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Green Institutional Investors and Corporate Environmental Violations: Evidence from China

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Abstract

The existing literature has extensively examined the influences of governments, media, the public, financial institutions, and executives on corporate environmental violations, yet the role of investors remains underexplored. This study introduces the perspective of green institutional investors to investigate how they affect corporate environmental violations. The results show that such investors significantly curb environmental violations by strengthening environmental oversight and alleviating financing constraints. Furthermore, cross-sectional evidence reveals that this inhibitory effect is more pronounced in settings with weaker government, media, and public environmental attention, underdeveloped green credit systems, and limited executive green experience. Additional analysis of economic consequences indicates that such investors help mitigate both operational and financial risks by reducing environmental violations. Finally, evidence of spillover effects confirms that this inhibitory effect extends to both industry and regional levels. Overall, this study highlights the vital role of investors in deterring corporate environmental misconduct.

Keywords: investors; green institutional investors; environmental violations; environmental misconduct

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1. Introduction

Corporate environmental misconduct poses serious environmental and social threats. It not only directly disrupts ecological stability and resource sustainability, jeopardizing public health and social order [1,2], but also hinders high-quality economic growth and industrial upgrading, thereby impairing national reputation and global competitiveness [3,4]. In response to this pressing global issue, countries around the world are actively enhancing their environmental governance frameworks to strengthen oversight and incentives for corporate environmental behavior [5]. As the largest developing economy, China faces particularly acute challenges related to corporate environmental misconduct. According to statistics from China's Ministry of Ecology and Environment, in 2024 alone, environmental authorities at various levels issued 55,900 administrative penalty decisions, with total fines amounting to RMB 4.612 billion, underscoring the severity of corporate environmental violations in the country. While extant research has examined the roles of governments [6,7], media [8,9], the public [10,11], financial institutions [12], and executives [1,13,14] in influencing corporate environmental violations, the function of investors has received limited attention. To address this gap, this study introduces the perspective of green institutional investors and investigates their impact on corporate environmental violations, aiming to

elucidate the significant yet underexplored role that investors play in mitigating corporate environmental misconduct.

Although governments, media, the public, financial institutions, and executives all serve as governance actors in curbing corporate environmental violations, each is constrained by significant limitations. Governments have enacted stringent environmental regulations to standardize corporate behavior; however, their reliance on ex-post punitive measures falls short of securing comprehensive oversight across the full spectrum of operational activities [6,15]. The media plays an external supervisory role, yet its effectiveness is undermined by limited expertise and selective coverage [9,16]. The public enhances reputational risks for violators, but its impact is weakened by inadequate investigative resources and inconsistent attention [7,17]. Financial institutions, employing policy tools including green credit, aim to promote sustainable innovation and reduce emissions; nevertheless, widespread information asymmetry weakens the efficacy of these financial incentives [12]. While executives are crucial in enforcing environmental compliance, agency problems and cognitive biases often result in short-termism and insufficient constraint of violations [18]. Thus, sole dependence on these actors does not suffice for robust environmental governance. Green institutional investors, leveraging their dual capacity for monitoring and incentive alignment, can help bridge these governance gaps and more effectively curb corporate environmental misconduct.

Green institutional investors may not only inhibit but also exacerbate corporate environmental violations, reflecting their dual pursuit of environmental and economic objectives. They can suppress environmental violations through oversight and resource effects: their strong informational capabilities allow them to identify environmental risks early and exercise shareholder activism to improve oversight [19], while their substantial capital and influence provide critical financial support for environmental projects, easing financing constraints and reducing incentives for non-compliance [20,21]. Conversely, green institutional investors may also enable environmental violations through collusion effects. Some engage in symbolic environmental practices, cooperating with management to sustain a facade of compliance without meaningful improvement [22]. Furthermore, pressures to achieve short-term financial targets may lead them to prioritize economic returns over environmental goals, tacitly permitting or concealing managerial opportunism [23]. As a result, the overall influence of green institutional investors on corporate environmental violations continues to be unclear and calls for additional empirical study.

This study focuses on China to examine the influence of green institutional investors on corporate environmental violations, driven by two key factors. First, China represents a critical setting for environmental governance challenges. Decades of rapid economic expansion have resulted in widespread environmental deterioration [24,25]. As indicated by the 2024 Environmental Performance Index (EPI) released by the Yale Center for Environmental Law & Policy, China ranks 156th out of 180 countries, highlighting severe environmental strain. Curbing corporate environmental violations is therefore crucial to easing resource and pollution pressures and promoting high-quality economic development. Lessons from China may thus offer insights for other economies confronting similar sustainability issues. Second, China's green investment sector has experienced rapid but uneven growth. According to the 2024 China Sustainable Investment Review jointly issued by the China Responsible Investment Forum and SynTao Green Finance, the number of green funds rose dramatically from 33 in 2014 to 848 in 2024, reflecting substantial market development. However, this expansion remains predominantly policy-led and institutionally underdeveloped, characterized by inconsistent green standards, insufficient regulatory frameworks, and shortages in specialized expertise and governance mechanisms. These institutional weaknesses raise doubts regarding the actual effectiveness of green institu-

tional investors in enhancing corporate environmental accountability. Studying China's context thus provides valuable implications for building stronger and more effective green investment systems worldwide.

This study utilizes data from heavily polluting firms listed on China's Shanghai and Shenzhen A-share markets to assess how green institutional investors affect corporate environmental violations. The results demonstrate that green institutional investors significantly inhibit corporate environmental violations. Mechanism analyses indicate that these investors leverage their informational edge to strengthen environmental oversight and employ their resource capacity to alleviate financing constraints, thereby reducing corporate environmental misconduct. Cross-sectional tests reveal that the inhibitory effect is more pronounced in settings with weaker government, media, and public environmental attention, underdeveloped green credit systems, and limited executive green experience. Furthermore, analysis of economic consequences shows that these investors help mitigate both operational and financial risks by curbing environmental violations. Finally, examination of spillover effects confirms that the inhibitory effect generates positive externalities at the industry and regional levels. Overall, the evidence underscores the critical and multifaceted part played by investors in limiting corporate environmental wrongdoing.

This study provides a number of significant additions to the existing literature. First, it extends the theoretical framework concerning governance determinants of corporate environmental violations by incorporating a distinctive analytical perspective focused on investor influence. Although scholarly attention has largely concentrated on the roles of governments [6,7], media [8,9], the public [10,11], financial institutions [12], and executives [1,13,14], the role of investors has been relatively understudied. These conventional actors typically function through either supervisory and corrective mechanisms, as seen with governments, media, the public, and executives, or credit-linked incentives, in the case of financial institutions. Yet, dependence on a single type of mechanism has shown to be inadequate in effectively curbing environmental misconduct. By focusing on green institutional investors, which combine oversight with resource effects, this research not only enlarges the range of recognized governance actors, but also illustrates how collaborative interactions among diverse stakeholders constitute an effective response to corporate environmental misconduct.

Second, this article deepens insights into investor-led environmental governance effects by systematically investigating the link between green institutional investors and corporate environmental violations. While earlier studies have documented their beneficial role in corporate environmental engagement, as reflected in promoted green innovation [19,26], higher ESG performance [20,21,27], and enhanced environmental performance [28,29], their connection with environmental compliance has not been sufficiently examined. It is essential to recognize that greater environmental involvement does not necessarily lead to improved compliance, for two main reasons: environmental measures may fall short of rising regulatory requirements, and firms might adopt symbolic measures or partial disclosure without meaningful improvement, thereby failing to avert violations. By examining how green institutional investors affect corporate environmental violations, this study not only evaluates whether investor-driven environmental practices conform with compliance standards, but also yields important theoretical and practical implications for the efficacy of investor-led governance.

Third, this paper clarifies the connections among governments, media, the public, financial institutions, executives, and investors in governing corporate environmental violations. While the existing literature has separately analyzed the influences of governments [6,7], media [8,9], the public [10,11], financial institutions [12], and executives [1,13,14] on corporate environmental violations, the interactions between these actors

and investors have been largely neglected. This study reveals that the inhibitory effect of green institutional investors on corporate environmental violations is more evident in situations characterized by lower government, media, and public environmental attention, less developed green credit systems, and limited green experience among executives. This outcome not only sheds light on the interactions among these key stakeholders, but also offers a foundation in theory and practice for leveraging their synergistic effects in reducing environmental misconduct.

Fourth, this research identifies broader ripple effects of green institutional investors in mitigating corporate environmental violations. While previous research has mainly focused on how such investors directly influence their portfolio firms [19,26,27], possible spillover effects have been generally ignored. The evidence shows that green institutional investors not only reduce environmental violations in their invested firms, but also produce a restraining influence on industry and regional peers. This implies that peer firms observe and adopt the environmental behaviors of firms held by green institutional investors, thereby refining their own environmental decision-making and reducing violations. Through such observational and learning mechanisms, green institutional investors support the broader sustainability of entire industries and regions. These findings provide a fresh theoretical perspective on the governance effectiveness of green institutional investors.

2. Literature Review and Hypothesis Development

2.1. Literature Review

The body of scholarship most directly relevant to this research broadly comprises two principal strands: the first investigates the governance effects of green institutional investors, while the second centers on identifying the determinants behind corporate environmental violations.

The first strand of literature on the governance effects of green institutional investors spans both environmental and economic spheres. By committing to a green investment philosophy, these investors motivate firms to pursue economic returns while concurrently boosting environmental performance and sustainable development, thus promoting synergistic growth in both economic and environmental value [26]. In terms of environmental outcomes, they exercise a beneficial regulatory influence by directing managerial attention toward environmental issues, which supports corporate green innovation [19,26], raises ESG performance [20,21,27], and enhances comprehensive environmental performance [28,29]. However, some studies argue that green institutional investors may participate in symbolic posturing by emphasizing environmental objectives primarily to attract investment, while neglecting to deliver substantive oversight, thereby constraining their ability to effectively improve corporate environmental performance [22,30]. Regarding economic effects, research indicates that such investors' preference for environmental value leads them to tolerate lower expected returns, reflecting a diminished focus on financial gains [31,32]. Yet, from a long-term perspective, environmentally responsible firms often display greater risk resilience, which may eventually result in superior financial performance for green institutional investors [33,34].

