Does Investor Attention Affect Corporate Greenwashing? Evidence from China

Abstract

Enhancing ESG performance has emerged as a crucial strategy for companies to bolster market value and competitiveness. However, this trend has sparked concerns about corporate greenwashing, where companies may selectively disclose ESG-related information to garner short-term benefits. Against this backdrop, using Chinese A-share listed companies from 2010 to 2022, we examine the impact of investor attention on corporate greenwashing. The findings reveal that investor attention significantly curbs corporate greenwashing. Mechanism analysis indicates that investor attention achieves this by alleviating corporate financing constraints and enhancing transparency in corporate information. Furthermore, moderating analysis suggests that enhancing internal controls and increasing environmental subsidies can strengthen the inhibitory effect of investor attention on corporate greenwashing. Finally, heterogeneity analysis demonstrates that the inhibitory effect of investor attention on corporate greenwashing is more pronounced in state-owned enterprises and companies facing high financing constraints. These findings not only contribute to the literature on investor attention but also offer insights for governing corporate greenwashing and advancing the dual-carbon goal.

Keywords: Investor attention; Corporate greenwashing; Internal controls; Environmental subsidies; China

1. Introduction

The dual carbon goal represents a significant initiative in which China proactively assumes its responsibilities as a major global player while also serving as a crucial decision in China's pursuit of sustainable development. As the dual carbon goal continues to advance further, achieving green development becomes a pivotal means of harmonizing environmental protection and economic growth. As the micro-level foundation of pollution emissions and economic development, the imperative for Chinese enterprises lies in enhancing ESG performance to transition toward green development. In response, the Chinese government has issued a series of documents, such as the "Management Measures for Enterprises' Lawful Disclosure of Environmental Information", the "Format Guidelines for Enterprises' Lawful Disclosure of Environmental Information" and the "Work Plan to Improve the Quality of Listed Companies with Central Enterprise Holdings". These documents mandate that enterprises disclose ESG-related information in accordance with the law and establish a sound ESG information disclosure system. This serves as a crucial foundation for enhancing the ESG evaluation system and driving forward the green development of enterprises (Liu et al., 2023; He et al., 2023; Zheng et al., 2023) [1-3]. Against this backdrop, companies are increasingly focusing on their own ESG performance, aiming to cultivate a green brand image to enhance corporate reputation and gain a competitive advantage. However, companies that enhance their ESG performance exhibit clear positive externalities (Tan, 2024) [4]. Furthermore, due to the current inadequacies in corporate disclosure regulations, companies demonstrate a high level of selectivity when disclosing ESG-related information (Ye et al., 2023) [5]. This indicates that companies may selectively report environmental information or falsely embellish their image to achieve short-term gains. This phenomenon is referred to as greenwashing, where companies selectively disclose favorable information or falsely disclose environmental information to enhance

their green image and gain public recognition and market approval (Zhang et al, 2023) [6]. Although greenwashing may bring short-term gains to companies, in the long term, this unethical behavior can have detrimental effects on both corporate and societal green development. Therefore, governing corporate greenwashing is beneficial not only for driving the green transformation of companies but also for safeguarding the interests of investors and promoting the green development of the economy.

Investors are crucial entities in the capital market and serve as contributors to the financial market, being one of the vital channels for companies to acquire funding. Under the guidance of the China Securities Regulatory Commission on the active promotion of ESG investment principles by investors, investors not only consider economic information such as a company's financial performance in investment decisions but also regard nonfinancial information, especially ESG performance, as important investment evaluation indicators (Jiang et al., 2022; Matthews et al., 2022; Liu et al., 2023) [7-9]. This implies that investors' attention to companies can influence their ESG performance, thereby impacting corporate greenwashing. Therefore, can investor attention inhibit corporate greenwashing? What is the underlying mechanism? Answering this question not only contributes to expanding the literature on investor attention but also offers valuable insights for governing corporate greenwashing and promoting green development.

The main contributions of this study are as follows: (1) When studying corporate greenwashing, existing research has focused extensively on analyzing the motives and consequences of this behavior, but there has been relatively little analysis of the governance of corporate greenwashing. Therefore, this article expands the research perspective from the understanding of corporate greenwashing to the management of corporate greenwashing, enriching the research on topics related to corporate greenwashing. (2) From the perspective of investor attention, existing research has focused predominantly on the economic consequences of investor attention, such as its impact on corporate debt burden, financing constraints, and risk exposure, while overlooking the influence of investors as external stakeholders on corporate greenwashing (Zhao, 2022; Wang and Zhang, 2023)[10-11]. Therefore, this study explores the impact of investor attention on corporate greenwashing and its underlying mechanisms, thus expanding and deepening the research on investor attention. This study also considers the influence of internal and external factors of companies on the relationship between investor attention and corporate greenwashing. Specifically, this study examines the moderating effects of internal controls and environmental regulations on the relationship between investor attention and corporate greenwashing. This not only enriches and expands the research on investor attention but also delves into the internal and external factors influencing corporate greenwashing. The conclusions of this study can offer new insights for addressing corporate greenwashing in China while also providing empirical guidance and a theoretical basis for regulatory authorities to continuously enhance investor education and guidance efforts.

