Transportation Research Part E: Logistics and Transportation Review*, *47*(6), 822–836. https://doi.org/10.1016/j.tre.2011.05.016

CNRDS. (n.d.). https://www.cnrds.com/Home/Login

CSMAR. (n.d.). *Database*. https://data.csmar.com/

Da, Z., Engelberg, J., & Gao, P. J. (2011). In search of attention. *The Journal of Finance*, *66*(5), 1461–1499. https://doi.org/10.1111/j.1540-6261.2011.01679.x

Ding, R., & Hou, W. (2015). Retail investor attention and stock liquidity. *Journal of International Financial Markets, Institutions and Money*, *37*, 12–26. https://doi.org/10.1016/j.intfin.2015.04.001

Drake, M. S., Jennings, J., Roulstone, D. T., & Thornock, J. R. (2017). The comovement of investor attention. *Management Science*, *63*(9), 2773–3145. https://doi.org/10.1287/mnsc.2016.2477

Environmental Statistics Group, Center for Statistical Sciences, Peking University. (2019). *Air quality assessment report (VI): Assessment of regional pollution conditions in "2+43" Cities 2013–2018*. http://www.gsm.pku.edu.cn/pdf/2013201820190410.pdf

Fiske, S., & Taylor, S. (2016). *Social cognition: From brains to culture*. SAGE publications.

Francoeur, C., Lakhal, F., Gaaya, S., & Saad, I. B. (2021). How do powerful CEOs influence corporate environmental performance? *Economic Modelling*, *94*, 121–129. https://doi.org/10.1016/j.econmod.2020.09.024

Gao, Y., Wang, Y., & Zhang, M. (2021). Who really cares about the environment? CEOs' military service experience and firms' investment in environmental protection. *Business Ethics, the Environment & Responsibility*, *30*(1), 4–18. https://doi.org/10.1111/beer.12320

Hameed, Z., Naeem, R. M., Misra, P., Chotia, V., & Malibari, A. (2023). Ethical leadership and environmental performance: The role of green IT capital, green technology innovation, and technological orientation. *Technological Forecasting and Social Change*, *194*, Article 122739. https://doi.org/10.1016/j.techfore.2023.122739

Han, F., Mao, X., Yu, X., & Yang, L. (2024). Government environmental protection subsidies and corporate green innovation: Evidence from Chinese microenterprises. *Journal of Innovation & Knowledge*, *9*(1), Article 100458. https://doi.org/10.1016/j.jik.2023.100458

Hao, J. (2023). Retail investor attention and corporate innovation in the big data era. *International Review of Financial Analysis*, *86*, Article 102486. https://doi.org/10.1016/j.irfa.2023.102486

He, Y., Ding, X., & Yang, C. (2021). Do environmental regulations and financial constraints stimulate corporate technological innovation? Evidence from China. *Journal of Asian Economics*, *72*, Article 101265. https://doi.org/10.1016/j.asieco.2020.101265

He, F., Yan, Y., Hao, J., & Wu, J. (2022). Retail investor attention and corporate green innovation: Evidence from China. *Energy Economics*, *115*, Article 106308. https://doi.org/10.1016/j.eneco.2022.106308

Helmke, G., & Levitsky, S. (2004). Informal institutions and comparative politics: A research agenda. *Perspectives on Politics*, *2*(4), 725–740. https://doi.org/10.1017/S1537592704040472

Hu, J., Wu, H. Y., & Ying, S. X. (2022). Environmental regulation, market forces, and corporate environmental responsibility: Evidence from the implementation of cleaner production standards in China. *Journal of Business Research*, *150*, 606–622. https://doi.org/10.1016/j.jbusres.2022.06.049

Huang, Y., Qiu, H., & Wu, Z. (2016). Local bias in investor attention: Evidence from China's internet stock message boards. *Journal of Empirical Finance*, *38*, 338–354. https://doi.org/10.1016/j.jempfin.2016.07.007

Jang, J., & Jun, S.-G. (2025). YouTube view count, investor attention and stock returns. *International Review of Financial Analysis*, *97*, Article 103782. https://doi.org/10.1016/j.irfa.2024.103782

Li, Z., Liao, G., & Albitar, K. (2020). Does corporate environmental responsibility engagement affect firm value? The mediating role of corporate innovation. *Business Strategy and the Environment*, *29*(3), 1045–1055. https://doi.org/10.1002/bse.2416