A second major line of inquiry on the determinants of corporate environmental violations has established four central levels of influence: government, media, public, and executives. At the government level, regulatory tools—such as ecological and environmental damage compensation policies [4], soil pollution prevention measures [35], green taxation systems [36], and low-carbon city pilot programs [37]—have been confirmed a significant reduction in corporate environmental violations. Moreover, improvements in the efficiency of environmental supervision are linked to decreased corporate environmental violations [6,7]. Media outlets act as vital information intermediaries that increase trans-

parency and public scrutiny, thus contributing to the reduction in corporate environmental violations [8,9]. Likewise, public environmental oversight imposes external pressure that deters firms from committing environmental violations [10,11]. In the case of executives, specific managerial characteristics are significant in predicting reduced corporate environmental violations: female directorship [13], founder CEOs [1], overseas experience [38,39], and environmental expertise [2,14] have all been linked to fewer corporate environmental violations. In contrast, CEOs with childhood poverty experiences show a greater likelihood of prioritizing economic objectives over environmental standards, elevating the propensity for corporate environmental violations [18].

A synthesis of prior studies reveals several remaining research gaps. First, while existing work has analyzed the environmental governance effects of green institutional investors, substantial theoretical uncertainty persists due to inconsistent empirical findings, which point to such effects being either beneficial or adverse. Additionally, current research has mainly explained these governance outcomes using the framework of environmental responsibility, while paying limited attention to the potential for environmentally irresponsible practices. Second, although much has been established about how government, media, public, and executive factors affect corporate environmental violations, the role of investors has attracted relatively little academic interest. As proponents of socially responsible investment, green institutional investors are ideally suited to guide firms toward sustainable development; however, their specific role in reducing corporate environmental violations remains poorly understood. Accordingly, adopting an investor-centric perspective, this study analyzes the impact of green institutional investors on corporate environmental violations.

2.2. Theoretical Analysis and Hypothesis Development

Green institutional investors may suppress corporate environmental violations through dual mechanisms of oversight and resource effects. Regarding the former, by leveraging their information-based comparative advantage, these investors can exert supervisory pressure to deter such violations. Owing to extensive market intelligence and well-developed information-gathering capacities, they are positioned to access corporate environmental information with relatively minimal cost through avenues including site visits and private communications [40]. Additionally, their specialized investment teams draw on professional knowledge to assess environmental risks and detect compliance gaps [26]. This informational superiority facilitates timely identification of environmental misconduct, empowering investors to carry out monitoring roles through shareholder activism, the threat of divestment, and other governance tools, thus diminishing corporate environmental violations. As for the latter, green institutional investors hold resource-based advantages that enable a financing effect, further limiting environmental violations. They not only supply substantial long-term oriented funding [20] but also improve transparency for external stakeholders, thereby helping to draw in additional market-based investment to portfolio companies [21]. These financial inputs allow green institutional investors to support environmental projects, ease funding limitations on firms pursuing environmental governance, and in turn lessen environmental violations. In summary, by strengthening environmental oversight and alleviating financial constraints, green institutional investors can meaningfully restrain corporate environmental violations.

First, through reinforced environmental oversight, green institutional investors can help limit corporate environmental violations. They mainly exercise environmental oversight via the "voice" and "exit" mechanisms. Through active ownership, green institutional investors can table environmental proposals at shareholder meetings to express views on corporate environmental decision-making and solicit support to gain voting leverage, thus curbing managers' environmental violations [41]. At the same time, they may engage

in direct dialog with management to communicate green business strategies and steer environmentally friendly investment decisions [42]. Such behind-the-scenes exchanges are notably efficient and adaptable [43], enabling ongoing discussion of environmental governance plans and supporting the successful rollout of environmental projects. Green institutional investors might also use the threat of exit or actual disposal of shares to signal opposition to corporate environmental non-compliance, compelling managers to revise investment decisions [19], thereby restraining opportunistic environmental behaviors. In this way, green institutional investors help build up corporate environmental oversight.

The intensified environmental oversight brought about by green institutional investors aids in cutting down corporate environmental violations. Enhanced environmental oversight prompts managers to heighten environmental awareness and refine environmental behavior. In relation to environmental awareness, monitoring by green institutional investors sharpens managers' focus on environmental issues and orients their attention toward the long-term economic advantages of environmental protection. This helps ease environmental agency conflicts between managers and shareholders, lessens managerial short-termism [44], and motivates managers to deliberately avoid environmental violations in day-to-day operations, leading to fewer non-compliance events. With respect to environmental behavior, monitoring by green institutional investors results in more responsible environmental choices, such as growing environmental investments and green innovation. Elevated environmental investment can modernize pollution treatment equipment, cut emissions, and weaken the potential for environmental violations [36]. Expanded green innovation incorporates new environmental technologies and methods into production processes, fundamentally lessening the likelihood of environmental violations [41]. These upgraded environmental behaviors address corporate environmental issues at the root and so assist in suppressing environmental violations.

Second, by alleviating corporate financing constraints, green institutional investors can hinder corporate environmental violations. They deliver both direct and indirect resources to relieve firms' financial limitations. In the area of direct resources, green institutional investors hold capital advantages that allow them to give direct funding support for corporate environmental projects. These investors seek environmental and social values together with economic returns [28]. Consequently, they channel capital into high-risk and long-cycle environmental ventures [26,32], thereby loosening corporate financing constraints. Concerning indirect resources, green institutional investors perform a certification role that aids in securing additional funding for environmental projects. They target investments in companies with strong environmental performance or sustainable development potential [33], so their shareholding has an endorsing effect, confirming a firm's commitment to environmental governance. This helps raise transparency for external stakeholders, easing access to external resources such as government subsidies, credit financing, and trade credit [20,42]. Hence, green institutional investors help ease corporate financing constraints.

The relaxed financing constraints supported by green institutional investors aid in restraining corporate environmental violations. When financial limitations are eased, firms can improve resource allocation and reinforce environmental management, boosting their capacity to prevent environmental violations. Regarding resource allocation, relaxed financing constraints lower firms' operational strain and dampen short-term profit-seeking behavior, promoting a greater emphasis on long-term sustainable development [45,46]. This translates into increased funding for environmental projects, empowering companies to modernize production equipment, refine technical processes, and accomplish green transformation, thus diminishing environmental violations. From the standpoint of environmental management, reduced financial pressure increases discretionary cash flow,

permitting firms to strengthen their internal environmental management systems [47]. This might involve establishing environmental protection departments, hiring environmental experts, conducting employee training, building up environmental monitoring systems, and formulating emergency management protocols. Well-structured environmental management systems offer systematic guidance for corporate environmental protection efforts [48], helping firms avert, track, and address potential environmental risks, as well as identify and correct environmental issues in operations promptly, finally lowering the likelihood of environmental violations.

Furthermore, green institutional investors might give rise to a collusion effect that could potentially encourage corporate environmental violations. This effect stems from two main motivations. First, green institutional investors may be influenced by symbolic motives. Adopting a "green" label allows them to draw more capital and impose higher management fees [49,50]. Therefore, such investors might outwardly advocate sustainable investment rhetoric for financial gain without authentically integrating environmental outcomes into their overall strategy [22]. To uphold their green image, these investors may choose to cooperate with management in sustaining an appearance of environmental commitment, rather than applying genuine oversight to improve the firm's actual environmental performance. Second, green institutional investors often confront substantial performance pressures. While they pursue long-term environmental value, they must also achieve short-term financial targets to meet return expectations from clients and sustain competitiveness in the industry [23]. Environmental investments, however, often demand substantial capital commitments without yielding immediate financial returns, possibly impairing profits and worsening short-term performance [41]. Faced with such pressure, green institutional investors may favor financial gains over environmental goals.

The collusion effect linked to green institutional investors can contribute to corporate environmental violations in two ways. First, it may permit managerial short-termism, thus raising environmental violations. In the quest for short-term returns, green institutional investors might relax monitoring standards and weaken accountability mechanisms, implicitly allowing environmentally myopic decisions [51]. For instance, they might refrain from casting dissenting votes on key proposals with environmental risks during shareholder meetings, or scale back the intensity and critical stance of private communications with management, accepting diluted environmental performance targets and disregarding potential environmental violations. Such conduct weakens the supervisory role of green institutional investors and can contribute to increased environmental non-compliance. Second, collusion may include concealing environmental risks, further raising violation risks. Close alignment of interests between green institutional investors and management could drive the withholding of material environmental risk information [52]. These investors might endorse selective disclosure of environmental information and superficial environmental governance measures by management. Beyond that, they could use their specialized knowledge and market influence to help enhance corporate environmental image, obscuring true performance to avoid regulatory scrutiny and external oversight, in the end promoting environmental violations.

Building on the preceding discussion, the following competing hypotheses are proposed:

H1. *Green institutional investors are negatively correlated with corporate environmental violations.*

H2. *Green institutional investors are positively correlated with corporate environmental violations.*

The theoretical framework of this study is shown in Figure 1.

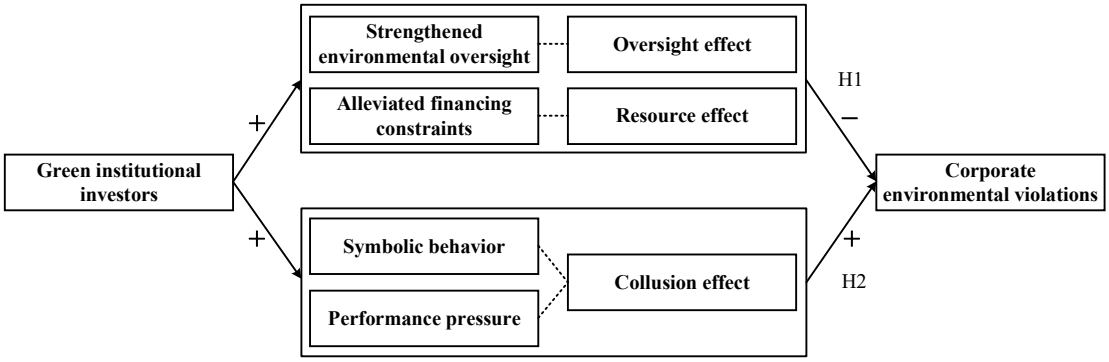

Figure 1. Theoretical framework.