The remainder of this paper is structured as follows: the second part comprises the literature review and research hypotheses, the third part details the data sources and model methodology, the fourth part presents the empirical analysis, and the fifth part offers the conclusion and policy recommendations.

2. Literature review and research hypotheses

2.1 Literature review on investor concerns and corporate greenwashing

The manifestations of greenwashing primarily manifest in two aspects: first, manipulating the

extent of information disclosure, exaggerating the true environmental performance of companies, and inflating their actual value (Marquis et al., 2016; Yu et al., 2020) [12-13]. Second, it involves selectively disclosing environmental information, revealing favorable information to selected investors while concealing negative aspects (Lyon and Montgomery, 2015) [14]. Moreover, the previous literature has predominantly investigated the motives behind corporate greenwashing from three perspectives. First, there is the pursuit of short-term gains. Greenwashing not only helps reduce operational costs but also facilitates profit generation. Due to the delayed benefits and increased costs associated with substantive environmental actions, greenwashing can garner public approval and boost consumer purchases without additional investment. Furthermore, greenwashing helps companies gain the trust of banks and governments at low costs, thereby securing convenient loans and policy incentives (Truong et al., 2021; Shen et al., 2023) [15-16]. Second, there is information asymmetry. Parguel et al. (2011) found that companies use corporate social responsibility reports to communicate their green actions to the public; however, due to the information asymmetry between companies and the public, individuals may not be able to discern the authenticity of the information provided by companies and are thus potentially misled [17]. Third, there is the influence of policy regulations. Some scholars argue that robust environmental regulatory tools can curb corporate greenwashing (Smith, 2014) [18]. However, other scholars suggest that when faced with command-and-control environmental regulations, companies tend to opt for symbolic environmental actions to disguise their fulfillment of social responsibility obligations (Wang and Zhang, 2023; Berrone et al., 2017) [11,19]. Moreover, regarding the impact of investor attention on corporate behavior, researchers have found that investor attention can promote companies' ESG performance and enhance their information disclosure. Companies utilize environmental information disclosure as a means to attract investors. Businesses utilize environmental information disclosure as a means to attract investors. Consequently, heightened investor attention reduces the level of information asymmetry between companies and external stakeholders, thereby enhancing companies' ESG performance (Chen et al., 2013; Nor et al., 2016; Zhao et al., 2023) [20-22]. Furthermore, the shareholding of institutional investors can enhance the quality of environmental information disclosure by companies and foster corporate social responsibility (Wegener et al., 2013; Dyck, 2019) [23-24]. Moreover, research has shown that institutional investors' attention motivates companies to undertake more ESG actions, further attracting investors interested in ESG investments (Barzuza et al., 2019; Jiang et al., 2022) [25,7]. However, conversely, some researchers argue that investor attention may diminish a company's ESG performance. This is attributed to investors' limited sustainability and regulatory capabilities and differences in social responsibility among various investors, which compels corporate management to lean toward speculative behavior, hindering their pursuit of sustainable development (Bebchuk et al., 2017) [26]. Based on the aforementioned research, investor attention can indeed influence a company's information disclosure and ESG performance. However, its impact on corporate greenwashing and its underlying mechanisms remain unclear, and further research is needed.

2.2 Theoretical analysis and research hypotheses

Investors are incentivized to scrutinize the authenticity of target company information and the quality of environmental information disclosure to maximize their own interests. Additionally, policies impose requirements on investors. Investors are obligated to consider the quality of environmental information disclosure by target companies when making investment decisions, fulfilling their responsibilities as investors. Consequently, investors are motivated to increase their

level of attention toward companies. As investor attention further escalates, companies are driven to voluntarily engage in substantive environmental actions and acquire a genuine green image to secure long-term investments.

Specifically, investor attention primarily influences corporate greenwashing in two ways. First, investor attention helps to alleviate corporate financing constraints, thereby mitigating companies' motivations for greenwashing driven by cost reduction (Bai et al., 2022) [27]. As contributors to the capital market, investors' heightened attention to a target implies increased investment willingness. Actual investment behavior results in companies acquiring funds, thereby providing more resources for green development. Moreover, an increase in investor attention may lead to actual investments, accelerating the dissemination of corporate market information. This can attract the attention of other potential investors in the market, enabling the target company to obtain more financial support (Chen and Zhang, 2018) [28]. Finally, investor attention can enhance the transparency of corporate information. This increases the cost for companies to manipulate information disclosure, compelling them to actively reduce greenwashing (Lys, 2015) [29]. To make informed investment decisions, investors conduct thorough investigations into the information of target companies. Additionally, investors have limited energy and attention, leading them to adopt a precise targeting approach when gathering information. Therefore, on the one hand, the sustained attention of investors releases more specific information about target companies into the market. On the other hand, precise information acquisition enhances the efficiency of information dissemination, attracting the attention of potential investors in the market. This further increases the speed of corporate information dissemination and transparency (Lu et al., 2022) [30]. An increase in information transparency increases the probability of exposure to companies' symbolic environmental actions. To maintain the trust of investors and the market, companies voluntarily disclose high-quality environmental information, thereby reducing greenwashing and actively fulfilling environmental and social responsibilities (Wang and Zhang, 2021) [31]. This provides an image of resource conservation and environmental friendliness to the external world (Wang et al., 2021) [32]. Based on the above analysis, the following hypothesis is proposed:

H1: Investor attention can curb corporate greenwashing.