Li, C., Liu, X., Hou, Z., & Li, Y. (2023a). Retail investor attention and equity mispricing: The mediating role of earnings management. *Finance Research Letters*, *53*, Article 103621. https://doi.org/10.1016/j.frl.2022.103621

Li, D. Y., Jiang, J., Zhang, L., Huang, C., & Wang, D. (2023b). Do CEOs with sent-down movement experience foster corporate environmental responsibility? *Journal of Business Ethics*, *185*, 147–168. https://doi.org/10.1007/s10551-022-05300-0

Li, J., Lian, G., & Xu, A. (2023c). How do ESG affect the spillover of green innovation among peer firms? Mechanism discussion and performance study. *Journal of Business Research*, *158*, Article 113648. https://doi.org/10.1016/j.jbusres.2023.113648

Li, P., Zou, H., Coffman, D., Mi, Z., & Du, H. (2024). The synergistic impact of incentive and regulatory environmental policies on firms' environmental performance. *Journal of Environmental Management*, *365*, Article 121646. https://doi.org/10.1016/j.jenvman.2024.121646

Li, R., & Ramanathan, R. (2024). The interactive effect of environmental penalties and environmental subsidies on corporate environmental innovation: Is more better or worse? *Technological Forecasting and Social Change*, *200*, Article 123193. https://doi.org/10.1016/j.techfore.2023.123193

Liao, F., Hu, Y., & Xu, S. (2023). How do environmental subsidies affect the environmental performance of heavily polluting enterprises: Evidence from China. *Economic Research-Ekonomska Istraživanja*, *36*(3), Article 2160777. https://doi.org/10.1080/1331677X.2022.2160777

Lin, B. Q., & Zhang, Q. X. (2023). Corporate environmental responsibility in polluting firms: Does digital transformation matter? *Corporate Social Responsibility and Environmental Management*, *30*(5), 2234–2246. https://doi.org/10.1002/csr.2480

Lin, H., Zeng, S., Wang, L., Zou, H., & Ma, H. (2016). How does environmental irresponsibility impair corporate reputation? A multi-method investigation. *Managerial and Decision Economics*, *23*(6), 413–423. https://doi.org/10.1002/csr.1387

Liu, X., Liu, S., Wang, J., & Chen, H. (2024). Does internal control affect corporate environmental responsibility? Evidence from China. *International Journal of Emerging Markets*. https://doi.org/10.1108/IJOEM-06-2023-0955

Marquis, C., & Bird, Y. H. (2018). The paradox of responsive authoritarianism: How civic activism spurs environmental penalties in China. *Organization Science*, *29*(5), 755–987. https://doi.org/10.1287/orsc.2018.1212

Pan, J., Du, L., Wu, H., & Liu, X. (2024). Does environmental law enforcement supervision improve corporate carbon reduction performance? Evidence from environmental protection interview. *Energy Economics*, *132*, Article 107441. https://doi.org/10.1016/j.eneco.2024.107441

Prasad, M., Mishra, T., & Bapat, V. (2019). Corporate social responsibility and environmental sustainability: Evidence from India using energy intensity as an indicator of environmental sustainability. *IIMB Management Review*, *31*(4), 374–384. https://doi.org/10.1016/j.iimb.2019.07.014

Shi, B., Wang, X., Jiang, X., Yang, H., & Sui, W. (2024). Green institutional investors' shareholding and corporate environmental responsibility. *Finance Research Letters*, *62*(B), Article 105232. https://doi.org/10.1016/j.frl.2024.105232

Suchman, M. C. (1995). Managing legitimacy: Strategic and institutional approaches. *Academy of Management Review*, *20*(3), 571–610. https://doi.org/10.2307/258788

Sun, G., Fang, J., Li, J., & Wang, X. (2024). Research on the impact of the integration of digital economy and real economy on enterprise green innovation. *Technological Forecasting and Social Change*, *200*, Article 123097. https://doi.org/10.1016/j.techfore.2023.123097

Tan, Y., & Zhu, Z. (2022). The effect of ESG rating events on corporate green innovation in China: The mediating role of financial constraints and managers' environmental awareness. *Technology in Society*, *68*, Article 101906. https://doi.org/10.1016/j.techsoc.2022.101906