3. Research Design

3.1. Sample Selection and Data Sources

The sample comprises A-share companies in heavily polluting industries listed on China's Shanghai and Shenzhen Stock Exchanges over the 2015–2023 timeframe. The sample window starts in 2015, consistent with the implementation of China's revised Environmental Protection Law, which markedly intensified environmental enforcement actions for violations while also improving information disclosure and public participation mechanisms. This study focuses on heavily polluting enterprises as they represent major sources of environmental pollution, face stricter regulatory requirements, and show greater vulnerability to environmental violations [14,18]. The classification of heavily polluting industries complies with the Guidelines for Environmental Verification Industry Classification of Listed Companies issued by China's Ministry of Environmental Protection.

The initial sample was processed by applying the following screening steps: first, companies under special treatment statuses, including ST or *ST, were omitted; second, observations with missing data for critical variables were excluded. These steps yielded a final dataset containing 8793 firm-year observations. To manage outliers, all continuous variables were winsorized at the 1st and 99th percentiles.

Data on corporate environmental violations were collected from the Institute of Public and Environmental Affairs (IPE). Information relating to green institutional investors and control variables was gathered from the China Stock Market & Accounting Research (CSMAR) database.

3.2. Variable Definitions

3.2.1. Dependent Variable

The dependent variable is corporate environmental violations, measured with two metrics: *EVL* and *EVF*. Building on Abebe and Acharya (2022) [1] and Jin et al. (2024) [36], this study assesses environmental violations from two perspectives: likelihood and frequency. The first variable, environmental violation likelihood (*EVL*), is a binary indicator set to 1 for firms with any environmental violation in a given year, and 0 otherwise. The second variable, environmental violation frequency (*EVF*), is computed as the natural logarithm of one plus the annual number of environmental violations per firm.

3.2.2. Independent Variable

The independent variable is green institutional investors (*GII*). Building on Chi et al. (2023) [26] and Tang et al. (2024) [19], this variable is represented by a dichotomous measure that takes the value of 1 for firms having green institutional investor shareholding in a given year, and 0 otherwise. The identification procedure entailed retrieving and combining data from the Fund Entity Information Table and the Stock Investment Details

Table within the CSMAR database to compile complete fund ownership records of listed companies. Thereafter, the investment objectives and scope descriptions of each fund were carefully examined for environmental terminology. A firm was categorized as having green institutional investors if the fund's documentation included vocabulary associated with environmental protection, green initiatives, ecology, low-carbon practices, sustainability, energy conservation, clean energy, or new energy development, along with other relevant concepts.

3.2.3. Control Variables

Drawing on Liu (2018) [13] and Du and Ren (2024) [18], a set of firm-level control variables have been incorporated to address potential confounding effects. These variables comprise firm size (*Size*), financial leverage (*Lev*), return on assets (*Return*), loss status (*Loss*), board size (*Board*), the proportion of independent directors (*Indep*), CEO duality (*Dual*), ownership concentration (*Top1*), and auditor type (*Big4*). Detailed descriptions of all variables examined in this research are provided in Table 1.

Table 1. Variable definitions.

Variable Type	Variable Symbol	Variable Meaning
Dependent variable	*EVL*	A dummy variable that equals 1 for firms with any environmental violation in a given year, and 0 otherwise
	EVF	A continuous variable that equals to the natural logarithm of one plus the annual number of environmental violations per firm
Independent variable	*GII*	A dummy variable that equals 1 for firms having green institutional investor shareholding in a given year, and 0 otherwise
Control variables	*Size*	Natural logarithm of total assets
	Lev	Total liabilities/total assets
	Return	Net profit/total assets
	Loss	A dummy variable that equals 1 for firms with a negative net profit, and 0 otherwise
	Board	Natural logarithm of the number of board members
	Indep	Number of independent directors/total board members
	Dual	A dummy variable that equals 1 if the CEO also serves as the chairman, 0 otherwise
	Top1	Shares held by the largest shareholder/total shares
	Big4	A dummy variable that equals 1 for firms audited by a Big Four international accounting firm, and 0 otherwise.

3.3. Empirical Model

To examine how green institutional investors affect corporate environmental violations, this study constructed Model (1).

$$EVL_{i,t}/EVF_{i,t} = \alpha_0 + \alpha_1 GII_{i,t} + \gamma Controls_{i,t} + Firm\ FE + Year\ FE + \varepsilon_{i,t} \quad (1)$$

where i and t denote firm and year, respectively; *EVL* captures the likelihood of corporate environmental violations; while *EVF* measures their frequency; *GII* stands for green institutional investors; *Controls* encompass the array of control variables; *Firm FE* and *Year FE* represent firm and year fixed effects, respectively; and ε is the error term. Considering that *EVL* is a binary variable, a logit model is applied, and for *EVF*, which is continuous, ordinary least squares (OLS) regression is utilized.

4. Empirical Analysis

4.1. Descriptive Statistics

Table 2 presents the descriptive statistics of the main variables. For *EVL*, the mean value is 0.128, indicating that approximately 12.8% of the sample firms were involved in environmental violations. For *EVF*, the mean reaches 0.138, spanning from 0.000 to 3.892, implying that the actual count of environmental violations varies between 0 and 48 across sample firms, reflecting notable dispersion in violation frequency. The mean for *GII* is 0.469, suggesting that green institutional investors hold stakes in nearly 46.9% of the sample firms.

Table 2. Results of the descriptive statistics.

Variables	Observations	Mean	Median	Min	Max	SD
EVL	8793	0.128	0.000	0.000	1.000	0.334
EVF	8793	0.138	0.000	0.000	3.892	0.413
GII	8793	0.469	0.000	0.000	1.000	0.499
Size	8793	22.411	22.211	20.080	26.376	1.330
Lev	8793	0.393	0.381	0.055	0.899	0.197
Return	8793	0.048	0.044	−0.200	0.259	0.069
Loss	8793	0.122	0.000	0.000	1.000	0.327
Board	8793	2.124	2.197	1.609	2.708	0.198
Indep	8793	0.374	0.333	0.333	0.556	0.051
Dual	8793	0.286	0.000	0.000	1.000	0.452
Top1	8793	0.342	0.318	0.092	0.750	0.146
Big4	8793	0.065	0.000	0.000	1.000	0.247

Table 3 outlines the results of the univariate tests. Firms with green institutional investors (*GII* = 1) display a markedly lower likelihood of environmental violations (*EVL*), recording 0.042 less than firms without such investors (*GII* = 0). Likewise, firms with green institutional investors also demonstrate a statistically significant reduction in the frequency of environmental violations (*EVF*), which is 0.035 lower. These results indicate that firms associated with green institutional investors experience both a lower probability and a lower frequency of environmental violations compared to firms without such investors, offering initial confirmation for hypothesis H1.

Table 3. Results of the univariate tests.

Variables	Mean			*t* Test	
	***GII* = 1**	***GII* = 0**	**Difference**	***t*-Value**	***p*-Value**
EVL	0.106	0.148	−0.042 ***	5.825	0.000
EVF	0.120	0.154	−0.035 ***	3.917	0.000

Note: *** indicate statistical significance at the 1% level.

Table 4 displays the results of the correlation analysis. The coefficients between *GII* and both *EVL* (−0.062, $p < 0.01$) and *EVF* (−0.042, $p < 0.01$) are statistically significant and negative, confirming support for hypothesis H1.

Table 4. Results of the correlation analysis.

Variables	*EVL*	*EVF*	*GII*
EVL	1		
EVF	0.871 ***	1	
GII	−0.062 ***	−0.042 ***	1

Note: *** indicate statistical significance at the 1% level.

4.2. Baseline Analysis

Table 5 presents the baseline regression estimates examining the effect of green institutional investors on corporate environmental violations. As detailed in columns (1) and (2), *GII* displays significantly negative coefficients of −0.546 and −0.574 on *EVL* ($p < 0.01$), suggesting a marked decline in the likelihood of environmental violations. Correspondingly, results in columns (3) and (4) reveal significantly negative coefficients of −0.034 and −0.035 on *EVF* ($p < 0.01$), reflecting a considerable drop in the frequency of environmental violations. Additionally, the coefficient in column (4) implies a 3.5% lower frequency of environmental violations for firms with green institutional investors, highlighting the meaningful economic effect of their governance role. These results collectively demonstrate that green institutional investors produce a significant restraining influence on corporate environmental violations, thereby supporting hypothesis H1.

Table 5. Results of the baseline regression analysis.

Variables	*EVL* (1)	*EVL* (2)	*EVF* (3)	*EVF* (4)
GII	−0.546 ***	−0.574 ***	−0.034 ***	−0.035 ***
	(−4.278)	(−4.402)	(−3.517)	(−3.662)
Size		0.122		0.012
		(0.645)		(0.821)
Lev		1.414 **		0.054
		(2.166)		(0.960)
Return		0.141		−0.008
		(0.116)		(−0.082)
Loss		−0.187		−0.016
		(−0.986)		(−0.867)
Board		0.080		−0.007
		(0.135)		(−0.130)
Indep		0.033		0.014
		(0.018)		(0.082)
Dual		0.203		0.016
		(1.201)		(1.063)
Top1		−1.669 *		−0.191
		(−1.743)		(−1.444)
Big4		−0.612		−0.074 *
		(−1.052)		(−1.775)
constant			0.070 ***	−0.131
			(5.627)	(−0.399)
Fixed Effects	Yes	Yes	Yes	Yes
Observations	3521	3521	8793	8793
Pseudo R^2	0.053	0.059		
Adjusted R^2			0.020	0.021

Note: Values provided in parentheses are *t*-statistics derived from firm-level clustered standard errors. *, **, and *** correspond to statistical significance at the 10%, 5%, and 1% levels, in that order.