Market-based environmental regulations mainly include pollution charges and environmental subsidies (Luo et al., 2023; Zhang et al., 2023)[33-34]. This study chooses market-based environmental regulation tools to explore their moderating effect on the relationship between investor attention and corporate greenwashing. The reason is that market-based environmental regulations can internalize the negative externalities generated by corporate environmental pollution into the costs of companies, incentivizing companies to reduce pollution emissions and increase substantive environmental actions. Specifically, under the scenario of pollution charges, if the pollution fees incurred by a company due to excessive emissions exceed the cost of improving technology or employing environmental equipment, the company will automatically opt for environmental actions to reduce emissions. Additionally, companies can obtain compensation in the market for their environmental actions, such as environmental subsidies, which can directly assist financially constrained companies in purchasing environmental equipment or improving environmental technologies. This helps mitigate the high costs and financial constraints encountered by companies in undertaking environmental innovation or research and development projects, thereby directly promoting substantive environmental actions by companies. Market-based environmental regulatory mechanisms can incentivize companies to reduce pollution in their

production and operational activities, thereby promoting companies' effective fulfillment of environmental social responsibilities (Tian et al., 2024)[35]. Additionally, penalties for environmental pollution, such as pollution charges, and incentives for compliance, such as environmental subsidies, can facilitate more effective enforcement of environmental regulations, thereby alleviating conflicts of interest between companies and investors (Sheng et al., 2020) [36]. Based on the above analysis, the following hypothesis is proposed:

H2: Market-based environmental regulations can enhance the inhibitory effect of investor attention on corporate greenwashing.

Internal control is the mechanism for internal supervision and governance within a company, serving as a guarantee for the healthy operation of the enterprise. It plays a crucial role in driving enterprises toward achieving green development. High-quality internal control can harmonize the distribution of interests between owners and investors, thus enhancing corporate ESG performance (Chen et al., 2020; Bai et al., 2024) [37-38]. This is mainly manifested in two aspects. First, high-quality internal control can enhance the level of internal supervision within a company, reduce agency costs, and thereby restrain short-sighted corporate management behaviors, such as engaging in greenwashing (Goh and Li, 2011; Wang et al., 2023) [39-40]. Second, high-quality internal control can alleviate information asymmetry within a company, thereby enhancing information flow efficiency. This makes it easier for investors to identify corporate operational issues, increasing the cost for companies to conceal them and thus restraining greenwashing (Tang et al., 2015) [41]. Finally, high-quality internal control ensures the compliance and standardization of corporate operations. On the one hand, it reduces operational risks, enabling companies to fulfill their social responsibilities more securely. On the other hand, it mitigates conflicts of interest between company owners and investors, enhances operational efficiency, and promotes corporate green performance, thereby curbing greenwashing (Li, 2020; Jung et al., 2013) [42-43]. Based on the above analysis, the following hypothesis is proposed:

H3: Improving internal control can enhance the inhibitory effect of investor attention on corporate greenwashing.

3. Data source and model specification

3.1 Data sources

3.1.1 Sample selection

This study selects Chinese A-share listed companies from 2010 to 2022 as the sample, excluding the ST and *ST companies, the financial and insurance industries, and samples with severe missing data. The final dataset comprises 7504 sample observations. The corporate greenwashing data used in this study are sourced from Bloomberg ESG scores and Huazheng ESG indices. Corporate characteristic data are obtained from the CRNDS, CCER, Wind, and CSMAR databases. Stata software is used for sample processing and regression analysis. Finally, all continuous variables in this study are winsorized at the 1st and 99th percentiles.

3.1.2 The dependent variable

The dependent variable is corporate greenwashing. In this study, the ESG performance disclosed by companies is measured using the Bloomberg ESG score, while the actual ESG performance of companies is measured using the Huazheng ESG index. The degree of greenwashing by a company is measured as the difference between the standardized measure of the company's ESG disclosure score relative to the industry average ESG disclosure score and the standardized measure of the company's actual ESG performance score relative to the industry average actual ESG

performance score, as referenced from Zhang (2023) [44]. Specifically, the measurement for corporate greenwashing in this study is as follows:

$$\text{Greenwashing} = [\frac{\text{ESG}_{\text{Di,j,t}} - \overline{\text{ESG}_{\text{Di,j,t}}}}{\delta_D} - \frac{\text{ESG}_{\text{Ri,j,t}} - \overline{\text{ESG}_{\text{Ri,j,t}}}}{\delta_R}]$$

3.1.3 The independent variable

The explanatory variable is investor attention (Invatten). Following the methodology of Da et al. (2011) and He et al. (2022), this study selects the Internet search index from the CNRDS database and takes its natural logarithm as a proxy variable for investor attention. This index covers a wide range of online search content related to listed companies, including search data using stock codes, company abbreviations, and full company names as keywords, providing a comprehensive reflection of investor attention [45-46]. Moreover, it encompasses a large sample of listed companies and a long time span, allowing for a comprehensive measurement of investor attention.