Tao, C., Hui, D., & Chen, L. (2020). Institutional shareholders and corporate social responsibility. *Journal of Financial Economics*, *135*(2), 483–504. https://doi.org/10.1016/j.jfineco.2019.06.007

Tian, X., Zhang, Z., Zhang, C., & Gao, M. (2024). Investor attention, analysts coverage and idiosyncratic volatility puzzle: Based on behavioral perspective. *International Journal of Emerging Markets*, *19*(7), 1804–1838. https://doi.org/10.1108/IJOEM-02-2021-0289

Vargas-Santander, K. G., Álvarez-Diez, S., Baixauli-Soler, S., & Belda-Ruiz, M. (2024). Do financial constraints lead to environmental, social and governance controversies? The role of country context. *Business Strategy and the Environment*, *34*, 965–981. https://doi.org/10.1002/bse.4025

Wang, W., Zhao, X.-Z., Chen, F.-W., Wu, C.-H., Tsai, S., & Wang, J. (2019). The effect of corporate social responsibility and public attention on innovation performance: Evidence from high-polluting industries. *International Journal of Environmental Research and Public Health*, *16*(20), Article 3939. https://doi.org/10.3390/ijerph16203939

Wang, C. Y., Li, W. Y., Li, J., & Wan, L. (2024). The effects of extreme climate events on green technology innovation in manufacturing enterprises. *Journal of Business Economics and Management*, *25*(2), 337–355. https://doi.org/10.3846/jbem.2024.21170

Wang, J. (2024). Assessing environmental protection Tax's impact on firms' green practices: The mediating effect of green innovation and the moderating effect of executive green awareness. *Journal of Cleaner Production*, *474*, Article 43593. https://doi.org/10.1016/j.jclepro.2024.143593

Wen, D., Zhang, Z., Nie, J., & Cao, Y. (2024). Investor attention and anomalies: Evidence from the Chinese stock market. *International Review of Financial Analysis*, *96*(B), Article 103775. https://doi.org/10.1016/j.irfa.2024.103775

Xu, S., & Ma, P. Y. (2022). CEOs' poverty experience and corporate social responsibility: Are CEOs who have experienced poverty more generous? *Journal of Business Ethics*, *180*, 747–776. https://doi.org/10.1007/s10551-021-04899-w

Yao, S., Pan, Y., Wang, L., Sensoy, A., & Cheng, F. (2023). Building eco-friendly corporations: The role of minority shareholders. *Journal of Business Ethics*, *182*, 933–966. https://doi.org/10.1007/s10551-022-05291-y

Zeng, H., Li, X., He, Y., & Meng, S. (2024). Balancing acts: The relationship between corporate environmental irresponsibility, charitable donations, and financial performance. *Managerial and Decision Economics*, *45*(2), 921–939. https://doi.org/10.1002/mde.4051

Zhang, C. (2017). Political connections and corporate environmental responsibility: Adopting or escaping? *Energy Economics*, *68*, 539–547. https://doi.org/10.1016/j.eneco.2017.10.036

Zhang, J., Zhang, D., Huang, L., Wen, H., Zhao, G., Zhan, D. (2019). Spatial distribution and influential factors of industrial land productivity in China's rapid urbanization. *Journal of Cleaner Production*, *234*, 1287–1295. https://doi.org/10.1016/j.jclepro.2019.06.287

Zhang, C., Zhou, B., & Tian, X. (2022a). Political connections and green innovation: The role of a corporate entrepreneurship strategy in state-owned enterprises. *Journal of Business Research*, *146*, 375–384. https://doi.org/10.1016/j.jbusres.2022.03.084

Zhang, D., Zhang, J., Han, R., & Zhan, D. (2022b). Two-stage development, allocation strategies' effect, and industrial land policies' adjustment, China. *Growth and Change*, *53*(2), 890–909. https://doi.org/10.1111/grow.12613

Zhang, W., Luo, Q., & Liu, S. (2022c). Is government regulation a push for corporate environmental performance? Evidence from China. *Economic Analysis and Policy*, *74*, 105–121. https://doi.org/10.1016/j.eap.2022.01.018

Zhang, B. B., Wang, Y., & Sun, C. W. (2023). Urban environmental legislation and corporate environmental performance: End governance or process control? *Energy Economics*, *118*, Article 106494. https://doi.org/10.1016/j.eneco.2022.106494