4.3. Robustness Tests

4.3.1. Instrumental Variable Approach

To mitigate endogeneity issues stemming from omitted variables and reverse causality, this study adopts an instrumental variable approach. Regional environmental policy intensity serves as the instrument for green institutional investors, measured by the natural logarithm of one plus the number of effective environmental regulations and standards in the region (*INTEN*). This variable meets the relevance criterion since green institutional investors are particularly sensitive to regional differences in environmental stringency. More stringent policies raise compliance expenditures and violation risks for local firms, which

in turn prompts green institutional investors to strengthen monitoring efforts to manage risk and draws increased investment from such investors, who perceive strict regulatory environments as favorable for valuing firms with advanced green technologies. Moreover, regional environmental policy intensity satisfies the exogeneity condition because its determinants, including central government directives and local political priorities, function at a macro level, rendering it largely exogenous to firm-level environmental violations. It is unlikely that a single firm could exert substantial influence on regional environmental policy intensity, supporting the instrument's validity.

Table 6 reports the results of the instrumental variable approach in columns (1) through (3). Diagnostic tests for instrument validity show that the Kleibergen–Paap rk LM statistic is 12.153 (p-value = 0.0005), enabling rejection of the null hypothesis of underidentification, and the Cragg-Donald Wald F statistic is 27.179, above the 10% critical value of 16.38, indicating no weak instrument problem. Results in columns (2) to (3) indicate that green institutional investors suppress both the likelihood and the frequency of corporate environmental violations. These findings buttress the robustness of the key findings against potential omitted variable bias and reverse causality.

Table 6. Results of the instrumental variable approach and treatment effect model.

Variables	Instrumental Variable Approach			Treatment Effect Model		
	First Stage	Second Stage		First Stage	Second Stage	
	GII	*EVL*	*EVF*	*GII*	*EVL*	*EVF*
	(1)	(2)	(3)	(4)	(5)	(6)
INTEN	0.064 ***			0.173 ***		
	(3.783)			(5.381)		
GII		−8.300 ***	−0.757 ***		−0.579 ***	−0.035 ***
		(−4.552)	(−3.487)		(−4.444)	(−3.641)
IMR					1.230 **	0.029
					(2.014)	(0.528)
Size	0.156 ***	1.339 ***	0.124 ***	0.404 ***	0.439 *	0.019
	(8.995)	(3.883)	(3.505)	(16.515)	(1.797)	(0.972)
Lev	−0.166 ***	0.066	−0.060	−0.802 ***	0.761	0.038
	(−2.616)	(0.095)	(−0.946)	(−5.341)	(1.100)	(0.617)
Return	1.411 ***	10.517 ***	0.993 ***	7.053 ***	5.310 *	0.114
	(11.392)	(3.727)	(3.028)	(14.951)	(1.787)	(0.413)
Loss	0.063 ***	0.243	0.028	0.227 ***	−0.096	−0.014
	(3.307)	(1.130)	(1.199)	(3.321)	(−0.485)	(−0.725)
Board	0.051	0.578	0.031	0.275 *	0.288	−0.003
	(0.728)	(0.965)	(0.529)	(1.883)	(0.480)	(−0.051)
Indep	0.186	1.536	0.130	0.382	0.187	0.018
	(0.895)	(0.833)	(0.713)	(0.738)	(0.104)	(0.102)
Dual	0.039 **	0.458 **	0.045 **	0.280 ***	0.422 **	0.022
	(2.087)	(2.529)	(2.531)	(5.770)	(2.136)	(1.177)
Top1	−0.053	−1.974 **	−0.229 *	−0.273	−1.811 *	−0.194
	(−0.415)	(−2.045)	(−1.746)	(−1.632)	(−1.897)	(−1.474)
Big4	0.043	−0.187	−0.042	0.327 ***	−0.363	−0.070 *
	(0.922)	(−0.315)	(−0.974)	(2.971)	(−0.595)	(−1.672)
constant	−3.450 ***		−2.360 ***	−10.699 ***		−0.331
	(−8.062)		(−3.224)	(−16.696)		(−0.672)
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	8793	3521	8793	8793	3521	8793
Pseudo R^2		0.062		0.173	0.060	
Adjusted R^2	0.074		0.024			0.021

Note: Values provided in parentheses are t-statistics derived from firm-level clustered standard errors. *, **, and *** correspond to statistical significance at the 10%, 5%, and 1% levels, in that order.

4.3.2. Treatment Effect Model

To mitigate potential endogeneity arising from sample self-selection, this study applies a treatment effect model. In the first stage, green institutional investors (*GII*) is modeled as the dependent variable, with the exogenous regional environmental policy intensity (*INTEN*) serving as the exclusion restriction, accompanied by control variables and fixed effects, to compute the inverse Mills ratio (*IMR*). In the second stage, the baseline Model (1) is augmented through the incorporation of the *IMR*.

Table 6 displays the results from the treatment effect model in columns (4) to (6). Results in columns (5) and (6) reveal that green institutional investors significantly restrain corporate environmental violations. The overall results affirm the robustness of the main findings to potential bias from sample self-selection.

4.3.3. Propensity Score Matching

To improve comparability between firms with and without green institutional investors, this study employs propensity score matching (PSM) with the following matching parameters: the covariates include all control variables, the matching algorithm applies nearest-neighbor matching, the matching process is conducted with replacement, and matching ratios are set to both one-to-one and one-to-two. Figure 2 presents the common support test results, showing that after matching, no statistically significant differences persist between the two groups. Further analysis is conducted on the matched sample, and the corresponding results are reported in Table 7. The findings confirm that green institutional investors reduce corporate environmental violations even after controlling for inherent firm-level differences.

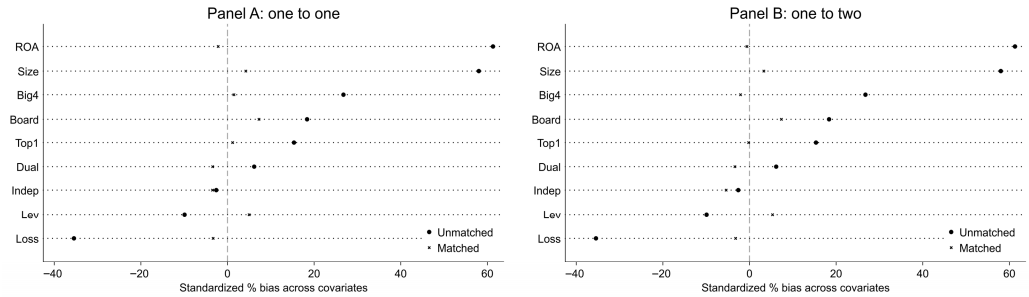

Figure 2. Results of the common support test.

Table 7. Results of the PSM.

Variables	Matching Ratio: One to One		Matching Ratio: One to Two	
	EVL	*EVF*	*EVL*	*EVF*
	(1)	(2)	(3)	(4)
GII	−0.381 **	−0.021 *	−0.473 ***	−0.024 **
	(−2.428)	(−1.727)	(−3.239)	(−2.293)
Size	0.298	0.024	0.293	0.016
	(1.103)	(1.214)	(1.227)	(0.918)
Lev	0.288	−0.015	0.800	0.018
	(0.322)	(−0.231)	(1.050)	(0.310)
Return	1.886	0.110	2.004	0.133
	(1.115)	(0.892)	(1.384)	(1.156)
Loss	0.154	0.003	0.056	−0.002
	(0.533)	(0.107)	(0.234)	(−0.100)
Board	0.078	−0.026	0.116	−0.009
	(0.097)	(−0.357)	(0.159)	(−0.129)
Indep	0.018	0.034	1.149	0.095
	(0.007)	(0.138)	(0.535)	(0.431)

Table 7. *Cont.*

Variables	Matching Ratio: One to One		Matching Ratio: One to Two	
	EVL (1)	*EVF* (2)	*EVL* (3)	*EVF* (4)
Dual	0.294	0.019	0.307	0.023
	(1.261)	(1.094)	(1.490)	(1.467)
Top1	−0.818	−0.145	−1.150	−0.212
	(−0.649)	(−1.000)	(−1.004)	(−1.577)
Big4	−0.586	−0.062	−0.459	−0.052
	(−0.850)	(−1.383)	(−0.706)	(−1.112)
constant		−0.369		−0.249
		(−0.865)		(−0.632)
Fixed Effects	Yes	Yes	Yes	Yes
Observations	1917	5955	2400	6880
Pseudo R^2	0.056		0.057	
Adjusted R^2		0.019		0.020

Note: Values provided in parentheses are *t*-statistics derived from firm-level clustered standard errors. *, **, and *** correspond to statistical significance at the 10%, 5%, and 1% levels, in that order.

4.3.4. Alternative Measure of the Independent Variable

To reduce potential mismeasurement of the independent variable, this study draws on the methodology of Feng and Yuan (2024) [20] to develop an alternative metric, namely the number of green institutional investors (*GIIr*), calculated as the natural logarithm of one plus the number of green institutional investors. The results using this alternative measure are shown in columns (1) and (2) of Table 8. The results collectively support that a larger number of green institutional investors reduces both the likelihood and frequency of corporate environmental violations, further reinforcing the reliability of the main conclusion.

Table 8. Results of the alternative measure of independent variable, exclusion of the impact of the COVID-19 pandemic and replacement of regression methods.