3.1.4 Control variables

Drawing on the relevant literature, to reduce the influence of other factors on the research outcomes, this study also selected several control variables related to financial characteristics and governance effectiveness at the firm level. Specifically, these variables include enterprise size (Size), the natural logarithm of total assets at the end of the period; enterprise age (Age), the natural logarithm of the number of years the company has been listed; leverage ratio (Lev), the ratio of total liabilities to total assets at the end of the period; return on assets (Roa), the ratio of net profit to total assets; ownership concentration (Dual), the sum of the shareholding ratios of the second to fifth largest shareholders divided by the shareholding ratio of the largest shareholder; and enterprise growth ability (Growth), the value of the ratio of operating income to the previous year's operating income minus one, representing the growth rate of the enterprise's operating income.

3.1.5 Mediating variables

Financial Constraint (SA): Financial constraint refers to the various restrictions that a company faces when it has financing needs. Specifically, companies with high financial constraints find it more difficult to obtain financial support or face higher financing costs when facing financial risks. According to previous research findings, financial constraints are one of the motivations for companies to engage in greenwashing (Li et al., 2022) [47]. When facing tight financial conditions, companies have difficulty allocating sufficient funds to environmental initiatives and fulfilling social responsibilities; thus, they choose greenwashing. This study measures the degree of financial constraints using the absolute value of the SA index, where a higher value indicates more severe financial constraints (Guo et al., 2023) [48].

Transparency (TM): Transparency refers to the extent to which companies disclose financial and managerial information. Companies with high transparency disclose more information to the market, increasing the supply of information to the market. Compared to competitors, they are more likely to attract the attention of potential investors in the market. According to limited attention theory, investors tend to invest in companies in which they are interested (Chen et al., 2020) [49]. Therefore, companies with high transparency can attract more and higher-quality investments, have more funds for environmental projects, and thus reduce greenwashing.

3.1.6 Moderating variables

Internal Control Level (Inncon): The internal control level refers to the actual effectiveness and real level of various control and management methods adopted by enterprises in the process of operation to achieve predetermined goals. Enterprises with high internal control levels can

effectively monitor various aspects, such as environmental information disclosure, pollution emissions, and governance, thereby inhibiting greenwashing. Drawing from the literature, this study uses the Dibo Internal Control Index to represent the level of internal control in enterprises. This index can effectively measure the level of internal control in enterprises because it starts from the five major objectives of internal control and adjusts based on internal control deficiencies, comprehensively reflecting the quality of internal control and risk management capabilities. This study measures the quality of internal control using the natural logarithm of the Dibo Internal Control Index, where a higher value indicates a higher level of internal control (Li et al., 2021; Chalmers et al., 2019) [50-51].

Environmental Regulation (Envtool): Environmental regulation refers to various regulations imposed on environmental behavior for the purpose of environmental protection and pollution control. At present, the main environmental regulatory tools in China include pollution charges and environmental subsidies. Generally, market-based environmental regulatory tools transform external market oversight into the internal behavior of enterprises, which forces business managers to weigh the consequences of greenwashing. Therefore, following Berrone et al. (2013) and Montmartin and Herrera (2015), this study introduces pollution charges (Tax) and environmental subsidies (Subsidy) as moderating variables of environmental regulation into the regression model for analysis [52-53]. The variables and their definitions considered in this paper are presented in Table 1.

Table 1. Variables and definitions

Type	Symbols	Names	Definitions
Dependent Variable	$Greenwashing_{it}$	Greenwashing	Greenwashing
Independent Variable	$Invatten_{it}$	Investor Attention	Internet Search Index
Control Variables	$Size_{it}$	Enterprise Scale	Natural logarithm of the total assets
	Age_{it}	Enterprise Age	Natural logarithm of the enterprise age
	Roa_{it}	Return on Assets	The ratio of net income to the average total assets
	Lev_{it}	Debt-to-Asset Ratio	The ratio of total liabilities to total assets at the end of the year
	$Growth_{it}$	Growth Force	The ratio of current year's operating revenue to the previous year's operating revenue minus 1
	$Dual_{it}$	Dual Role of the Board Chairman	1 for the chairman of the board and CEO are held by the same individual, and 0 otherwise
	$TobinQ_{it}$	Tobin's Q Value	The Tobin's Q value of a firm

3.2 Model specification

The following models were constructed in this study to investigate the impact of investor attention on the greenwashing behavior of firms, with specific model specifications as follows:

$$Greenwashing_{i,t} = \alpha_0 + \alpha_1 Invatten_{i,t} + \alpha_2 CVs_{i,t} + \sum industry + \sum year + \sum provience + \varepsilon_{i,t} \quad (1)$$