Variables	Alternative Measure of the Independent Variable		Exclusion of the Impact of the COVID-19 Pandemic		Replacement of Regression Methods
	EVL (1)	*EVF* (2)	*EVL* (3)	*EVF* (4)	*EVL* (5)
GIIr	−0.323 ***	−0.019 ***			
	(−3.678)	(−3.385)			
GII			−0.676 ***	−0.031 **	−0.019 ***
			(−3.590)	(−2.054)	(−3.475)
Size	0.117	0.012	−0.462	−0.070 ***	0.008
	(0.617)	(0.812)	(−1.477)	(−2.695)	(0.650)
Lev	1.409 **	0.053	1.306	0.021	0.072 *
	(2.139)	(0.945)	(1.303)	(0.245)	(1.726)
Return	0.182	−0.000	−0.128	0.185	0.006
	(0.149)	(−0.004)	(−0.064)	(1.095)	(0.073)
Loss	−0.163	−0.015	−0.163	0.014	−0.015
	(−0.864)	(−0.789)	(−0.509)	(0.448)	(−1.040)
Board	0.041	−0.008	1.547	0.108	0.013
	(0.069)	(−0.133)	(1.397)	(1.159)	(0.273)
Indep	−0.095	0.015	2.147	0.478	0.009
	(−0.053)	(0.088)	(0.682)	(1.592)	(0.066)
Dual	0.179	0.016	0.256	0.006	0.012
	(1.058)	(1.038)	(0.957)	(0.233)	(0.940)
Top1	−1.693 *	−0.196	−1.455	−0.220	−0.142 *
	(−1.748)	(−1.476)	(−0.903)	(−1.096)	(−1.765)

Table 8. *Cont.*

Variables	Alternative Measure of the Independent Variable		Exclusion of the Impact of the COVID-19 Pandemic		Replacement of Regression Methods
	EVL	*EVF*	*EVL*	*EVF*	*EVL*
	(1)	(2)	(3)	(4)	(5)
Big4	−0.598	−0.073 *	−0.657	−0.175 ***	−0.033
	(−1.070)	(−1.748)	(−0.683)	(−3.019)	(−1.100)
constant		−0.131		1.274 **	−0.123
		(−0.400)		(2.141)	(−0.405)
Fixed Effects	Yes	Yes	Yes	Yes	Yes
Observations	3521	8793	1413	4191	8793
Pseudo R^2	0.056		0.144		
Adjusted R^2		0.020		0.045	0.018

Note: Values provided in parentheses are *t*-statistics derived from firm-level clustered standard errors. *, **, and *** correspond to statistical significance at the 10%, 5%, and 1% levels, in that order.

4.3.5. Exclusion of the Impact of the COVID-19 Pandemic

To address potential distortions from the COVID-19 pandemic, this study draws on Yu et al. (2024) [53] and removes all observations from 2020 onward. Columns (3) and (4) of Table 8 present the findings from this modified specification that omits the potential pandemic impact. The results affirm the ongoing effectiveness of green institutional investors in curbing corporate environmental violations even when the pandemic period is excluded, strengthening the validity of the main conclusions.

4.3.6. Replacement of Regression Methods

To address the potential impact of estimation methods on the findings, this study adopts an alternative estimation technique for the dependent variable *EVL*, replacing the logit model with an OLS regression. The results are shown in column (5) of Table 8. The findings demonstrate that green institutional investors continue to be effective in reducing corporate environmental violations even under the OLS approach, thus further supporting the validity of the main conclusions.

5. Mechanism Analyses

Building on the theoretical framework, green institutional investors suppress corporate environmental violations via two central pathways. First, they capitalize on informational advantages to participate in shareholder activism and use exit threats, thus enhancing environmental oversight and lowering violations. Second, they utilize resource advantages to offer firms both direct funding and indirect resources, which alleviates financing constraints and further discourages environmental violations.

To examine the potential mechanisms, this study constructs Model (2).

$$MV_{i,t} = \alpha_0 + \alpha_1 GII_{i,t} + \gamma Controls_{i,t} + Firm\ FE + Year\ FE + \varepsilon_{i,t} \quad (2)$$

where *MV* refers to the mechanism variables, while all other variables retain their original definitions from Model (1).

5.1. Environmental Oversight Mechanism

The environmental oversight mechanism explains how green institutional investors utilize their informational advantages to enhance corporate environmental supervision and reduce violations through both "voice" and "exit" strategies. More precisely, they participate in shareholder activism by submitting environmental proposals or engaging in private dialogs with management to advocate for better environmental governance [41], thus deterring non-compliant behavior. Furthermore, these investors may express dissent

through the threat of exit or actual divestment, pushing managers to adjust investment plans toward environmentally sustainable practices [19]. These combined efforts enhance monitoring and help prevent corporate environmental violations.

To test the environmental oversight mechanism, this study builds on Chi et al. (2023) [26] and Tang et al. (2024) [19] and constructs the following measures. For environmental awareness, corporate environmental attention is measured by the density of environmental terminology in the Management Discussion and Analysis. This is represented by two variables: *ETM*, calculated as the natural logarithm of one plus the environmental keyword frequency, and *ETR*, expressed as the proportion of environmental keywords in the text. For environmental behavior, corporate environmental actions are evaluated through environmental investment and green innovation: environmental investment (*EIV*) is defined as the firm's environmental protection investment relative to total assets, and green innovation (*EIO*) is constructed as the natural logarithm of one plus the firm's green patent applications.

The regression results for the environmental oversight mechanism are shown in columns (1) to (4) of Table 9. Columns (1) and (2) demonstrate that green institutional investors help improve corporate environmental awareness. Columns (3) and (4) suggest that such investors stimulate greater environmental investment and green innovation. In summary, these results verify that green institutional investors act as supervisors by increasing environmental awareness and fostering environmental behavior, ultimately contributing to the reduction in corporate environmental violations.

Table 9. Results of the mechanism analysis.

Variables	Environmental Oversight Mechanism				Financing Constraints Mechanism	
	Environmental Awareness Level		Environmental Behavior Level			
	ETM	*ETR*	*EIV*	*EIO*	*KZ*	*SA*
	(1)	(2)	(3)	(4)	(5)	(6)
GII	0.024 ***	0.009 ***	0.005 ***	0.068 ***	−0.180 ***	−0.011 ***
	(5.377)	(3.121)	(7.926)	(2.895)	(−4.602)	(−3.231)
Size	−0.020 **	−0.031 ***	0.003 ***	0.296 ***	−0.406 ***	−0.010
	(−2.375)	(−5.255)	(4.172)	(9.009)	(−5.576)	(−1.262)
Lev	0.040	0.018	0.013 ***	−0.109	6.414 ***	0.070 ***
	(1.455)	(1.091)	(4.554)	(−1.006)	(27.025)	(5.144)
Return	−0.044	−0.048	−0.023 ***	−0.284	−12.830 ***	0.011
	(−0.990)	(−1.616)	(−4.720)	(−1.454)	(−21.781)	(0.593)
Loss	−0.001	−0.000	−0.001 *	−0.011	−0.574 ***	0.000
	(−0.203)	(−0.047)	(−1.658)	(−0.314)	(−8.495)	(0.035)
Board	−0.009	0.014	−0.004	−0.049	−0.573 ***	−0.011
	(−0.320)	(0.855)	(−1.290)	(−0.382)	(−2.584)	(−0.809)
Indep	0.075	0.060	−0.005	0.190	−0.226	−0.020
	(0.942)	(1.315)	(−0.726)	(0.500)	(−0.365)	(−0.481)
Dual	−0.011	−0.005	0.001	−0.048	−0.078	−0.001
	(−1.475)	(−1.375)	(0.735)	(−1.547)	(−1.273)	(−0.329)
Top1	−0.011	−0.010	−0.005	0.215	−0.229	−0.084 *
	(−0.254)	(−0.324)	(−1.051)	(0.855)	(−0.618)	(−1.905)
Big4	−0.001	0.025 **	−0.002	−0.130	−0.319 *	−0.014 *
	(−0.059)	(2.545)	(−1.093)	(−1.168)	(−1.802)	(−1.776)
constant	1.559 ***	0.850 ***	−0.061 ***	−6.192 ***	9.014 ***	3.994 ***
	(7.820)	(6.261)	(−3.116)	(−7.564)	(5.315)	(21.810)
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	8793	8793	8793	8793	8793	8793
Adjusted R^2	0.111	0.055	0.044	0.118	0.443	0.765

Note: Values provided in parentheses are *t*-statistics derived from firm-level clustered standard errors. *, **, and *** correspond to statistical significance at the 10%, 5%, and 1% levels, in that order.

5.2. Financing Constraints Mechanism

The financing constraints mechanism proposes that the resource advantages of green institutional investors allow firms to secure both direct and indirect resources, thus easing financing constraints and reducing environmental violations. Initially, green institutional investors, possessing substantial capital, offer sufficient financial backing for corporate environmental projects [32], which helps reduce financial pressures and discourages environmental non-compliance. Moreover, green institutional investors act as a signal that enables access to additional government and market resources [20], further reducing financing difficulties and inhibiting environmental violations.

To examine the financing constraints mechanism, this study employs the approaches of Kaplan and Zingales (1997) [54] and Hadlock and Pierce (2010) [55], applying the KZ index and the SA index to measure the degree of financing constraints faced by firms. The results of this mechanism are presented in columns (5) and (6) of Table 9. Both columns indicate that green institutional investors lead to a marked reduction in financing constraints. These findings support that green institutional investors generate a resource effect through alleviating financing constraints, which helps restrain corporate environmental violations.

6. Cross-Sectional Analyses

To explore the complex interactions among green institutional investors, governments, media, the public, financial institutions, and executives in curbing corporate environmental violations, this study conducts a heterogeneity analysis focusing on five key dimensions: government environmental attention, media environmental attention, public environmental attention, the green credit system, and executives' green experience.

6.1. Government Environmental Attention

The efficacy of green institutional investors in curbing corporate environmental violations is potentially dependent on the level of government environmental attention. Existing research demonstrates that government environmental attention signifies governmental commitment to environmental protection, guiding the allocation of public resources and significantly influencing corporate environmental conduct [56]. Lower levels of government environmental attention are linked to diminished regulatory stringency and insufficient penalties for environmental offenses [14]. This undermines regulatory deterrence, shifting firms' cost–benefit assessments toward non-compliance and increasing both the probability and occurrence of environmental violations. Furthermore, reduced government environmental attention frequently results in diminished policy support, including environmental subsidies and tax incentives for corporate eco-friendly initiatives [57]. These limitations exacerbate firms' financial constraints, weaken their capacity to address environmental challenges, and lead to more frequent violations. Green institutional investors can mitigate these shortcomings by strengthening monitoring and resource provision, compensating for the lack of regulatory rigor and public support in environments with lower government environmental attention, thus helping to curb corporate environmental violations. Consequently, the governance effect of green institutional investors is amplified in settings where government environmental attention is limited.

To evaluate the role of government environmental attention, this study adopts the approach of Chen et al. (2024) [56], constructing a metric derived from the ratio of environmental keywords to the total word count in the government work reports of each firm's host city. The sample is divided into higher- and lower-attention groups based on the measure's median value. Table 10 summarizes the regression results. The findings reveal that the inhibitory effect of green institutional investors on corporate environmental violations is stronger when government environmental attention is lower, implying that

such investors can serve as a substitute mechanism to address insufficient government environmental supervision and more effectively diminish environmental violations.

Table 10. Results of the government environmental attention.

Variables	Government Environmental Attention		Government Environmental Attention	
	Lower *EVL* (1)	Higher *EVL* (2)	Lower *EVF* (3)	Higher *EVF* (4)
GII	−0.730 ***	−0.215	−0.045 ***	−0.002
	(−3.691)	(−1.059)	(−2.755)	(−0.118)
Size	0.171	0.051	0.014	−0.001
	(0.594)	(0.183)	(0.536)	(−0.033)
Lev	0.971	1.429	0.021	0.076
	(0.839)	(1.564)	(0.237)	(1.125)
Return	2.288	−2.178	0.150	−0.195
	(1.143)	(−1.166)	(1.011)	(−1.438)
Loss	−0.087	−0.504	−0.009	−0.043 *
	(−0.292)	(−1.609)	(−0.345)	(−1.700)
Board	1.338	−1.171	0.029	−0.052
	(1.082)	(−1.447)	(0.273)	(−0.815)
Indep	−0.618	−1.653	−0.158	0.103
	(−0.186)	(−0.634)	(−0.548)	(0.459)
Dual	0.489 *	−0.039	0.046 *	−0.015
	(1.850)	(−0.153)	(1.807)	(−0.671)
Top1	−2.062	−1.545	−0.363 **	−0.272 **
	(−1.133)	(−1.074)	(−2.029)	(−2.198)
Big4	−1.467	0.640	−0.222 **	−0.013
	(−1.510)	(0.799)	(−2.372)	(−0.369)
constant			−0.094	0.223
			(−0.159)	(0.520)
Fixed Effects	Yes	Yes	Yes	Yes
Observations	1225	1439	4508	4285
Pseudo R^2	0.079	0.088		
Adjusted R^2			0.032	0.025
Difference	(1)–(2) = −0.515 ***		(3)–(4) = −0.043 ***	

Note: Values provided in parentheses are *t*-statistics derived from firm-level clustered standard errors. *, **, and *** correspond to statistical significance at the 10%, 5%, and 1% levels, in that order.

6.2. Media Environmental Attention

The efficacy of green institutional investors in curbing corporate environmental violations is potentially dependent on the level of media environmental attention. Existing scholarship underscores the media's critical role in deterring environmental misconduct through both supervisory and informational pathways [58]. Weaker media environmental attention diminishes the media's motivation to gather corporate environmental information, such as through field visits and interviews, eroding its monitoring capacity [59]. Consequently, firms encounter reduced external pressure, potentially elevating violation rates. Additionally, insufficient media environmental attention causes delayed and fragmented dissemination of corporate environmental information [8], which worsens information asymmetry in the market and hinders effective monitoring by other stakeholders, thereby implicitly allowing more violations. Green institutional investors help bridge this gap by strengthening environmental oversight and restraining managerial opportunism, thus making up for weaker media scrutiny and reducing corporate environmental violations. Therefore, the inhibitory effect of green institutional investors is heightened in contexts where media environmental attention is lower.

To assess the role of media environmental attention, this study employs the metric created by Li et al. (2023) [58], calculated as the natural logarithm of one plus the number of media reports on corporate environmental issues. The sample is categorized into higher-

and lower-attention groups using this measure's median value. Table 11 displays the regression results. The results confirm that the inhibitory effect of green institutional investors on environmental violations is stronger in settings with lower media environmental attention, implying they function as a substitutive governance mechanism that addresses the limitations of insufficient media monitoring.

Table 11. Results of the media environmental attention.

Variables	Media Environmental Attention		Media Environmental Attention	
	Lower	Higher	Lower	Higher
	EVL	*EVL*	*EVF*	*EVF*
	(1)	(2)	(3)	(4)
GII	−0.638 ***	−0.208	−0.036 **	−0.001
	(−2.989)	(−1.189)	(−2.574)	(−0.085)
Size	0.289	0.052	0.030	−0.010
	(0.925)	(0.198)	(1.496)	(−0.409)
Lev	1.283	0.775	0.002	0.114
	(1.311)	(0.829)	(0.020)	(1.566)
Return	1.477	−2.311	0.088	−0.137
	(0.809)	(−1.035)	(0.493)	(−0.933)
Loss	−0.048	−0.145	0.010	−0.021
	(−0.166)	(−0.488)	(0.350)	(−0.705)
Board	−0.017	−0.074	−0.019	−0.040
	(−0.017)	(−0.102)	(−0.298)	(−0.444)
Indep	−1.200	1.950	−0.073	0.124
	(−0.359)	(0.862)	(−0.384)	(0.407)
Dual	0.332	0.132	0.030	−0.002
	(1.250)	(0.568)	(1.435)	(−0.097)
Top1	−1.681	−2.510 *	−0.074	−0.448 ***
	(−1.006)	(−1.873)	(−0.395)	(−2.795)
Big4	0.271	−1.865 ***	0.024	−0.159 **
	(0.182)	(−2.882)	(0.418)	(−2.403)
constant			−0.496	0.459
			(−1.113)	(0.856)
Fixed Effects	Yes	Yes	Yes	Yes
Observations	1431	1385	4042	4751
Pseudo R^2	0.111	0.066		
Adjusted R^2			0.032	0.024
Difference	(1)–(2) = −0.430 **		(3)–(4) = −0.035 ***	

Note: Values provided in parentheses are *t*-statistics derived from firm-level clustered standard errors. *, **, and *** correspond to statistical significance at the 10%, 5%, and 1% levels, in that order.

6.3. Public Environmental Attention

The efficacy of green institutional investors in curbing corporate environmental violations is potentially dependent on the level of public environmental attention. Prior research indicates that public environmental attention exerts pressure on both governments and firms, thereby reducing instances of corporate environmental misconduct [60]. Reduced public environmental attention lowers the probability that violations are reported to or filed with regulatory bodies [10], which significantly decreases the detection and penalty rates of corporate environmental misconduct. Consequently, the expected costs and risks linked to violations decline, potentially raising their occurrence. Furthermore, in environments with limited public environmental attention, firms face fewer threats to brand reputation and market value stemming from environmental non-compliance [61], which weakens their sense of social responsibility and undermines ethical constraints. This may prompt managers to resort to environmental violations as a cost-reduction tactic, further increasing

violation incidence. Green institutional investors help address this institutional void by utilizing shareholder influence to strengthen environmental oversight, thereby offsetting inadequate public monitoring and reducing corporate environmental violations. Accordingly, the inhibitory effect produced by green institutional investors becomes more critical in settings characterized by lower public environmental attention.

To evaluate the role of public environmental attention, this study applies the measurement method proposed by Wang et al. (2021) [62], which utilizes the natural logarithm of one plus the Baidu search volume for environment-related keywords at the regional level. The sample is separated into higher- and lower-attention groups using this measure's median value. Table 12 displays the regression results. The findings imply that green institutional investors produce a more substantial mitigating effect on corporate environmental violations when public environmental attention is lower, indicating that such investors can compensate for weaker public oversight and more successfully prevent environmental violations.

Table 12. Results of the public environmental attention.

Variables	Public Environmental Attention		Public Environmental Attention	
	Lower	Higher	Lower	Higher
	EVL	*EVL*	*EVF*	*EVF*
	(1)	(2)	(3)	(4)
GII	−0.830 ***	−0.207	−0.055 ***	0.011
	(−3.671)	(−1.172)	(−4.370)	(0.776)
Size	−0.142	0.096	0.005	0.012
	(−0.459)	(0.324)	(0.224)	(0.460)
Lev	1.286	0.886	0.043	0.058
	(1.252)	(0.901)	(0.546)	(0.732)
Return	0.248	−0.404	0.001	0.001
	(0.137)	(−0.198)	(0.008)	(0.005)
Loss	−0.258	0.009	−0.006	−0.004
	(−0.929)	(0.031)	(−0.238)	(−0.151)
Board	0.565	0.045	0.028	−0.068
	(0.517)	(0.060)	(0.374)	(−0.748)
Indep	1.517	−2.087	0.009	−0.024
	(0.467)	(−0.823)	(0.043)	(−0.084)
Dual	0.070	0.393	0.007	0.029
	(0.266)	(1.495)	(0.265)	(1.307)
Top1	−1.458	−2.278 *	−0.129	−0.345 *
	(−0.767)	(−1.870)	(−0.880)	(−1.918)
Big4	0.198	−0.555	−0.044	−0.052
	(0.207)	(−0.711)	(−0.443)	(−1.029)
constant			−0.069	0.065
			(−0.131)	(0.117)
Fixed Effects	Yes	Yes	Yes	Yes
Observations	1378	1358	4055	4738
Pseudo R^2	0.061	0.055		
Adjusted R^2			0.015	0.019
Difference	(1)–(2) = −0.623 ***		(3)–(4) = −0.066 ***	

Note: Values provided in parentheses are t-statistics derived from firm-level clustered standard errors. * and *** correspond to statistical significance at the 10% and 1% levels, in that order.

6.4. Green Credit System

The efficacy of green institutional investors in curbing corporate environmental violations may depend on the development of the green credit system. When the green credit system is underdeveloped or inefficient, firms often face considerable challenges in securing adequate resources to address environmental violations. A less robust green credit

system suggests that banks and conventional financial institutions are either unwilling or ill-equipped to provide sufficient loans for environmental projects [63,64]. These initiatives typically require long-term capital with uncertain short-term returns [65], making them less attractive to traditional lenders, who focus on profitability and risk management. Accordingly, firms experience a shortage of funding to upgrade pollution treatment equipment, implement clean technologies, or establish advanced environmental management systems. Without such financial support, companies may postpone or abandon environmental initiatives, thus raising the risk of violations due to outdated infrastructure and insufficient operational capacity for pollution control. Green institutional investors help address this institutional shortfall by easing financing constraints, thereby making up for inadequate credit incentives and reducing corporate environmental violations. Therefore, the inhibitory effect of green institutional investors is more evident in settings where the green credit system is less developed.