Furthermore, to analyze the mechanism by which investor attention influences the greenwashing behavior of firms, this paper constructed Model (2) for analysis, with the following specific model specifications:

$$Mediator_{i,t} = \beta_0 + \beta_1 Invatten_{i,t} + \beta_2 CVs_{i,t} + \sum industry + \sum year + \sum provience + \varepsilon_{i,t} \quad (2)$$

Finally, to analyze the impact of internal and external factors of firms on the relationship between investor attention and greenwashing behavior, this study constructed Model (3) for analysis, with the specific model specifications as follows:

$$Greenwashing_{i,t} = \gamma_0 + \gamma_1 Invatten_{i,t} + \gamma_2 CVs_{i,t} + \gamma_3 Invatten_{i,t} * CVs_{i,t}$$
$$+ \sum industry + \sum year + \sum provience + \varepsilon_{i,t} \quad (3)$$

4. Empirical analysis

4.1 Descriptive statistics

Table 2 presents the descriptive statistics of each variable, including the sample size, median, mean, maximum, minimum, and standard deviation for each variable. First, we observe that the mean of investor attention is 13.04, with a standard deviation of 0.67, indicating significant variations in investor attention among different firms. Moreover, these differences may influence firm decisions, such as greenwashing. Second, the mean of greenwashing is -0.62, with a standard deviation of 1.06, suggesting substantial variations in greenwashing levels among different firms. This preliminarily indicates the necessity of exploring the relationship between investor attention and greenwashing. Finally, the mean, standard deviation, and other descriptive statistics of the remaining variables align with existing research.

Table 2. Descriptive Statistics

Variable	Obs.	Mean	S.D	Min	Med	Max
Greenwashing	7504	-0.62	1.06	-2.74	-0.72	2.55
Invatten	7504	13.04	0.67	11.61	12.98	14.75
Size	7504	23.07	1.22	20.46	22.95	26.81
Age	7504	2.90	0.30	1.95	2.94	3.47
Growth	7504	0.14	0.28	-0.47	0.10	2.21
Lev	7504	0.46	0.18	0.07	0.47	0.86
Board	7504	2.19	0.20	1.61	2.20	2.71
TobinQ	7504	2.14	1.44	0.85	1.65	10.03
Dual	7504	0.20	0.40	0.00	0.00	1.00
Roa	7504	0.05	0.05	-0.18	0.04	0.20

4.2 Correlation Analysis

The correlation between investor attention and corporate greenwashing is shown in Table 3.

As depicted in Table 3, the correlation coefficient between investor attention and corporate greenwashing is -0.056, which is significantly negative, indicating a significant negative impact of investor attention on corporate greenwashing. However, correlation alone cannot clearly elucidate the mechanism through which investor attention affects corporate greenwashing, necessitating further analysis through empirical testing. Additionally, the correlation coefficients between the other variables in Table 3 are all below 0.5, suggesting that the selected variables can be used for subsequent empirical analysis.

Table 3. Correlation analysis

	Greenwashing	Invatten	Size	Age	Growth	Lev	Board	TobinQ	Dual	Roa
Greenwashing	1									
Invatten	-0.056***	1								
Size	0.175***	0.364***	1							
Age	0.0140	-0.078***	0.165***	1						
Growth	0.00300	0.00900	-0.0130	-0.098***	1					
Lev	0.077***	0.121***	0.499***	0.110***	0.00400	1				
Board	0.064***	0.081***	0.222***	0.055***	-0.048***	0.128***	1			
TobinQ	-0.033***	0.113***	-0.428***	-0.175***	0.178***	-0.423***	-0.160***	1		
Dual	-0.00400	-0.0130	-0.091***	-0.071***	0.066***	-0.073***	-0.186***	0.137***	1	
Roa	0.00400	0.025**	-0.106***	-0.061***	0.249***	-0.446***	-0.042***	0.445***	0.062***	1

4.3 Regression analysis

4.3.1 The impact of investor attention on corporate greenwashing

To investigate the impact of investor attention on corporate greenwashing, empirical regressions were conducted following Model (1). The results of the effect of investor attention on corporate greenwashing are presented in Table 4. The OLS regression results for the effect of investor attention on corporate greenwashing are shown in Table 4. Columns (1), (2), and (3) of Table 4 progressively include annual, provincial, and industry fixed effects. The coefficients of investor attention in Columns (1), (2), and (3) are significantly negative. Column (1) of Table 4 indicates that under annual fixed effects, the coefficient of investor attention is significantly negative at the 5% level. Column (2) of Table 4 indicates that under annual and provincial fixed effects, the coefficient of investor attention is significantly negative at the 10% level. Column (3) of Table 4 indicates that under annual, provincial, and industry fixed effects, the coefficient of investor attention is significantly negative at the 5% level. These results suggest that investor attention significantly suppresses corporate greenwashing, supporting H1.