To assess the role of the green credit system, this study uses the metric introduced by Xu and Lin (2025) [65], which is calculated as the ratio of interest expenses from six major high-energy-consuming industries to the total interest expenses of all industrial enterprises at the provincial level. The sample is separated into weaker and stronger green credit system groups using this measure's median value. Table 13 reports the regression results. The results support the view that green institutional investors have a more substantial mitigating effect on corporate environmental violations within a weaker green credit system, suggesting that such investors can offset deficient credit incentives and more effectively discourage environmental violations.

Table 13. Results of the green credit system.

Variables	Green Credit System		Green Credit System	
	Weaker *EVL* (1)	Stronger *EVL* (2)	Weaker *EVF* (3)	Stronger *EVF* (4)
GII	−0.878 ***	−0.195	−0.064 ***	0.003
	(−4.159)	(−1.015)	(−3.921)	(0.208)
Size	0.159	0.171	0.018	0.007
	(0.567)	(0.606)	(0.920)	(0.306)
Lev	0.813	1.120	0.044	0.104
	(0.834)	(1.050)	(0.573)	(1.594)
Return	2.712	−1.859	0.242	−0.148
	(1.575)	(−0.850)	(1.453)	(−1.033)
Loss	−0.139	−0.078	0.000	−0.017
	(−0.498)	(−0.274)	(0.006)	(−0.615)
Board	−0.005	−0.219	−0.075	0.004
	(−0.004)	(−0.271)	(−0.954)	(0.049)
Indep	−1.677	1.695	−0.372	0.311
	(−0.463)	(0.748)	(−1.597)	(1.185)
Dual	0.310	0.107	0.020	0.011
	(1.273)	(0.423)	(0.767)	(0.560)
Top1	−0.913	−3.274 **	−0.118	−0.486 ***
	(−0.560)	(−2.340)	(−0.834)	(−3.538)
Big4	0.767	−1.013 *	−0.101	−0.082 *
	(0.733)	(−1.759)	(−0.701)	(−1.673)
constant			0.012	−0.062
			(0.027)	(−0.130)
Fixed Effects	Yes	Yes	Yes	Yes
Observations	1434	1312	4123	4670
Pseudo R^2	0.095	0.066		
Adjusted R^2			0.027	0.023
Difference	(1)–(2) = −0.683 ***		(3)–(4) = −0.067 ***	

Note: Values provided in parentheses are *t*-statistics derived from firm-level clustered standard errors. *, **, and *** correspond to statistical significance at the 10%, 5%, and 1% levels, in that order.

6.5. Executives' Green Experience

The efficacy of green institutional investors in curbing corporate environmental violations may be influenced by executives' green experience. Existing research shows that executives with green backgrounds enhance corporate environmental ethos and facilitate green resource acquisition, thereby reducing violations [14]. When executives lack such background, they may underappreciate the complexity and consequences of environmental issues and overlook the strategic value and economic opportunities associated with environmental stewardship [2]. As a result, they exhibit a systematic bias toward immediate financial outcomes at the expense of environmental performance, heightening the risk of violations. Additionally, without green experience, executives are less adept at leveraging their social networks to secure critical environmental resources such as green credit and tax incentives, which are vital for addressing resource constraints in environmental governance [66]. This limits the firm's capacity to improve its environmental performance and raises the likelihood of violations. Green institutional investors help remedy these gaps by applying their informational and resource advantages to counteract environmental short-termism and resource shortages stemming from insufficient executive expertise, thereby restraining corporate environmental violations. Thus, the inhibitory effect of green institutional investors is more substantial when executives' green experience is lacking.

To investigate the role of executives' green experience, this study follows the approach of Dong et al. (2024) [14], using a binary variable that reflects whether the chairperson or general manager has relevant environmental experience. The sample is split into two groups using this measure. Table 14 reports the regression results. The findings support the conclusion that green institutional investors have a more pronounced mitigating effect on corporate environmental violations when executives lack green experience, demonstrating that such investors can make up for governance deficiencies caused by inadequate environmental expertise and more successfully curb violations.

Table 14. Results of the executives' green experience.

Variables	Executives' Green Experience		Executives' Green Experience	
	Without *EVL* (1)	With *EVL* (2)	Without *EVF* (3)	With *EVF* (4)
GII	−0.717 ***	−0.356	−0.053 ***	−0.001
	(−5.110)	(−0.751)	(−5.714)	(−0.026)
Size	0.145	1.056	0.009	−0.029
	(0.674)	(1.331)	(0.602)	(−0.304)
Lev	2.054 ***	−6.396 **	0.053	−0.176
	(2.849)	(−2.560)	(0.952)	(−1.072)
Return	0.918	0.333	0.035	0.091
	(0.686)	(0.069)	(0.374)	(0.235)
Loss	−0.211	0.482	−0.023	0.074
	(−1.039)	(0.591)	(−1.315)	(0.837)
Board	0.095	0.133	−0.015	0.180
	(0.141)	(0.062)	(−0.301)	(0.866)
Indep	−0.130	9.281	−0.047	1.392 **
	(−0.065)	(1.624)	(−0.303)	(2.020)
Dual	0.132	−0.802 *	0.011	−0.087
	(0.736)	(−1.656)	(0.795)	(−0.987)
Top1	−0.918	−5.734	−0.124	−0.142
	(−0.838)	(−1.280)	(−0.919)	(−0.436)
Big4	−0.341	−12.510 ***	−0.065	−0.056
	(−0.504)	(−8.076)	(−1.550)	(−0.651)

Table 14. *Cont.*

Variables	Executives' Green Experience		Executives' Green Experience	
	Without *EVL* (1)	With *EVL* (2)	Without *EVF* (3)	With *EVF* (4)
constant			−0.036	0.006
			(−0.106)	(0.003)
Fixed Effects	Yes	Yes	Yes	Yes
Observations	2982	278	8010	783
Pseudo R^2	0.068	0.128		
Adjusted R^2			0.023	0.033
Difference	(1)–(2) = −0.361 **		(3)–(4) = −0.052 ***	

Note: Values provided in parentheses are *t*-statistics derived from firm-level clustered standard errors. *, **, and *** correspond to statistical significance at the 10%, 5%, and 1% levels, in that order.

7. Further Analyses

Building upon the preceding analysis, this study further investigates two primary questions: first, whether green institutional investors can mitigate corporate operational and financial risks by curbing environmental violations; and second, whether such inhibitory effect exhibits spillover effects at both the industry and regional levels.

7.1. Economic Consequences

Green institutional investors help diminish corporate operational risk through the suppression of environmental violations. By exercising active oversight and maintaining stakeholder engagement, they effectively decrease a firm's exposure to compliance-driven risks, such as regulatory fines or operational suspensions. This fosters more stable operations, limits unplanned disruptions, and strengthens the firm's reputation and stakeholder trust [3,5]. Through preventing environmental incidents, green investors also aid in avoiding costly legal disputes and project delays, thus reinforcing the firm's operational continuity and competitive standing.

Moreover, green institutional investors help alleviate financial risk by restraining environmental violations. Lessened exposure to environmental fines, litigation costs, and cleanup expenses directly bolsters profitability and stabilizes cash flows. In addition, firms with superior environmental performance often gain improved access to capital, frequently at more favorable terms, as banks and investors increasingly integrate sustainability criteria into risk assessments [67,68]. Stronger environmental compliance also reduces reputational damage that could adversely influence stock performance and investor confidence. Consequently, lowered financial volatility and increased resilience to market and regulatory changes contribute to a healthier financial risk profile.

To examine whether green institutional investors reduce corporate operational and financial risks through the mitigation of environmental violations, this study constructs Model (3).

$$\begin{aligned} OR_{i,t}/FR_{i,t} = {} & \alpha_0 + \alpha_1 GII_{i,t} + \alpha_2 EVL_{i,t}/EVF_{i,t} + \alpha_3 GII_{i,t} \times EVL_{i,t}/EVF_{i,t} \\ & + \gamma Controls_{i,t} + Firm\ FE + Year\ FE + \varepsilon_{i,t} \end{aligned} \tag{3}$$

where *OR* denotes corporate operational risk, *FR* represents corporate financial risk, and all other variables retain their original definitions from Model (1). Following Geng et al. (2021) [69], operational risk is measured as the standard deviation of earnings before interest and taxes over the past three years ($t-2$ to t). Following Bao et al. (2024) [70], financial risk is proxied by the Z-score.

The results of the economic consequences are presented in Table 15. Columns (1) and (2) illustrate that green institutional investors reduce corporate operational risk through curbing environmental violations. Columns (3) and (4) further establish that they alleviate corporate financial risk by suppressing these violations. Collectively, the findings demonstrate that green institutional investors' inhibition of environmental violations produces favorable economic effects, evident as marked declines in both operational and financial risk.

Table 15. Results of the economic consequences.