Table 4. Results of investor attention to corporate greenwashing

Variables	(1) Greenwashing	(2) Greenwashing	(3) Greenwashing
Invatten	-0.047**	-0.082***	-0.061**

	(0.021)	(0.024)	(0.025)
Size	0.180***	0.201***	0.196***
	(0.014)	(0.016)	(0.017)
Age	-0.048	0.010	-0.080*
	(0.042)	(0.046)	(0.048)
Growth	-0.021	-0.018	0.004
	(0.045)	(0.046)	(0.046)
Lev	0.008	-0.071	0.144
	(0.085)	(0.089)	(0.094)
Board	0.172***	0.138**	0.093
	(0.059)	(0.060)	(0.064)
TobinQ	0.046***	0.049***	0.029**
	(0.011)	(0.011)	(0.012)
Dual	0.030	0.037	0.057*
	(0.031)	(0.031)	(0.031)
Roa	0.022	-0.115	-0.160
	(0.299)	(0.311)	(0.320)
_cons	-4.508***	-4.453***	-4.638***
	(0.338)	(0.353)	(0.400)
Year	N	Y	Y
Province	N	N	Y
Industry	N	N	Y
N	7504	7504	7504
R²	0.035	0.037	0.109

Note: ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively, with robust standard errors in parentheses.

4.3.2 Robustness test

To validate the robustness of the research findings, following Zhang (2023), He et al. (2022), and Li et al. (2023), this study replaces the independent variable with the investor search index for the stock codes of Chinese listed companies (Invatt_code); furthermore, this study assigns a value of "1" to Greenwashing values greater than 0 and "0" otherwise, replacing the dependent variable [44,46,54]. The fixed effects-instrumental variables (FE-IV) method is employed to mitigate

endeigenity, while propensity score matching (PSM) is utilized to address self-selection bias. Subsequently, regression analyses are conducted, and columns (1) to (4) of Table 5 demonstrate the robustness of the research results.

Table 5. Robustness test

Variables	(1) Greenwashing	(2) Greenwashing	(3) FE-IV	(4) PSM
Invatt_code	-0.039***			
	(0.009)			
Invatten		-0.041**	-0.081**	-0.015**
		(0.020)	(0.033)	(0.006)
Size	0.184***	0.217***	0.226***	0.181***
	(0.014)	(0.022)	(0.019)	(0.026)
Age	-0.074	-0.026	-0.084	-0.118*
	(0.048)	(0.068)	(0.054)	(0.071)
Growth	0.007	-0.010	-0.003	0.061
	(0.046)	(0.063)	(0.053)	(0.071)
Lev	0.139	0.085	0.116	0.130
	(0.094)	(0.134)	(0.104)	(0.141)
Board	0.091	0.204**	0.072	0.182*
	(0.064)	(0.090)	(0.071)	(0.096)
TobinQ	0.023*	0.025	0.029**	0.021
	(0.012)	(0.017)	(0.014)	(0.017)
Dual	0.057*	0.085**	0.054	0.026
	(0.031)	(0.043)	(0.034)	(0.046)
Roa	-0.158	-0.664	-0.217	0.464
	(0.320)	(0.438)	(0.346)	(0.471)
_cons	-4.676***	-5.584***	-5.217***	-4.874***
	(0.378)	(0.541)	(0.448)	(0.700)
Year	Y	Y	Y	Y
Province	Y	Y	Y	Y
Industry	Y	Y	Y	Y
N	7504	7504	6157	3499
R^2	0.111	0.102	0.125	0.119

Note: ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively, with robust standard errors in parentheses.

4.4 Mechanism analysis

In the previous empirical analysis, this study found that investor attention can significantly inhibit greenwashing by firms. Therefore, how does investor attention affect greenwashing? This deserves further empirical analysis. Accordingly, this paper analyses the potential mechanism through which investor attention influences greenwashing according to Model (2). The results shown in column (1) of Table 6 indicate that investor attention significantly reduces firms' financial constraints. The alleviation of firms' financial constraints can effectively mitigate their financial pressures, thereby restraining greenwashing. This suggests that investor attention can inhibit

greenwashing by reducing firms' financial constraints.

Furthermore, the results presented in column (2) of Table 6 indicate that investor attention significantly enhances firms' information transparency. An improvement in firms' information transparency can effectively reduce information asymmetry and lower firms' financing costs, thereby aiding in the suppression of greenwashing. This suggests that investor attention can inhibit greenwashing by enhancing firms' information transparency.

In conclusion, investor attention can mitigate greenwashing through mechanisms such as reducing firms' financing constraints and enhancing firms' information transparency.

Table 6. Mechanism analysis

Variables	(1) Financial constraint	(2) Information transparency
Invatten	-0.707***	0.137***
	(0.143)	(0.017)
Size	1.247***	0.112***
	(0.095)	(0.012)
Age	-0.002	-0.105***
	(0.282)	(0.035)
Growth	-1.197***	-0.091***
	(0.285)	(0.031)
Lev	-1.208**	0.057
	(0.553)	(0.066)
Board	2.494***	0.192***
	(0.385)	(0.050)
TobinQ	-0.385***	-0.008
	(0.068)	(0.008)
Dual	-0.640***	0.091***
	(0.180)	(0.023)
Roa	4.359**	0.301
	(1.833)	(0.221)
_cons	-41.092***	-4.575***
	(2.197)	(0.297)
Year	Y	Y
Province	Y	Y
Industry	Y	Y
N	7503	6618
R^2	0.342	0.306

Note: ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively, with robust standard errors in parentheses.

4.5 Moderating analysis

In the preceding analysis, the study reveals that investor attention can mitigate corporate greenwashing by reducing firms' financing constraints and enhancing corporate transparency. This section further examines the moderating effects of internal and external factors on the relationship between investor attention and corporate greenwashing. Accordingly, the study employs Model (3)

to analyze the moderating role of these factors. The empirical results are presented in Table 7.

Column (1) of Table 7 displays the impact of pollution charges on the relationship between investor attention and corporate greenwashing. The coefficient of Tax*Invatten indicates that pollution charges do not affect the inhibitory effect of investor attention on corporate greenwashing. Conversely, as observed from column (2) of Table 7, environmental subsidies can strengthen the inhibitory effect of investor attention on corporate greenwashing. These results support H2.

Additionally, as shown in column (3) of Table 7, the coefficient of Innco*Invatten indicates that improving internal control can enhance the inhibitory effect of investor attention on corporate greenwashing. These results support H3.

Table 7. Moderating analysis

Variables	(1) Greenwashing	(2) Greenwashing	(3) Greenwashing
Invatten	0.118	0.055	-0.018
	(0.197)	(0.043)	(0.030)
Tax	0.207		
	(0.179)		
Tax* Invatten	-0.015		
	(0.014)		
Subsidy		0.122^{***}	
		(0.034)	
Subsidy*Invattn		-0.009^{***}	
		(0.003)	
Innco			1.463^{***}
			(0.474)
Innco* Invatten			-0.107^{***}
			(0.036)
Size	0.220^{***}	0.200^{***}	0.203^{***}
	(0.028)	(0.017)	(0.017)
Age	-0.123^{**}	-0.086^{*}	-0.081^{*}
	(0.055)	(0.048)	(0.048)
Growth	0.051	0.003	0.001
	(0.053)	(0.046)	(0.046)
Lev	0.007	0.138	0.133
	(0.110)	(0.094)	(0.094)
Board	0.033	0.091	0.094
	(0.074)	(0.064)	(0.064)
TobinQ	0.022	0.028^{**}	0.031^{**}
	(0.014)	(0.012)	(0.012)
Dual	0.063^{*}	0.061^{**}	0.059^{*}
	(0.035)	(0.031)	(0.031)
Roa	-0.361	-0.111	-0.173
	(0.379)	(0.320)	(0.320)
_cons	-6.693^{**}	-6.161^{***}	-5.382^{***}
	(3.208)	(0.593)	(0.452)

N	6006	7493	7504
R^2	0.127	0.112	0.111
Year	Y	Y	Y
Province	Y	Y	Y
Industry	Y	Y	Y

Note: ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively, with robust standard errors in parentheses.

4.6 Heterogeneity analysis

Due to differences in property rights and financing constraints, different enterprises exhibit heterogeneous characteristics (Lu et al., 2023) [55]. Moreover, these heterogeneous characteristics may affect the inhibitory effect of investor attention on greenwashing by enterprises. Therefore, it is necessary to conduct heterogeneity analysis based on differences in property rights and financing constraints. Table 8 shows the inhibitory effect of investor attention on greenwashing by enterprises under different property rights and financing constraints.

Columns (1) and (2) of Table 8 present empirical analyses based on different property rights. According to columns (1) and (2) of Table 8, the inhibitory effect of investor attention on greenwashing is more pronounced for state-owned enterprises (SOEs). This is because, compared to private enterprises, SOEs undertake many "implicit" social responsibilities due to their political affiliations, which may increase their motivation to engage in greenwashing (Matuszak and Kabaciński, 2021) [56]. In such cases, as SOEs face greater investor attention, the cost of engaging in greenwashing increases, leading to a situation where the costs outweigh the benefits, thereby restraining greenwashing activities by SOEs.

Additionally, Columns (3) and (4) in Table 8 depict the empirical analysis conducted based on different levels of financial constraints. Through Columns (3) and (4) of Table 8, it can be observed that the inhibitory effect of investor attention on greenwashing is more pronounced in firms with greater financial constraints. This is because, compared to firms with lower financial constraints, firms facing greater financial constraints have a stronger incentive to engage in low-cost greenwashing activities to generate returns (Hu et al., 2023) [57]. In such circumstances, since investor attention helps alleviate firms' financing constraints, it is beneficial for reducing the greenwashing motives of firms facing greater financial constraints. This finding implies that the inhibitory effect of investor attention on greenwashing is more pronounced in firms facing high financing constraints.