Variables	Operational Risk		Financial Risk	
	OR	*OR*	*FR*	*FR*
	(1)	(2)	(3)	(4)
GII	0.005 ***	0.005 ***	0.074	0.101
	(4.683)	(4.321)	(0.531)	(0.744)
EVL	0.006 **		−0.566 **	
	(2.562)		(−2.506)	
GII × *EVL*	−0.010 ***		0.748 **	
	(−3.535)		(2.399)	
EVF		0.004 **		−0.270
		(2.453)		(−1.439)
GII × *EVF*		−0.006 ***		0.536 **
		(−3.357)		(2.103)
Size	−0.008 **	−0.008 **	−1.119 ***	−1.120 ***
	(−2.276)	(−2.279)	(−4.349)	(−4.361)
Lev	−0.001	−0.001	−13.738 ***	−13.762 ***
	(−0.146)	(−0.132)	(−15.893)	(−15.892)
Return	0.046 *	0.045 *	7.537 ***	7.558 ***
	(1.824)	(1.813)	(4.222)	(4.238)
Loss	0.029 ***	0.029 ***	0.435 *	0.441 *
	(13.235)	(13.219)	(1.863)	(1.892)
Board	0.008	0.008	−0.391	−0.386
	(0.906)	(0.904)	(−0.637)	(−0.630)
Indep	0.015	0.015	1.840	1.823
	(0.688)	(0.701)	(0.801)	(0.794)
Dual	0.002	0.002	−0.136	−0.136
	(1.424)	(1.387)	(−0.557)	(−0.557)
Top1	−0.041 ***	−0.041 ***	−2.899 *	−2.849 *
	(−3.497)	(−3.515)	(−1.713)	(−1.684)
Big4	0.017 **	0.017 **	−0.295	−0.292
	(2.442)	(2.457)	(−0.425)	(−0.419)
constant	0.181 ***	0.182 ***	37.654 ***	37.624 ***
	(2.845)	(2.850)	(6.114)	(6.126)
Fixed Effects	Yes	Yes	Yes	Yes
Observations	8793	8793	8793	8793
Adjusted R^2	0.069	0.068	0.155	0.155

Note: Values provided in parentheses are *t*-statistics derived from firm-level clustered standard errors. *, **, and *** correspond to statistical significance at the 10%, 5%, and 1% levels, in that order.

7.2. Spillover Effects

The governance function performed by green institutional investors regarding corporate environmental violations may produce spillover effects at both industry and regional levels via observational learning and competitive dynamics. Within industries, firms are likely to adopt the environmental governance practices of peer companies subject to pressure from green institutional investors [42,71], thus facilitating the spread of compliance strategies and green technologies. Across regions, the demonstrated effectiveness of green institutional investor engagement in one area can prompt neighboring firms to proactively

enhance their environmental conduct as a protective measure against reputational damage and regulatory scrutiny [72,73], while rivalry for green investment and market positioning may additionally encourage voluntary adoption of higher environmental standards beyond the reach of direct investor influence.

To examine the spillover effects of green institutional investors' inhibitory role on corporate environmental violations at both the industry and regional levels, this study develops Model (4).

$$EVL_{i,t}/EVF_{i,t} = \alpha_0 + \alpha_1 GIIindu_{i,t}/GIIprov_{i,t} + \gamma Controls_{i,t} + Firm\ FE + Year\ FE + \varepsilon_{i,t} \quad (4)$$

where *GIIindu* refers to the industry-level mean of green institutional investors (derived from the annual average of *GII* among other firms in the same industry), *GIIprov* signifies the provincial-level mean of green institutional investors (constructed as the mean annual *GII* among other firms in the same province), and all other variables retain their original definitions from Model (1).

The results of the spillover effects are reported in Table 16. Columns (1) and (2) reveal that green institutional investors within the same industry help curb corporate environmental violations. Columns (3) and (4) indicate that green institutional investors within the same province also contribute to suppressing environmental violations. These findings confirm that the spillover effects of green institutional investors' inhibitory role on corporate environmental violations function through two distinct channels, impacting both the industry and regional levels.

Table 16. Results of the spillover effects.

Variables	Industry Level		Province Level	
	EVL (1)	*EVF* (2)	*EVL* (3)	*EVF* (4)
GIIindu	−2.726 **	−0.261 **		
	(−2.159)	(−2.443)		
GIIprov			−1.374 **	−0.118 **
			(−2.340)	(−2.355)
Size	0.039	0.007	0.045	0.007
	(0.206)	(0.487)	(0.241)	(0.473)
Lev	1.418 **	0.058	1.353 **	0.059
	(2.171)	(1.037)	(2.054)	(1.048)
Return	−0.709	−0.049	−0.852	−0.058
	(−0.594)	(−0.495)	(−0.711)	(−0.588)
Loss	−0.232	−0.019	−0.210	−0.018
	(−1.235)	(−1.010)	(−1.112)	(−0.984)
Board	0.080	−0.007	0.088	−0.007
	(0.138)	(−0.133)	(0.148)	(−0.127)
Indep	−0.099	0.013	−0.075	0.010
	(−0.056)	(0.074)	(−0.042)	(0.056)
Dual	0.157	0.015	0.166	0.015
	(0.931)	(0.971)	(0.983)	(0.966)
Top1	−1.543	−0.187	−1.575 *	−0.189
	(−1.623)	(−1.410)	(−1.648)	(−1.425)
Big4	−0.679	−0.077 *	−0.618	−0.072 *
	(−1.194)	(−1.833)	(−1.064)	(−1.742)
constant		0.077		0.017
		(0.231)		(0.053)
Fixed Effects	Yes	Yes	Yes	Yes
Observations	3521	8793	3521	8793
Pseudo R^2	0.052		0.052	
Adjusted R^2		0.020		0.020

Note: Values provided in parentheses are *t*-statistics derived from firm-level clustered standard errors. * and ** correspond to statistical significance at the 10% and 5% levels, in that order.

8. Discussion and Conclusions

8.1. Conclusions

Prior research has predominantly examined the effects of governments, media, the public, financial institutions, and executives on corporate environmental violations, yet has largely neglected the role of investors. This study introduces the perspective of green institutional investors to explore how investors influence corporate environmental violations. The results show that green institutional investors significantly inhibit corporate environmental violations. Mechanism analyses suggest that green institutional investors leverage informational advantages to strengthen environmental oversight and utilize resource advantages to alleviate financing constraints, thereby reducing corporate environmental violations. Cross-sectional tests reveal that this inhibitory effect is stronger in contexts characterized by lower government, media, and public environmental attention, underdeveloped green credit systems, and absence of green experience among executives. Furthermore, economic consequence analysis indicates that green institutional investors help mitigate both operational and financial risks through the reduction in environmental violations. Finally, spillover effect analysis confirms that this inhibitory effect exhibits positive externalities at both industry and regional levels.

8.2. Contributions and Implications

This study offers several key theoretical advances. First, it integrates green institutional investors—characterized by their dual capacity for oversight and resource provision—into the analytical framework of corporate environmental violation governance, thereby broadening the scope of actors considered in such governance. Second, it illuminates the interconnections among governments, media, the public, financial institutions, executives, and investors in addressing corporate environmental violations, thereby enriching the understanding of the factors shaping corporate environmental misconduct. Third, by focusing on corporate environmental violations, it enhances understanding of the environmental governance effects of green institutional investors and supplies further empirical evidence for evaluating the effectiveness of investor-driven governance. Fourth, it uncovers the spillover effects of green institutional investors in mitigating corporate environmental violations. Specifically, such investors not only reduce environmental violations in their invested firms but also deter violations among peer firms within the same industry and region through learning and competitive mechanisms. Together, these theoretical contributions help advance and refine the literature on green institutional investors and corporate environmental violations.

The research findings also yield practical implications for enhancing corporate environmental compliance:

First, governments ought to focus on building an incentive-compatible green investment system. The more pronounced inhibitory effect observed in regions with lower government environmental attention and underdeveloped green credit systems suggests that policymakers should promote market-oriented environmental governance mechanisms. This could involve implementing preferential tax policies, green credit incentives, and simplified environmental approval procedures to encourage increased institutional investment in sustainability. Additionally, enhancing the transparency of corporate environmental disclosure and fostering inter-agency coordination will facilitate more effective monitoring by green institutional investors, creating synergy between public regulation and market-based supervision.

Second, investors should embrace a comprehensive green investment philosophy that goes beyond a narrow focus on financial returns. Green institutional investors are encouraged to incorporate environmental performance systematically into their investment

evaluation and decision-making processes. By capitalizing on their informational and resource advantages, they can participate actively in corporate governance through private communications, shareholder proposals, and voting rights to enhance environmental management and innovation in portfolio companies. Moreover, developing in-house expertise in environmental issues will improve the assessment of environmental risks and opportunities.

Third, enterprises are advised to take initiative to reduce environmentally irresponsible behavior. Firms should consider introducing green institutional investors into their ownership structure to benefit from external monitoring and improved governance. Management ought to acknowledge that environmental responsibility is not limited to regulatory compliance but constitutes a strategic asset for mitigating operational and financial risks. Companies can implement clear environmental accountability mechanisms at the board and executive levels, boost investments in pollution prevention and green technology innovation, and regularly publish environmental performance reports to increase transparency. These measures will not only help prevent violations but also promote sustainable development and strengthen corporate reputation.

Fourth, developed countries should capitalize on their advanced markets and regulatory expertise to take a leading role in global sustainable finance. Benefiting from well-established financial systems and robust regulatory frameworks, these nations are well-placed to pioneer the integration of sustainability into global investment practices. They can design more sophisticated environmental risk-assessment models and disclosure standards to establish benchmarks for emerging markets. In light of the demonstrated role of green institutional investors in reducing violations and associated risks, regulators and institutional investors in advanced economies ought to advocate for widespread mandatory environmental disclosure, ensuring environmental criteria are embedded in investment evaluations. Furthermore, developed countries can support knowledge transfer and capacity-building programs to encourage global alignment in monitoring and reducing corporate environmental violations. By disseminating innovative tools and governance best practices, developed nations can amplify the positive spillover effects created by green institutional investors and help build a global economy oriented toward greater sustainability.

8.3. Limitations and Future Research Directions

This study investigates the influence of green institutional investors on corporate environmental violations, underscoring the pivotal role of investors in mitigating corporate environmental misconduct. Nevertheless, several limitations persist due to constraints in research context and data availability, which merit further exploration and refinement in future studies. First, the reliance on China as the empirical setting may constrain the broader applicability of the findings. China's distinctive institutional environment, evolving financial market infrastructure, and distinctive patterns of investor behavior may restrict the transferability of conclusions to countries with differing institutional frameworks. Future research could undertake cross-national comparative analyses to explore how varying institutional settings shape the mechanisms and efficacy of such influences. Second, the measurement of corporate environmental violations may be subject to potential measurement error. This study relies on administrative penalties issued by environmental authorities as the primary indicator of corporate environmental violations. However, this metric may be affected by external factors such as regional enforcement intensity, reporting delays, and local protectionism, possibly introducing systematic bias. Subsequent studies could integrate third-party pollutant monitoring data and adopt multidimensional assessment strategies to evaluate corporate environmental violations, thereby yielding more robust and complementary evidence.

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