Table 8. Heterogeneity analysis

Variables	(1) State-owned enterprise	(2) Private enterprise	(3) High financial constraint	(4) Low financial constraint
Invatten	-0.147***	-0.008	-0.096**	0.006
	(0.036)	(0.037)	(0.038)	(0.035)
Size	0.248***	0.199***	0.225***	0.148***
	(0.023)	(0.028)	(0.026)	(0.025)
Age	0.150*	-0.094	-0.381***	0.461***
	(0.082)	(0.063)	(0.082)	(0.122)

Growth	-0.027	-0.028	0.021	-0.021
	(0.067)	(0.065)	(0.072)	(0.056)
Lev	-0.198	0.343**	-0.188	0.356***
	(0.133)	(0.143)	(0.156)	(0.120)
Board	0.037	0.407***	0.133	0.052
	(0.087)	(0.103)	(0.096)	(0.087)
TobinQ	0.060***	0.021	0.021	0.031**
	(0.022)	(0.015)	(0.019)	(0.015)
Dual	0.001	0.007	0.104**	0.044
	(0.060)	(0.039)	(0.047)	(0.043)
Roa	-0.372	-0.051	-0.566	0.024
	(0.497)	(0.434)	(0.510)	(0.419)
_cons	-6.120***	-5.617***	-4.454***	-5.546***
	(0.558)	(0.613)	(0.571)	(0.641)
N	3946	3558	3447	4057
R^2	0.170	0.155	0.183	0.131
Year	Y	Y	Y	Y
Provine	Y	Y	Y	Y
Industy	Y	Y	Y	Y

Note: ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively, with robust standard errors in parentheses.

5. Conclusions and recommendations

Enterprises are important economic entities for China to achieve sustainable development, and analyzing greenwashing and its governance strategies is highly important. As important external stakeholders of enterprises, investors have a significant impact on the formulation of corporate governance decisions. Exploring the relationship between investor attention and greenwashing can further broaden the research on greenwashing governance. Therefore, this paper selects data from Chinese A-share listed companies from 2010 to 2022 to investigate the impact of investor attention on greenwashing. Additionally, this paper selects financing constraints and information transparency as mediating variables to further explore the mechanism through which investor attention affects greenwashing. Furthermore, this paper examines the moderating effects of internal controls and environmental regulations on the relationship between investor attention and greenwashing. Finally, this paper analyzes the differences in the impact of investor attention on greenwashing among companies with different property rights and financing constraints. The results indicate that investor attention significantly suppresses greenwashing. After conducting various robustness tests, the results of this paper remain robust. Mechanism analysis shows that investor attention suppresses greenwashing by reducing corporate financing constraints and enhancing information transparency. Moreover, internal controls and environmental subsidies can strengthen the inhibitory effect of investor attention on greenwashing. Finally, heterogeneity analysis demonstrates that the inhibitory effect of investor attention on greenwashing is stronger in state-owned enterprises and companies with high financing constraints.

Based on the research findings above, this paper proposes the following insights and policy recommendations. First, from the perspective of investors, it is necessary to further strengthen the guidance and supervision of investors. Investors are important participants in the capital market and

are also external stakeholders in corporate governance. Relevant policies should guide investors not only to focus on the financial performance of companies and other economic indicators but also to pay attention to the quality of environmental information disclosure and the fulfillment of social responsibilities by companies. Policymakers should supervise investors in incorporating environmental information disclosure into their investment strategies, making them aware that focusing on corporate social responsibility not only benefits themselves but also represents a sense of responsibility. Second, companies must be promoted and regulated to improve their internal governance. The internal stakeholders of companies are the main force in corporate governance. Establishing effective communication mechanisms and standardized processes internally can effectively reduce the cost of internal information asymmetry, improve efficiency, and save costs, thereby allowing more funds and energy to be used for substantive environmental actions. Internal governance should achieve the effect of companies voluntarily complying with relevant policies and fulfilling social responsibilities, laying the foundation for companies to embark on the path of green and sustainable development. Third, the external supervision of companies should be strengthened, and relevant policies should be improved. Formulating reasonable regulatory policies is crucial for corporate governance, and effective regulatory measures can promote the fulfillment of corporate environmental responsibilities. Supervision policies, such as environmental subsidies, which can inhibit greenwashing, should be implemented effectively to achieve genuine results. Additionally, different approaches should be taken for companies with different characteristics. Compared to private enterprises, state-owned enterprises are more likely to engage in false green behavior; thus, stronger supervision should be implemented for state-owned enterprises. Enterprises with high financing constraints are more motivated to engage in greenwashing; therefore, stronger supervision and the introduction of support subsidies should be applied to enterprises with high financing constraints, motivating them to engage in substantive environmental protection activities. Finally, greenwashing knowledge should be popularized, and universal environmental protection should be advocated. Nongovernmental organizations and media play a crucial role in supervising corporate behavior. On the one hand, they can enhance transparency between companies and the public, and on the other hand, they can encourage collaboration between nongovernmental organizations and socially responsible investors. By improving the information environment and supervision from external stakeholders, they can reduce corporate opportunistic behaviors, thus promoting companies and society toward a path of green and sustainable development.

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